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FLOAT PT RAN OPERAND EXE

MD-11-DQFPD-B

EP-DQFPD-B-DL-A

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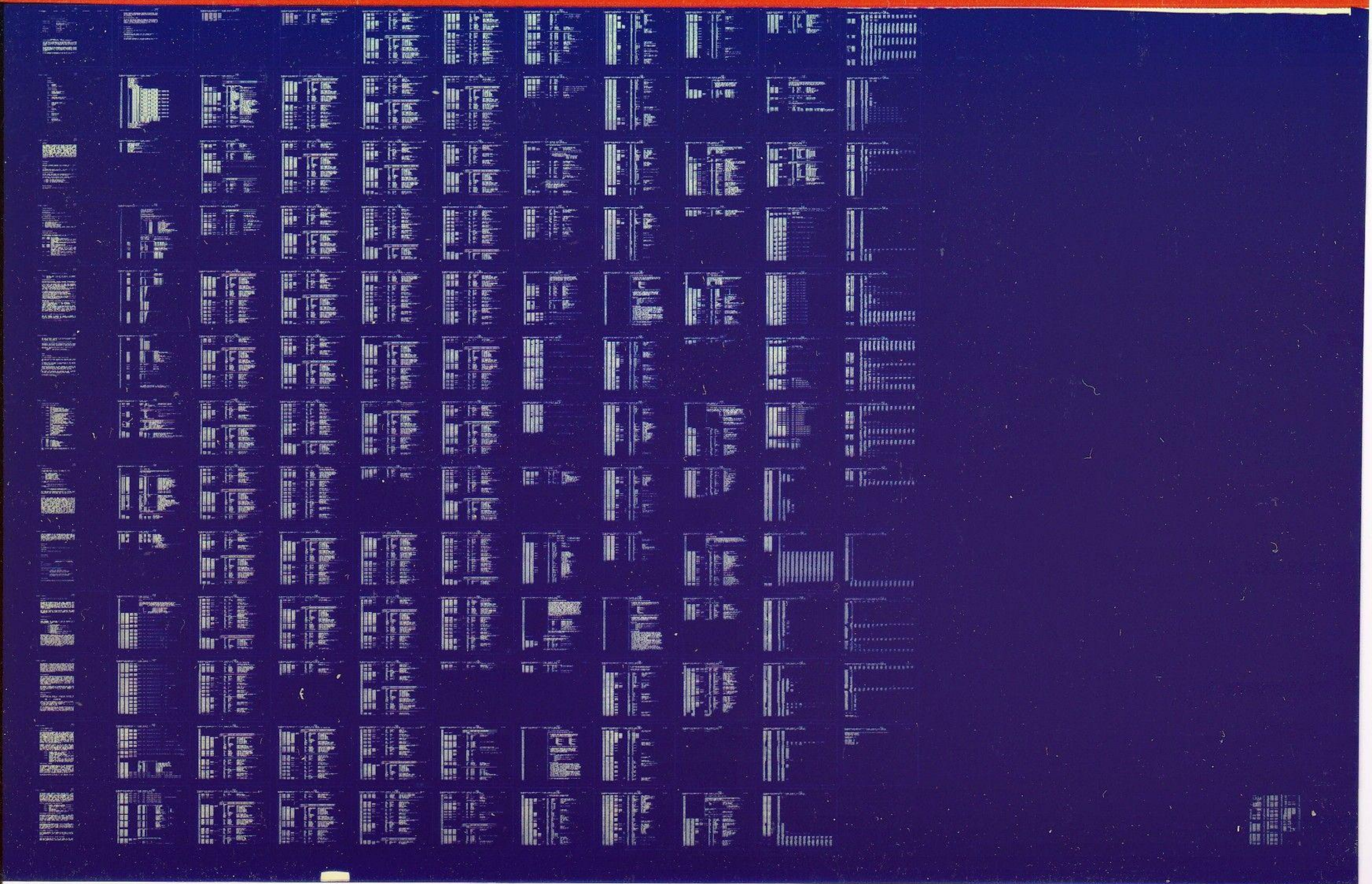
MADE IN USA



I D E N T I F I C A T I O N

PRODUCT CODE: MAINDEC-11-DQFPD-B-D

PRODUCT NAME: PDP-11/6X - FP11-E FLOATING POINT UNIT
ADD/SUB/MUL/DIV
RANDOM OPERAND EXERCISER

DATE : MAY, 1977

MAINTAINER: DIAGNOSTIC GROUP

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1. ABSTRACT

THIS PROGRAM IS AN EXERCISER FOR THE PDP-11/6X FLOATING POINT ADD, SUBTRACT, MULTIPLY, AND DIVIDE INSTRUCTIONS. RANDOM NUMBER PATTERNS ARE USED AS THE OPERANDS, AND THE HARDWARE GENERATED RESULTS ARE CHECKED AGAINST RESULTS OBTAINED FROM FLOATING POINT SOFTWARE ROUTINES TO INSURE CORRECTNESS. THE PDP-11/6X IS OPERATED IN DOUBLE AND SINGLE FLOATING MODE, ROUND AND TRUNCATE MODE, AND WITH UNDERFLOW AND OVERFLOW CONDITIONS ENABLED AND DISABLED. THE PROGRAM WILL RUN FOR 400(8) "SUBPASSES" BEFORE GIVING AN "END OF PASS" INDICATION, SO THAT A SUFFICIENT NUMBER OF RANDOM PATTERNS ARE OBTAINED FOR USE AS OPERANDS. ALSO AT THIS TIME, OPTIONAL STATUS INFORMATION ON THE TYPES OF RANDOM OPERANDS SELECTED CAN BE PRINTED ON THE CONSOLE. BOTH "HOT" (FP11-E OPTION) AND "WARM" (PDP-11/6X MICROCODE) FLOATING POINT UNITS CAN BE SELECTED FOR TESTING.

2. REQUIREMENTS

2.1 EQUIPMENT

PDP-11/6X STANDARD COMPUTER WITH MINIMUM 16K OF MEMORY. OPTIONAL FP11-E FLOATING POINT UNIT, IF SELECTED.

2.2 STORAGE

THE PROGRAM USES MEMORY 0-34120(8). THE UPPER 2.0K WORDS ARE RESERVED FOR THE XXDP MONITOR, IF EMPLOYED.

2.3 PRELIMINARY PROGRAMS

THE CPU, CACHE, AND MEMORY TEST PROGRAMS MUST BE RUN FIRST TO VERIFY THE CORRECT OPERATION OF THE BASE MACHINE.

THE PDP-11/6X - FP11-E FLOATING POINT PROCESSOR INSTRUCTION SET TESTS SHOULD THEN BE RUN IN THE FOLLOWING ORDER:

(1) DQFPA FPU BASIC INSTRUCTION TESTS
(2) DQFPB FPU ADVANCED INSTRUCTION TESTS
(3) DQFPC FPU INSTRUCTION EXERCISER
(4) DQFPD FPU ADD/SUB/MUL/DIV RANDOM EXERCISER

3. LOADING PROCEDURE

USE THE STANDARD PROCEDURE FOR ABSOLUTE TAPES, OR LOAD VIA XXDP MEDIA.

4. STARTING PROCEDURE

4.1 CONTROL SWITCH SETTINGS

SEE SECTION 5.1
SWITCH REGISTER (000000) IS WORST CASE TEST.

4.2 STARTING ADDRESS

THE PROGRAM MUST ALWAYS BE STARTED AT LOCATION 200(8).

4.3 PROGRAM/OPERATOR ACTION

LOADING VIA ABSOLUTE PAPERTAPE:

(1) LOAD PROGRAM INTO MEMORY USING ABS LOADER.
(2) LOAD ADDRESS 200 (8).
(3) SET SWITCHES (SEE SECTION 5.1)
SR=(000000) IS WORST CASE TEST.
(4) PRESS CONTROL/START TO BEGIN.
(5) PROGRAM TYPES IDENTIFICATION HEADER (VERIFY THAT THE CORRECT PROGRAM HAS BEEN LOADED!), AND EXECUTION BEGINS.

5. OPERATING PROCEDURE

5.1 OPERATIONAL SWITCH SETTINGS

THE DEFINITION OF THE SPECIFIC BITS IN THE SWITCH REGISTER (EITHER HARDWARE OR SOFTWARE) ARE AS FOLLOWS:

SW15=1	100000	HALT ON ERROR
SW14=1	040000	LOOP ON CURRENTLY EXECUTING TEST
SW13=1	020000	INHIBIT ERROR TYPEOUTS (WHICH IS AN "ERROR MESSAGE" RESULTING FROM AN ERROR DETECTED IN THE HARDWARE)
SW12=1	010000	INHIBIT STATUS TYPEOUTS (WHICH IS A NON-ERROR RELATED INFORMATIVE MESSAGE, SUCH AS "END PASS #XXX")
SW11=1	004000	INHIBIT ITERATIONS PER TEST
SW10	002000	SET=BELL ON ERROR/CLEAR=BELL ON PASS END
SW09=1	001000	LOOP ON ERROR
SW08=1	000400	LOOP ON TEST NUMBER IN "SLPTST" IF SET, THEN THE TEST SPECIFIED BY THE TEST NUMBER CONTAINED IN THE MEMORY WORD "SLPTST" (SEE PROGRAM LISTING) WILL SPECIFY THE DESIRED TEST ON WHICH TO LOOP.
SW01	000002	CLEAR=TEST HOT-FP/WARM-FP ALTERNATELY EACH PASS (IE, PASS#1 HFP, PASS#1 WFP, PASS#2 HFP, PASS#2 WFP, ETC) SET=TEST ONLY UNIT SPECIFIED IN SW00
SW00	000001	SET=SELECT WARM FP, IF SW01=1

CLEAR=SELECT HOT FP, IF SW01=1

NOTE FOR SW01, SW00 - IF NO HOT FP (FP11-E) IS PRESENT, THEN WARM FP (PDP-11/6X MICROCODE) IS AUTOMATICALLY SELECTED.

5.2 PROGRAM/OPERATOR ACTION

ONCE EXECUTION HAS BEGUN, MINIMAL OPERATOR INTERVENTION IS REQUIRED, UNLESS THE PROGRAM DETECTS AN ERROR IN THE HARDWARE.

IF ALL IS WELL, THE PROGRAM TYPES ITS NAME UPON BEGINNING; AND AT THE START OF EACH PASS, THE CURRENT PASS NUMBER (IN OCTAL) IS ECHOED. NOTE THAT SETTING SW<12>=1 WILL INHIBIT THE TYPEOUT OF THE BEGIN AND END PASS MESSAGES.
IF SW<10>=0, THE CONSOLE BELL WILL BE RUNG AT THE END OF EACH PASS. NOTE THAT ONLY SW<10> AFFECTS THE BELL RINGING AT END OF PASS - SW<12> HAS NO EFFECT ON THIS FUNCTION.

IF AN ERROR OCCURS DURING EXECUTION, MANY VARIATIONS IN ACTION ARE POSSIBLE DEPENDING UPON THE SWITCH SETTINGS.
SW<15>=1 WILL CAUSE THE CPU TO HALT AFTER AN ERROR.
SW<13>=1 WILL ALSO INHIBIT ANY ERROR MESSAGE TYPEOUT THAT WOULD OCCUR AT THIS TIME.
SW<10>=1 WILL CAUSE THE CONSOLE BELL TO BE RUNG ONLY WHEN AN ERROR IS DETECTED (AND NOT AT THE END OF A PASS).
SW<9>=1 CAUSES THE PROGRAM TO LOOP ON THE MOST RECENT ERROR, AS LONG AS IT CONTINUES TO OCCUR.

THERE ARE ALSO SEVERAL OTHER GENERAL USE FUNCTIONS DEFINED BY THE SWITCHES:
SW<11>=1 WILL INHIBIT THE ITERATIONS (=2000(10)) PERFORMED OF EACH TEST ON PASSES 2,3,4, ... THRU THE PROGRAM.
SW<14>=1 CAUSES THE PROGRAM TO LOOP INDEFINATELY ON THE CURRENTLY EXECUTING TEST.
SW<8>=1 CAUSES THE PROGRAM TO CONTINUE EXECUTION AS NORMAL, EXCEPT WHEN THE CONTENTS OF MEMORY WORD "SLPTST" MATCHES THE NUMBER OF THE TEST CURRENTLY EXECUTING. AT THIS POINT, THE TEST IS LOOPED ON INDEFINATELY, UNTIL EITHER SW<8>=0 OR "SLPTST" IS CHANGED. NOTE THAT IF "SLPTST" DOES NOT MATCH THE TEST NUMBER OF ANY TEST, THE CONTENTS OF "SLPTST" ARE EFFECTIVELY IGNORED, AND EXECUTION PROCEEDS NORMALLY.

5.3 HOT (FP11-E) / WARM (PDP-11/6X) SELECTION

WHEN THE PROGRAM IS STARTED (AT 200(8)), A MESSAGE IS OPTIONALLY PRINTED INDICATING THE PRESCENCE/ABSCENCE OF AN FP11-E HOT FLOATING POINT UNIT OPTION (BASED UPON WHETHER "WHAMI" BIT<04> IS 1/0 RESPECTIVELY).

IF NO FP11-E HOT FP OPTION IS PRESENT, THE MESSAGE IS TYPED,

AND ANY ATTEMPTS TO SELECT IT FOR TESTING VIA SW01 AND SW00 ARE IGNORED. ONLY WARM FP (PDP-11/6X MICROCODE) FLOATING POINT CAN BE TESTED/SELECTED.

IF THE FP11-E IS PRESENT, TEST SELECTION IS AS FOLLOWS:

WHEN SW01=0, THE HOT AND WARM FLOATING POINT UNITS ARE TESTED ALTERNATELY EACH PASS - IN THE ORDER (1) HOT, THEN (2) WARM. NOTE THAT EACH "PASS" NOW CONSISTS OF TWO SEPARATE SUB-PASSES.

WHEN SW01=1, THEN DEDICATED SELECTION OF A PARTICULAR UNIT IS SPECIFIED IN SW00:

SW00=0 --> TEST HFP FP11-E OPTION ONLY
SW00=1 --> TEST WFP PDP-11/6X MICROCODE ONLY

5. ERRORS

6.1 FORMAT OF MESSAGES

6.1.1 ALL ERROR MESSAGES CONSIST OF THREE LINES OF DATA:

THE FIRST LINE IS A BRIEF MESSAGE WHICH EXPLAINS WHAT ERROR WAS DETECTED (EG, THE RESULT OF THE "ABSF" INSTRUCTION WAS BAD).

THE PREFIX "HOT:" OR "WARM:" IS ALSO ATTACHED TO THE MESSAGE TO INDICATE THE SOURCE OF THE ERROR; THE FP11-E UNIT OR THE PDP-11/6X RESPECTIVELY.

THE SECOND LINE CONSISTS OF DATA HEADERS TO IDENTIFY THE VALUES TYPED OUT ON LINE THREE. THESE HEADERS WILL EITHER BE OF THE FORM "EXPECTED" AND "RECEIVED" DATA, OR WILL BE A MNEMONIC NAME OF A WORD LOCATION IN MEMORY OR REGISTERS.

THE THIRD LINE DISPLAYS THE CONTENTS OF THE LOCATIONS SPECIFIED BY LINE TWO AS SIX DIGIT OCTAL NUMBERS. NOTE THAT ALL DATA DISPLAYED IN ANY MESSAGES ARE OCTAL NUMBERS.

AS EXPLAINED IN SECTION 5.2, SETTING SW<13>=1 WILL SUPPRESS THE TYPING OF THESE MESSAGES.

6.1.2 FLOATING POINT UNIT DATA FORMATS:

FLOATING POINT STATUS WORD (FPS):

BIT##	OCTAL	FUNCTION
15	100000	FER - FLOATING ERROR FLAG SET WHEN EITHER FIUV, FIU, FIV, FIC ENABLED AND APPROPRIATE EXCEPTION OCCURRED.
14	040000	FID - FLOATING DISABLE INTERRUPTS NO FP INTERRUPTS TO VECTOR 244(8) IF SET.
13, 12		NOT USED
11	004000	FIUV - FLOATING UNDEFINED VARIABLE INTERRUPT IF SET, (-0) MEMORY DATA IS ERROR
10	002000	FIU - FLOATING INTR UNDERFLOW IF SET AND UNDERFLOW, SET FER, STORE ANSWER, EXPONENT WRONG BY +400(8) IF CLEAR AND UNDERFLOW, ANSWER <-- ZERO
9	001000	FIV - FLOATING OVERFLOW INTERRUPT IF SET AND OVERFLOW, SET FER, STORE ANSWER, EXPONENT WRONG BY -400(8) IF CLEAR AND OVERFLOW, ANSWER <-- ZERO
8	000400	FIC - FLOATING INTEGER CONVERSION INTERRUPT IF SET AND "STCFI" ERROR, ANSWER <-- ZERO, SET ERROR IF CLEAR AND "STCFI" ERROR, ANSWER <-- ZERO
7	000200	FD - FLOATING MODE 1=DOUBLE, 64 BIT OPERANDS (4W) 0=SINGLE, 32 BIT OPERANDS (2W)
6	000100	FL - INTEGER MODE 1=LONG, 32 BIT INTEGERS (2W) 0=SHORT, 16 BIT INTEGERS (1W)
5	000040	FT - ROUND/TRUNCATE MODE 1=TRUNCATE RESULTS 0=ROUND RESULTS
4	000020	FMM - PUT FP11-E ONLY IN MAINTENANCE MODE
3:0	000017	FN-FZ-FV-FC - FLOATING CONDITION CODES

FLOATING EXCEPTION CODES (FEC):

OCTAL	ENABLE	
00	(NONE)	(NOT USED)
02	(NONE)	FP OPCODE ERROR
04	(NONE)	FP DIVIDE-BY-ZERO ERROR
06	W/FIC	FP INTEGER CONVERSION ERROR
10	W/FIV	FP OVERFLOW ERROR
12	W/FIU	FP UNDERFLOW ERROR
14	W/FIUV	FP UNDEFINED-VARIABLE/(-0) ERROR
16	W/FMM	FP MAINTENANCE TRAP

NOTE - IN "FEC" CODE TYPEOUTS IN ERROR MESSAGES ONLY THE LOW ORDER BYTE IS USED - IGNORE THE PROGRAM FLAG BIT IN THE UPPER BYTE.

FLOATING POINT DATA:

IN FLOAT MODE (FD=0), IS 2-16. BIT WORDS, 32. BITS
IN DOUBLE MODE (FD=1), IS 4-16. BIT WORDS, 64. BITS

FIRST WORD: (BOTH F, D MODES)
B15=SIGN OF NUMBER (1/-, 0/+)
B14:07=EXPONENT, 8.BITS, FROM -128./+127.
B06:00=FRACTION, 7.BITS
SECOND WORD: (BOTH F, D MODES)
B15:00=FRACTION, 16.BITS
THIRD, FOURTH WORDS: (ONLY D MODE)
B15:00, B15:00=FRACTION, 32. BITS

IN F MODE, THE COMPOSITE 24. BIT FRACTION
IS FORMED BY:

.1#[WORD1-BIT<06:00>]#[WORD2-BIT<15:00>]

IN D MODE, THE COMPOSITE 56. BIT FRACTION
IS FORMED BY:

.1#[WORD1-BIT<06:00>]#[WORD2-BIT<15:00>]
#[WORD3-BIT<15:00>]#[WORD4-BIT<15:00>]

FOR A MORE DETAILED OPERATION/EXPLANATION OF FLOATING POINT DATA FORMATS AND OPERATIONS, SEE THE PDP-11/6X PROCESSOR HANDBOOK SECTION ON THE FLOATING POINT INSTRUCTION SET.

6.2 RECOVERY

RECOVERY FROM ERRORS HAS BEEN ATTEMPTED TO BE MADE AS AUTOMATIC AND EFFORTLESS AS POSSIBLE. HOWEVER, IN MANY CASES, DUE TO THE NATURE OF THE ERROR, THE PROGRAM MAY NOT EVEN BE ABLE TO BE RUN (EG, IF THE FLOATING POINT MODULE IS IN A HUNG STATE, AND CAN NEVER ENTER THE READY STATE TO ACCEPT A NEW FPP INSTRUCTION). AT THIS POINT, SOLVING THE PROBLEM IS A DIRECT FUNCTION OF THE OPERATORS INGENUITY. THIS TEST SERIES HAS BEEN DESIGNED TO TEST THE FLOATING POINT PROCESSOR SO THAT THESE TYPES OF FAILURES TO RUN WILL BE MINIMAL. THE TESTS HAVE BEEN PLACED IN A SPECIFICALLY STRUCTURED SEQUENCE IN THE PROGRAM TO IMPLEMENT THIS STRATEGY: TESTING THE MOST BASIC ELEMENTS FIRST, PROCEEDING UPWARD IN COMPLEXITY AFTER ESTABLISHING THEIR CORRECT OPERATION. THIS IS WHY IT IS EXTREMELY IMPORTANT THAT THE FLOATING POINT TEST PROGRAMS BE (1) RUN IN THE PRESCRIBED ORDER, AND (2) ONLY BE STARTED AT THEIR BEGINNING ADDRESS (USUALLY 200(8)). THE PROGRAM WILL DISPLAY, AT AN ERROR, THE MOST PERTINENT INFORMATION RELATING TO THE ERROR, AND A BRIEF EXPLANATION OF THE FAILING FUNCTION.

6.3 CAUSES

THESE TEST PROGRAMS ARE NOT HARDWARE ORIENTED, AND AS SUCH IT IS NOT POSSIBLE TO CALL OUT PARTICULAR HARDWARE AREAS AND MODULES RELATING TO A GIVEN FUNCTIONAL FAILURE. HARDWARE DIAGNOSIS FOR A PARTICULAR MACHINE MUST BE DONE USING THE APPROPRIATE ENGINEERING ROM FLOWS AND PRINTS, ALONG WITH THE KNOWN FUNCTIONAL ERRORS (AS DETECTED BY THE PROGRAMS). THIS IS THE INTENT UNDER WHICH THESE INSTRUCTION TESTS WERE DESIGNED AND CODED.

7. RESTRICTIONS

7.1 STARTING

THE PROGRAM MUST BE STARTED AT LOCATION 200(8) ALWAYS.

7.2 OPERATIONAL

THERE ARE NO OPERATIONAL RESTRICTIONS.

8. MISCELLANEOUS

8.1 EXECUTION TIME

MODEL	AVERAGE EXECUTION TIME PER PASS SHORTEST PASS	LONGEST PASS
PDP-11/6X MICROCODE	0:20	9:30
PDP-11/6X W/FP11-E	0:15	5:15

TIMES SPECIFIED AS (MINUTES):(SECONDS)

SHORTEST PASS ::= PASS=1, NO ITERATIONS, USING:
SWR=(004003) FOR PDP-11/6X MICROCODE
SWR=(004002) FOR PDP-11/6X W/FP11-E

LONGEST PASS ::= PASS>=2, 2000. ITERATIONS/TEST, USING:
SWR=(000003) FOR PDP-11/6X MICROCODE
SWR=(000002) FOR PDP-11/6X W/FP11-E

8.2 STACK POINTER

THE STACK POINTER IS SET TO 1100(8) AT THE START OF EACH PASS. IF ALL IS OPERATING CORRECTLY, IT SHOULD ALSO BE THIS VALUE AT

THE START OF EACH TEST, AND AT THE END OF A PASS.

8.3 POWER FAIL

THE TESTS MAY BE POWER FAILED AT ANY TIME. SPURIOUS ERROR MESSAGES MAY OCCUR IF THE FAILURE OCCURRED WHILE THE F.P.U. WAS EXECUTING A FUNCTION, AS NONE OF ITS REGISTERS (FPS, FEC, FEA, ACCUMULATORS) ARE SAVED IN THE EVENT OF A POWER FAILURE. HOWEVER, THESE MESSAGES SHOULD ONLY OCCUR ONCE (IF AT ALL) IMMEDIATELY AFTER POWER IS RESTORED. WHEN POWER IS RESTORED, "POWER" IS TYPED ON THE CONSOLE AND EXECUTION CONTINUES WHERE IT WAS INTERRUPTED.

NOTE THAT THE "VOLATILE" SWITCH REGISTER CONTENTS ARE SAVED AND RESTORED FROM THE STACK IN A POWER FAIL SEQUENCE; THEREFORE THE SWITCH REGISTER SETTINGS SHOULD NOT BE LOST OVER A POWER FAIL.

9. PROGRAM DESCRIPTION

9.1 ORGANIZATION

THESE PROGRAMS ARE ORGANIZED AS MUCH AS POSSIBLE IN A STRAIGHTFORWARD, LINEAR MANNER. THE MAIN BODY OF CODE IS STRUCTURED AS FOLLOWS:

(1) INITIALIZATION ROUTINE
    - SETS UP VECTORS. TYPES HEADER, ETC.
(2) MAIN BODY OF TESTS
    - INLINE TEST CODE, INLINE TEST CALLS
(3) END OF PASS ROUTINE
    - END OF PASS PROCESSING
(4) TEST SUBROUTINES
    - SUBROUTINES CONTAINING COMMON TEST CODE
(5) OVERHEAD ROUTINES
    - SERVICE SUBROUTINES (TYPEOUT,ETC.)

WHEREVER FEASIBLE, COMMON SECIONS OF CODE FOR WIDELY USED FUNCTIONS ARE CONDENSED INTO SUBROUTINES TO CONSERVE MEMORY. THIS INCLUDES NOT ONLY STANDARD SERVICE ROUTINES (SUCH AS SCOPE, ERROR, AND ASCII TYPEOUT), BUT ALSO TESTING ROUTINES WHICH PERFORM VERY SIMILAR FUNCTIONS. THUS IN MANY CASES (THE "ADDF" INSTRUCTION TESTING, FOR EXAMPLE) A SINGLE BODY OF CODE (A SUBROUTINE) IS USED TO PERFORM ALL THE FUNCTIONAL TESTS, WITH A VARIABLE PARAMETER LIST PASSED AT EACH CALL CONTAINING THE DATA OPERANDS AND EXPECTED RESULT FOR EACH INDIVIDUAL TEST. THIS CONSTRUCTION FACILITATES THE ADDITION/DELETION OF TESTS (SHOULD THAT EVER BE NECESSARY), AND ALSO GREATLY CONSERVES MEMORY SPACE REQUIREMENTS WHEN A LARGE NUMBER OF CALLS TO A GIVEN BODY OF CODE ARE REQUIRED.

THE INDIVIDUAL TESTS WITHIN EACH PROGRAM HAVE ALSO BEEN SEQUENCED IN A PARTICULAR ORDER TO FACILITATE THE DETECTION AND RESOLUTION OF ERRORS AS QUICKLY AS POSSIBLE. EACH OF THE TESTS BEGINS AS SIMPLY AS POSSIBLE, FIRST TESTING THE MOST BASIC ELEMENTS. MORE COMPLEX ELEMENTS ARE TESTED AFTERWARDS, EMPLOYING A PHILOSOPHY THAT THE SIMPLER THE TEST, THE BETTER THE RESOLUTION. ALL FUNCTIONS ARE EVENTUALLY TESTED, BUT HOPEFULLY MOST ERRORS WILL BE CAUGHT AND CORRECTED EARLY. A MUCH MORE DETAILED ANALYSIS OF THE SEQUENCE OF TESTS PERFORMED IS PRESENTED IN SECTION 9.2.

9.2 TEST DESCRIPTION

THIS DIAGNOSTIC CONTAINS TESTS FOR THE FLOATING POINT 'ADD-', 'SUB-', 'MUL-', AND 'DIV-' INSTRUCTIONS. ALL COMBINATIONS OF THE SINGLE/DOUBLE, ROUND/TRUNCATE, AND OVERFLOW-UNDERFLOW INTERRUPTS ENABLED/DISABLED MODES ARE EMPLOYED. EACH TEST GENERATES A PAIR OF RANDOM NUMBER OPERANDS, THEN USES BOTH THE HARDWARE AND SOFTWARE ROUTINES TO GENERATE AN ANSWER: EACH SHOULD GENERATE THE SAME ANSWER (WITH A +/- 1 DEVIATION IN THE 'LSB' ALLOWED). FLOATING POINT 'LD-', 'ST-', 'CMP-', AND STATUS INSTRUCTIONS ARE ALSO USED FOR MANIPULATING THE OPERANDS AND RESULTS.

THE PURPOSE OF THESE TESTS IS TO EXERCISE BOTH THE DATA PATH AND CONTROL PORTIONS OF THE FLOATING POINT UNIT SELECTED FOR TESTING WITH AN 'UNLIMITED' SUPPLY OF VARYING OPERANDS, AS MIGHT BE ENCOUNTERED IN A USER/APPLICATION PROGRAM TYPE ENVIRONMENT.

9.3 SUBROUTINE ABSTRACTS

9.3.1 TRAPCATCHER

THE TRAPCATCHER IS A SERIES OF INSTRUCTIONS OCCUPYING THE INTERRUPT VECTOR AREA OF MEMORY. IT CONSISTS OF THE SEQUENCE:

```
        .WORD   .+2     ;PC AFTER TRAP
        .WORD   0       ;PS AFTER TRAP
```

PLACED AT EACH VECTOR ADDRESS IN LOCATIONS 4-776(8) OF MEMORY. THE FIRST WORD OF EACH PAIR ("PC AFTER TRAP") POINTS TO THE SECOND WORD, WHICH SERVES A DUAL PURPOSE AS (1) THE NEW LOADED PS (ALL ZEROS), AND (2) THE NEXT INSTRUCTION TO EXECUTE (0=HALT).

WHEN THE PROGRAM IS EXECUTING, ANY REQUIRED VECTORS ARE SET UP IN THE VECTOR AREA WITH APPROPRIATE VALUES; THE OTHERS BEING LEFT IN THE "TRAPCATCHER" STATE. THUS, IF AN UNEXPECTED TRAP EVER OCCURS IN THE MACHINE, IT WILL BE CAUGHT, AND THE MACHINE SUBSEQUENTLY HALTED, DISPLAYING THE VECTOR ADDRESS * PLUS FOUR

* IN THE ADDRESS LIGHTS.

9.3.2 SCOPE ROUTINE - $SCOPE

THE SCOPE ROUTINE IS ENTERED FROM THE FIRST INSTRUCTION OF EACH TEST IN THE PROGRAM. (NOTE THAT BY DEFINITION, A "TEST" WILL BE DESIGNATED AS THE SECTION OF CODE BETWEEN TWO "SCOPE" STATEMENTS.) THIS ROUTINE PROVIDES THE OVERHEAD CODE NECESSARY TO IMPLEMENT SEVERAL OF THE SWITCH REGISTER CONTROL OPTIONS. UPON ENTRANCE TO A TEST, THE SCOPE STATEMENT AT THE BEGINNING SETS UP CERTAIN LOCATIONS (SEE BELOW) TO SPECIFY THE CURRENT TEST NUMBER AND LOOPING ADDRESS (FOR ITERATIONS). CONTROL IS THEN PASSED TO THE ACTUAL TEST CODE, PERFORMING THE DESIRED TEST. UPON EXIT, THE SCOPE STATEMENT OF THE NEXT TEST IS ENTERED, WHICH DETERMINES WHETHER TO (1) LOOP BACK TO THE PREVIOUS TEST (EG, FOR ITERATIONS) OR (2) INITIALIZE FOR THE NEXT TEST (AS DESCRIBED EARLIER, ABOVE).

ENTRANCE TO THE SCOPE ROUTINE IS VIA AN "IOT" TRAP CALL THROUGH LOCATION 20(8). (FROM THE SCOPE=IOT EQUATE). DEPENDING UPON THE SWITCH SETTINGS (SEE 5.2), CODE IS PRESENT TO: LOAD THE FP11 MICRO BREAK REGISTER, LOOP ON THE CURRENTLY EXECUTING TEST, LOOP ON A SPECIFIC TEST, PERFORM ITERATIONS OF EACH TEST, AND SET UP ADDRESSES FOR POSSIBLE LOOPING ON ERRORS. IMPORTANT VALUES USED IN THIS ROUTINE ARE:

- $MXCNT - MAXIMUM NUMBER OF ITERATIONS PER TEST (GENERALLY WILL BE 2000(10))
- $TSTNM - A COUNTER INDICATING THE NUMBER (1-377(8)) OF THE TEST CURRENTLY BEING EXECUTED
- $LPADR - CONTAINS THE ADDRESS TO WHICH THE SCOPE ROUTINE WILL LOOP, IF THE CURRENT TEST IS BEING LOOPED UPON
- $LPERR - CONTAINS THE ADDRESS TO WHICH THE ERROR ROUTINE (SEE 9.3.3) WILL LOOP, IF AN ERROR OCCURS AND THE LOOPING ON AN ERROR OPTION IS SPECIFIED IN THE SWITCHES. SET UP BY SCOPE, GENERALLY WILL BE THE SAME AS $LPADR, ABOVE.

9.3.3 ERROR ROUTINE - $ERROR

THE ERROR ROUTINE IS ENTERED WHEN THE TEST CODE HAS DETERMINED THAT AN ERROR HAS OCCURRED AS PART OF A TEST. THROUGH USE OF THIS ROUTINE, THE TEST HAS A MEANS OF SIGNALING AN ERROR TO THE 10520 OPERATOR/MONITOR; AND IMPLEMENTING THE CONTROL FUNCTIONS FOR HALTING ON ERROR, BELL ON ERROR, AND LOOPING ON ERROR. IN ADDITION, THE ERROR ROUTINE HAS THE PROVISION TO TYPE OUT ON THE OPERATOR'S CONSOLE A MESSAGE BRIEFLY EXPLAINING THE ERROR, AND SOME OF THE MOST PERTINENT DATA VALUES TO HELP DIAGNOSE THE CAUSE (SEE SECTION 6.2).

THE CALLING MECHANISM IS SIMILAR TO THAT EMPLOYED FOR THE SCOPE ROUTINE (VIA A TRAP), EXCEPT IN THIS INSTANCE, THE "EMT"

INSTRUCTION IS USED, TRAPPING THROUGH LOCATION 30(8). (NOTE THE EQUATE ERROR N=EMT N). THE LOWER BYTE OF THE EMT INSTRUCTION IS CAPABLE OF TRANSMITTING A NUMBER FROM 0-377(8), WHICH WILL BE TERMED THE "ERROR ITEM NUMBER". THIS NUMBER DETERMINES WHICH ERROR MESSAGE, AND ASSOCIATED DATA VALUES WILL BE TYPED OUT WHEN A PARTICULAR ERROR IS SIGNALED. IF THIS NUMBER IS ZERO, JUST THE PC OF THE CALLING "ERROR" INSTRUCTION WILL BE TYPED, OTHERWISE, THE NUMBER IS USED AS AN INDEX THROUGH THE ERROR TABLE (SERRTB) TO FIND THE APPROPRIATE VALUES TO TYPE (SEE PROGRAM LISTING FOR FURTHER DETAILS).

IMPORTANT VALUES USED IN THIS ROUTINE ARE:

- EREG0 THRU EREG7 - CONTENTS OF GENERAL REGISTERS R0 THRU R7 JUST BEFORE ERROR CALL
- SERTTL - COMULATIVE NUMBER OF ERRORS ENCOUNTERED TO DATE
- SERRPC - CONTAINS THE PC OF THE "ERROR" INSTRUCTION JUST EXECUTED
- SLPERR - CONTAINS THE ADDRESS WHICH WILL BE LOOPED UPON FOR THE ERROR LOOPING FACILITY

9.3.4 ERROR MESSAGE TYPEOUT ROUTINE - $TYPERR

THIS ROUTINE ($TYPERR ENTRY POINT) IS CALLED BY THE ERROR PROCESSING ROUTINE DESCRIBED IN 9.3.3 ABOVE. ITS PURPOSE IS TO IMPLEMENT THE ERROR MESSAGE/DATA VALUE ERROR TYPEOUT FACILITY. THE SUBROUTINE WILL, GIVEN THE INDEXING BYTE FROM THE ERROR CALL INSTRUCTION, PICK UP THE CORRECT ERROR MESSAGE VECTOR FROM SERRTB (ERROR TABLE), AND TYPE OUT THE ERROR MESSAGE, DATA HEADER, AND DATA VALUES ON THE CONSOLE.

9.3.5 TYPE ROUTINE - $TYPE

THIS ROUTINE IS THE STANDARD SYSTEM TYPEOUT ROUTINE FOR ASCII SINGLE-CHARACTER-PER-BYTE STRINGS. IT IS CALLED THROUGH A TRAP INSTRUCTION WITH THE NEXT WORD CONTAINING THE ADDRESS OF THE FIRST CHARACTER IN THE STRING. TYPING TERMINATES WHEN AN ALL-ZERO BYTE IS FOUND. HORIZONTAL TAB STOPS ARE ALSO AUTOMATICALLY PLACED.

9.3.6 OCTAL NUMBER TYPE ROUTINE - $TYPOC

THIS ROUTINE CONVERTS THE TOP NUMBER ON THE STACK TO A 6-DIGIT OCTAL REPRESENTATION, AND TYPES IT ON THE CONSOLE USING THE TYPE ROUTINE $TYPE. SEE LISTING FOR OPTIONS AND FURTHER DETAILS.

9.3.7 POWER UP AND DOWN ROUTINES - $PWRUP AND $PWRDN

THESE TWO ROUTINES ARE ENTERED FOR THE POWER UP AND DOWN CONDITIONS, RESPECTIVELY. THE POWER DOWN ROUTINE ($PWRDN) SAVES THE GENERAL REGISTERS AND STACK POINTER. THE POWER UP

ROUTINE (SPWRUP) CORRESPONDINGLY RESTORES THE REGISTERS, STACK POINTER, AND TYPES THE MESSAGE "POWER" WHEN POWER IS RESTORED. THE VOLATILE INTERNAL SWITCH REGISTER IS ALSO SAVED/RESTORED BY THIS ROUTINE.

9.3.8 END OF PASS ROUTINE - SEOP

THE END OF PASS ROUTINE COUNTS THE NUMBER OF PASSES PERFORMED, DINGS THE BELL/TYPES A MESSAGE (IF ENABLED), SETS/CLEARS THE T-BIT (IF ENABLED), AND ALSO INTERFACES TO THE MONITOR, IF PRESENT. IT ALSO OPTIONALLY LOOPS FOR A NUMBER OF SUBPASSES BEFORE SIGNALLING AN END OF PASS CONDITION.

10. ACT/APT/XXDP

10.1 ACT COMPATIBILITY

THIS PROGRAM WILL RUN UNDER THE ACT SYSTEM.

10.2 APT COMPATIBILITY

THIS PROGRAM WILL RUN UNDER THE APT SYSTEM MONITOR. ALL NECESSARY SOFTWARE COMMUNICATION HOOKS ARE PRESENT.

10.3 XXDP COMPATIBILITY

FOR XXDP MEDIA COMPATIBILITY, THE TOP 2K WORDS OF THE 16K WORD MINIMUM MEMORY AREA ARE NOT DISTURBED DURING EXECUTION.

```
                        .TITLE  FPU ADD/SUB/MUL/DIV RANDOM EXER
                        ;*COPYRIGHT (C) 1976
                        ;*DIGITAL EQUIPMENT CORP.
                        ;*MAYNARD, MASS. 01754
                        ;*
                        ;*PROGRAM BY DONALD NORTH
                        ;*
                        ;*THIS PROGRAM WAS ASSEMBLED USING THE PDP-11 MAINDEC SYSMAC
                        ;*PACKAGE (MAINDEC-11-DZQAC-C3), JAN 19, 1977.
                        ;*
                        .SBTTL  OPERATIONAL SWITCH SETTINGS
                        ;*
                        ;*      SWITCH  OCTAL           USE
                        ;*      ------  ------          ----------------
                        ;*        15    100000          HALT ON ERROR
                        ;*        14    040000          LOOP ON CURRENTLY EXECUTING TEST
                        ;*        13    020000          INHIBIT ERROR TYPEOUTS
                        ;*        12    010000          INHIBIT STATUS TYPEOUTS
                        ;*        11    004000          INHIBIT ITERATIONS
                        ;*        10    000000          0=BELL ON PASS END
                        ;*              002000          1=BELL ON ERROR
                        ;*         9    001000          LOOP ON ERROR
                        ;*         8    000400          LOOP ON TEST NUMBER IN "SLPTST"
                        ;*         1    000000          0=TEST HFP/WFP ALTERNATELY EACH PASS
                        ;*              000002          1=TEST ONLY UNIT SPECIFIED IN SW<00>
                        ;*         0    000002          0=SELECT HFP, IF SW<01>=1
                        ;*              000003          1=SELECT WFP, IF SW<01>=1
                        ;*
                        .SBTTL  BASIC DEFINITIONS
                        ;
                        ;*INITIAL ADDRESS OF THE STACK POINTER *** 1100 ***
001100                  STACK=  1100
                        .EQUIV  EMT,ERROR       ;;BASIC DEFINITION OF ERROR CALL
                        .EQUIV  IOT,SCOPE       ;;BASIC DEFINITION OF SCOPE CALL
                        ;
                        ;*MISCELLANEOUS DEFINITIONS
000011                  HT=     11              ;;CODE FOR HORIZONTAL TAB
000012                  LF=     12              ;;CODE FOR LINE FEED
000015                  CR=     15              ;;CODE FOR CARRIAGE RETURN
000200                  CRLF=   200             ;;CODE FOR CARRIAGE RETURN-LINE FEED
177776                  PS=     177776          ;;PROCESSOR STATUS WORD
                        .EQUIV  PS,PSW
177774                  STKLMT= 177774          ;;STACK LIMIT REGISTER
177772                  PIRQ=   177772          ;;PROGRAM INTERRUPT REQUEST REGISTER
177570                  DSWR=   177570          ;;HARDWARE SWITCH REGISTER
177570                  DDISP=  177570          ;;HARDWARE DISPLAY REGISTER
                        ;
                        ;*GENERAL PURPOSE REGISTER DEFINITIONS
000000                  R0=     %0              ;;GENERAL REGISTER
000001                  R1=     %1              ;;GENERAL REGISTER
000002                  R2=     %2              ;;GENERAL REGISTER
000003                  R3=     %3              ;;GENERAL REGISTER
000004                  R4=     %4              ;;GENERAL REGISTER
000005                  R5=     %5              ;;GENERAL REGISTER
000006                  R6=     %6              ;;GENERAL REGISTER
```

```
                        R7=     %7              ;;GENERAL REGISTER
                        SP=     %6              ;;STACK POINTER
                        PC=     %7              ;;PROGRAM COUNTER

                        ;*PRIORITY LEVEL DEFINITIONS
000000                  PR0=    0               ;;PRIORITY LEVEL 0
000040                  PR1=    40              ;;PRIORITY LEVEL 1
000100                  PR2=    100             ;;PRIORITY LEVEL 2
000140                  PR3=    140             ;;PRIORITY LEVEL 3
000200                  PR4=    200             ;;PRIORITY LEVEL 4
000240                  PR5=    240             ;;PRIORITY LEVEL 5
000300                  PR6=    300             ;;PRIORITY LEVEL 6
000340                  PR7=    340             ;;PRIORITY LEVEL 7

                        ;*"SWITCH REGISTER" SWITCH DEFINITIONS
100000                  SW15=   100000
040000                  SW14=   40000
020000                  SW13=   20000
010000                  SW12=   10000
004000                  SW11=   4000
002000                  SW10=   2000
001000                  SW09=   1000
000400                  SW08=   400
000200                  SW07=   200
000100                  SW06=   100
000040                  SW05=   40
000020                  SW04=   20
000010                  SW03=   10
000004                  SW02=   4
000002                  SW01=   2
000001                  SW00=   1
                        .EQUIV  SW09,SW9
                        .EQUIV  SW08,SW8
                        .EQUIV  SW07,SW7
                        .EQUIV  SW06,SW6
                        .EQUIV  SW05,SW5
                        .EQUIV  SW04,SW4
                        .EQUIV  SW03,SW3
                        .EQUIV  SW02,SW2
                        .EQUIV  SW01,SW1
                        .EQUIV  SW00,SW0

                        ;*DATA BIT DEFINITIONS (BIT00 TO BIT15)
100000                  BIT15=  100000
040000                  BIT14=  40000
020000                  BIT13=  20000
010000                  BIT12=  10000
004000                  BIT11=  4000
002000                  BIT10=  2000
001000                  BIT09=  1000
000400                  BIT08=  400
000200                  BIT07=  200
000100                  BIT06=  100
000040                  BIT05=  40
000020                  BIT04=  20
000010                  BIT03=  10
```

```
                        BIT02=  4
                        BIT01=  2
                        BIT00=  1
                        .EQUIV  BIT09,BIT9
                        .EQUIV  BIT08,BIT8
                        .EQUIV  BIT07,BIT7
                        .EQUIV  BIT06,BIT6
                        .EQUIV  BIT05,BIT5
                        .EQUIV  BIT04,BIT4
                        .EQUIV  BIT03,BIT3
                        .EQUIV  BIT02,BIT2
                        .EQUIV  BIT01,BIT1
                        .EQUIV  BIT00,BIT0

                        ;*BASIC "CPU" TRAP VECTOR ADDRESSES
000004                  ERRVEC= 4               ;;TIME OUT AND OTHER ERRORS
000010                  RESVEC= 10              ;;RESERVED AND ILLEGAL INSTRUCTIONS
000014                  TBITVEC=14              ;;"T" BIT
000014                  TRTVEC= 14              ;;TRACE TRAP
000014                  BPTVEC= 14              ;;BREAKPOINT TRAP (BPT)
000020                  IOTVEC= 20              ;;INPUT/OUTPUT TRAP (IOT) **SCOPE**
000024                  PWRVEC= 24              ;;POWER FAIL
000030                  EMTVEC= 30              ;;EMULATOR TRAP (EMT) **ERROR**
000034                  TRAPVEC=34              ;;"TRAP" TRAP
000060                  TKVEC=  60              ;;TTY KEYBOARD VECTOR
000064                  TPVEC=  64              ;;TTY PRINTER VECTOR
000240                  PIRQVEC=240             ;;PROGRAM INTERRUPT REQUEST VECTOR

                        ;*MED INSTR CODES
076600                  MED=    076600          ;OPCODE

000022                  RWHAMI= 022             ;READ WHAMI

000144                  RFLAG=  144             ;READ FLAGS
000344                  WFLAG=  344             ;WRITE FLAGS

                        ;*FLOATING POINT INTERRUPT VECTOR
000244                  FPPVEC= 244

                        ;*FLOATING POINT REGISTER DEFINITIONS
000000                  AC0=    %0
000001                  AC1=    %1
000002                  AC2=    %2
000003                  AC3=    %3
000004                  AC4=    %4
000005                  AC5=    %5


                        .SBTTL  TRAP CATCHER

000000                          .=0
                        ;*ALL UNUSED LOCATIONS FROM 4 - 776 CONTAIN A ".+2,HALT"
                        ;*SEQUENCE TO CATCH ILLEGAL TRAPS AND INTERRUPTS
                        ;*LOCATION 0 CONTAINS 0 TO CATCH IMPROPERLY LOADED VECTORS
000174                          .=174
```

```
                                TRAP CATCHER

000174  000000                  DISPREG: .WORD  0               ;;SOFTWARE DISPLAY REGISTER
000176  000000                  SWREG:   .WORD  0               ;;SOFTWARE SWITCH REGISTER
                                .SBTTL  STARTING ADDRESS(ES)
000200  000137  003000                  JMP     @#START ;;JUMP TO STARTING ADDRESS OF PROGRAM

                                .SBTTL  ACT11 HOOKS

                                ;;*****************************************************************
                                ;HOOKS REQUIRED BY ACT11
                                        $SVPC=.                 ;SAVE PC
000204                                  .=46
000046
000046  022106                          $ENDAD                  ;;1)SET LOC.46 TO ADDRESS OF $ENDAD IN .SEOP
000052                                  .=52
000052  000000                          .WORD   0               ;;2)SET LOC.52 TO ZERO
000204                                  .=$SVPC                 ;; RESTORE PC
001000                                  .=1000
                                .SBTTL  APT PARAMETER BLOCK

                                ;;*****************************************************************
                                ;SET LOCATIONS 24 AND 44 AS REQUIRED FOR APT
                                ;;*****************************************************************
001000                                  .$X=.   ;;SAVE CURRENT LOCATION
000024                                  .=24    ;;SET POWER FAIL TO POINT TO START OF PROGRAM
000024  000200                          200     ;;FOR APT START UP
000044                                  .=44    ;;POINT TO APT INDIRECT ADDRESS PNTR.
000044  001000                          $APTHDR ;;POINT TO APT HEADER BLOCK
001000                                  .=.$X   ;;RESET LOCATION COUNTER
                                ;;*****************************************************************
                                ;SETUP APT PARAMETER BLOCK AS DEFINED IN THE APT-PDP11 DIAGNOSTIC
                                ;INTERFACE SPEC.

001000                          $APTHD:
001000  000000                  $HIBTS: .WORD   0       ;;TWO HIGH BITS OF 18 BIT MAILBOX ADDR.
001002  001202                  $MBADR: .WORD   $MAIL   ;;ADDRESS OF APT MAILBOX (BITS 0-15)
001004  000012                  $TSTM:  .WORD   10.     ;;RUN TIM OF LONGEST TEST
001006  000055                  $PASTM: .WORD   45.     ;;RUN TIME IN SECS. OF 1ST PASS ON 1 UNIT (QUICK VERIFY)
001010  000000                  $UNITM: .WORD   0       ;;ADDITIONAL RUN TIME (SECS) OF A PASS FOR EACH ADDITIONAL UNIT
001012  000014                          .WORD   $ETEND-$MAIL/2 ;;LENGTH MAILBOX-ETABLE(WORDS)
```

```
                                .SBTTL  COMMON TAGS

                                ;;*****************************************************************
                                ;*THIS TABLE CONTAINS VARIOUS COMMON STORAGE LOCATIONS
                                ;*USED IN THE PROGRAM.

                        001100          .=1100
001100                  001100  $CMTAG:                         ;;START OF COMMON TAGS
                                ;;-----START OF CLEAR COMMON TAGS-----
001100  000000                          .WORD   0
001102  000000          $TSTNM: .WORD   0               ;;CONTAINS THE TEST NUMBER
001104  000000          $ERFLG: .WORD   0               ;;CONTAINS ERROR FLAG
001106  000000          $ICNT:  .WORD   0               ;;CONTAINS SUBTEST ITERATION COUNT
001110  000000          $LPADR: .WORD   0               ;;CONTAINS SCOPE LOOP ADDRESS
001112  000000          $LPERR: .WORD   0               ;;CONTAINS SCOPE RETURN FOR ERRORS
001114  000000          $ERTTL: .WORD   0               ;;CONTAINS TOTAL ERRORS DETECTED
001116  000000          $ITEMB: .WORD   0               ;;CONTAINS ITEM CONTROL BYTE
001120  000001          $ERMAX: .WORD   1               ;;CONTAINS MAX. ERRORS PER TEST
001122  000000          $ERRPC: .WORD   0               ;;CONTAINS PC OF LAST ERROR INSTRUCTION
001124  000000          $GDADR: .WORD   0               ;;CONTAINS ADDRESS OF 'GOOD' DATA
001126  000000          $BDADR: .WORD   0               ;;CONTAINS ADDRESS OF 'BAD' DATA
001130  000000          $GDDAT: .WORD   0               ;;CONTAINS 'GOOD' DATA
001132  000000          $BDDAT: .WORD   0               ;;CONTAINS 'BAD' DATA
001134  000000                  .WORD   0               ;;RESERVED--NOT TO BE USED
001136  000000                  .WORD   0
001140  000             $AUTOB: .BYTE   0               ;;AUTOMATIC MODE INDICATOR
001141  000             $INTAG: .BYTE   0               ;;INTERRUPT MODE INDICATOR
001142  000000                  .WORD   0
                                ;;-----END OF CLEAR COMMON TAGS-----
001144  177570          $SWR:   .WORD   DSWR            ;;ADDRESS OF SWITCH REGISTER
001146  177570          DISPLA: .WORD   DDISP           ;;ADDRESS OF DISPLAY REGISTER
001150  000000          $LPTST: .WORD   0               ;;CONTAINS TEST NUMBER TO LOOP UPON
001152  177560          $TKS:   177560                  ;;TTY KBD STATUS
001154  177562          $TKB:   177562                  ;;TTY KBD BUFFER
001156  177564          $TPS:   177564                  ;;TTY PRINTER STATUS REG. ADDRESS
001160  177566          $TPB:   177566                  ;;TTY PRINTER BUFFER REG. ADDRESS
001162  000             $NULL:  .BYTE   0               ;;CONTAINS NULL CHARACTER FOR FILLS
001163  002             $FILLS: .BYTE   2               ;;CONTAINS # OF FILLER CHARACTERS REQUIRED
001164  012             $FILLC: .BYTE   12              ;;INSERT FILL CHARS. AFTER A "LINE FEED"
001165  000             $TPFLG: .BYTE   0               ;;"TERMINAL AVAILABLE" FLAG (BIT<07>=0=YES)
001166  000000          $TIMES: 0                       ;;MAX. NUMBER OF ITERATIONS
001170  000000          $ESCAPE:0                       ;;ESCAPE ON ERROR ADDRESS
001172  177607  000377  $BELL:  .ASCIZ  <207><377><377> ;;CODE FOR BELL
001176  077             $QUES:  .ASCII  /?/             ;;QUESTION MARK
001177  015             $CRLF:  .ASCII  <15>            ;;CARRIAGE RETURN
001200  000012          $LF:    .ASCIZ  <12>            ;;LINE FEED
                                ;;*****************************************************************
                                .SBTTL  APT MAILBOX-ETABLE

                                ;;*****************************************************************
                                .EVEN
001202                  001202  $MAIL:                          ;;APT MAILBOX
001202  000000          $MSGTY: .WORD   AMSGTY          ;;MESSAGE TYPE CODE
001204  000000          $FATAL: .WORD   AFATAL          ;;FATAL ERROR NUMBER
001206  000000          $TESTN: .WORD   ATESTN          ;;TEST NUMBER
001210  000000          $PASS:  .WORD   APASS           ;;PASS COUNT
```

```
001212 000000          $DEVCT: .WORD   ADEVCT  ;;DEVICE COUNT
001214 000000          $UNIT:  .WORD   AUNIT   ;;I/O UNIT NUMBER
001216 000000          $MSGAD: .WORD   AMSGAD  ;;MESSAGE ADDRESS
001220 000000          $MSGLG: .WORD   AMSGLG  ;;MESSAGE LENGTH
001222                 $ETABLE:                ;;APT ENVIRONMENT TABLE
001222    000          $ENV:   .BYTE   AENV    ;;ENVIRONMENT BYTE
001223    000          $ENVM:  .BYTE   AENVM   ;;ENVIRONMENT MODE BITS
001224 000000          $SWREG: .WORD   ASWREG  ;;APT SWITCH REGISTER
001226 000000          $USWR:  .WORD   AUSWR   ;;USER SWITCHES
001230 000000          $CPUOP: .WORD   ACPUOP  ;;CPU TYPE,OPTIONS
                       ;*                      BITS 15-11=CPU TYPE
                       ;*                              11/04=01,11/05=02,11/20=03,11/40=04,11/45=05
                       ;*                              11/70=06,PDQ=07,Q=10
                       ;*                      BIT 10=REAL TIME CLOCK
                       ;*                      BIT  9=FLOATING POINT PROCESSOR
                       ;*                      BIT  8=MEMORY MANAGEMENT
001232                 $ETEND:
                       .MEXIT
```

```
                                .SBTTL  ERROR POINTER TABLE

001232                          $ERRTB:

                                ;*THIS TABLE CONTAINS THE INFORMATION FOR EACH ERROR THAT CAN OCCUR.
                                ;*THE INFORMATION IS OBTAINED BY USING THE INDEX NUMBER FOUND IN
                                ;*LOCATION $ITEMB. THIS NUMBER INDICATES WHICH ITEM IN THE TABLE IS PERTINENT.
                                ;*NOTE1:        IF $ITEMB IS 0 THE ONLY PERTINENT DATA IS ($ERRPC).
                                ;*NOTE2:        EACH ITEM IN THE TABLE CONTAINS 4 POINTERS EXPLAINED AS FOLLOWS:

                                ;*      EM              ;;POINTS TO THE ERROR MESSAGE
                                ;*      DH              ;;POINTS TO THE DATA HEADER
                                ;*      DT              ;;POINTS TO THE DATA
                                ;*      DF              ;;POINTS TO THE DATA FORMAT
                                        ;*NOTE:  ERROR VECTOR TABLE ($ERRTB) HAS BEEN MODIFIED,
                                        ;*       SEE $ERRTYP ROUTINE FOR ITS STRUCTURE
001232  032524  033204  033474  EMV001: .WORD   EMJ,DHA,DTA,0,0,0,0,0,0,0       ;ADDF   *
001240  000000  000000  000000
001246  000000  000000  000000
001254  000000
001256  032545  033204  033474  EMV002: .WORD   EMK,DHA,DTA,0,0,0,0,0,0,0       ;SUBF   * FPS ERRORS
001264  000000  000000  000000
001272  000000  000000  000000
001300  000000
001302  032566  033204  033474  EMV003: .WORD   EML,DHA,DTA,0,0,0,0,0,0,0       ;MULF   *
001310  000000  000000  000000
001316  000000  000000  000000
001324  000000
                
001326  000000  000000  000000  EMV004: .WORD   0,0,0,0,0,0,0,0,0,0             ;(UNUSED)
001334  000000  000000  000000
001342  000000  000000  000000
001350  000000
                
001352  032275  033220  033514  EMV005: .WORD   EME,DHB,DTD,LOF,HIF,0,0,0,0,0   ;ADDF   *
001360  033622  033632  000000
001366  000000  000000  000000
001374  000000
001376  032275  033256  033526  EMV006: .WORD   EME,DHC,DTE,LOD,HID,0,0,0,0,0   ;ADDD   *
001404  033572  033606  000000
001412  000000  000000  000000
001420  000000
001422  032325  033220  033514  EMV007: .WORD   EMF,DHB,DTD,LOF,HIF,0,0,0,0,0   ;SUBF   *
001430  033622  033632  000000
001436  000000  000000  000000
001444  000000
001446  032325  033256  033526  EMV010: .WORD   EMF,DHC,DTE,LOD,HID,0,0,0,0,0   ;SUBD   * RESULT ERRORS
001454  033572  033606  000000
001462  000000  000000  000000
001470  000000
001472  032355  033220  033514  EMV011: .WORD   EMG,DHB,DTD,LOF,HIF,0,0,0,0,0   ;MULF   *
001500  033622  033632  000000
001506  000000  000000  000000
001514  000000
001516  032355  033256  033526  EMV012: .WORD   EMG,DHC,DTE,LOD,HID,0,0,0,0,0   ;MULD   *
001524  033572  033606  000000
```

```
338  001532  000000  000000  000000
339  001540  000000
340  001542  032405  033220  033514  EMV013: .WORD   EMH,DHB,DTD,LOF,HIF,0,0,0,0,0   ;DIVF   *
341  001550  033622  033632  000000
342  001556  000000  000000  000000
343  001564  000000
344  001566  032405  033256  033526  EMV014: .WORD   EMH,DHC,DTE,LOD,HID,0,0,0,0,0   ;DIVD   *
345  001574  033572  033606  000000
346  001602  000000  000000  000000
347  001610  000000
348
349  001612  032435  033354  033550  EMV015: .WORD   EMI,DHD,DTF,0,0,0,0,0,0,0       ;ILLEGAL FPP TRAP
350  001620  000000  000000  000000
351  001626  000000  000000  000000
352  001634  000000
353
354  001636  032607  033204  033474  EMV016: .WORD   EMM,DHA,DTA,0,0,0,0,0,0,0       ;DIVF   *
355  001644  000000  000000  000000
356  001652  000000  000000  000000
357  001660  000000
358  001662  032630  033204  033474  EMV017: .WORD   EMN,DHA,DTA,0,0,0,0,0,0,0       ;ADDD   *
359  001670  000000  000000  000000
360  001676  000000  000000  000000
361  001704  000000
362  001706  032651  033204  033474  EMV020: .WORD   EMO,DHA,DTA,0,0,0,0,0,0,0       ;SUBD   * FPS ERRORS
363  001714  000000  000000  000000
364  001722  000000  000000  000000
365  001730  000000
366  001732  032672  033204  033474  EMV021: .WORD   EMP,DHA,DTA,0,0,0,0,0,0,0       ;MULD   *
367  001740  000000  000000  000000
368  001746  000000  000000  000000
369  001754  000000
370  001756  032713  033204  033474  EMV022: .WORD   EMQ,DHA,DTA,0,0,0,0,0,0,0       ;DIVD   *
371  001764  000000  000000  000000
372  001772  000000  000000  000000
373  002000  000000
374
375  002002  032734  033433  033502  EMV023: .WORD   EMR,DHE,DTB,0,0,0,0,0,0,0       ;ADDF   *
376  002010  000000  000000  000000
377  002016  000000  000000  000000
378  002024  000000
379  002026  032761  033433  033502  EMV024: .WORD   EMS,DHE,DTB,0,0,0,0,0,0,0       ;SUBF   *
380  002034  000000  000000  000000
381  002042  000000  000000  000000
382  002050  000000
383  002052  033006  033433  033502  EMV025: .WORD   EMT,DHE,DTB,0,0,0,0,0,0,0       ;MULF   *
384  002060  000000  000000  000000
385  002066  000000  000000  000000
386  002074  000000
387  002076  033033  033433  033502  EMV026: .WORD   EMU,DHE,DTB,0,0,0,0,0,0,0       ;DIVF   * FEC/FEA ERRORS
388  002104  000000  000000  000000
389  002112  000000  000000  000000
390  002120  000000
391  002122  033060  033433  033502  EMV027: .WORD   EMV,DHE,DTB,0,0,0,0,0,0,0       ;ADDD   *
392  002130  000000  000000  000000
393  002136  000000  000000  000000
```

```
394  002144  000000
395  002146  033105  033433  033502  EMV030: .WORD   EMW,DHE,DTB,0,0,0,0,0,0,0        ;SUBD   *
396  002154  000000  000000  000000
397  002162  000000  000000  000000
398  002170  000000
399  002172  033132  033433  033502  EMV031: .WORD   EMX,DHE,DTB,0,0,0,0,0,0,0        ;MULD   *
400  002200  000000  000000  000000
401  002206  000000  000000  000000
402  002214  000000
403  002216  033157  033433  033502  EMV032: .WORD   EMY,DHE,DTB,0,0,0,0,0,0,0        ;DIVD   *
404  002224  000000  000000  000000
405  002232  000000  000000  000000
406  002240  000000
407
408  002242  032103  033204  033474  EMV033: .WORD   EMA,DHA,DTA,0,0,0,0,0,0,0        ;F-MODE EXERCISER  *  FPS
409  002250  000000  000000  000000
410  002256  000000  000000  000000
411  002264  000000
412  002266  032140  033204  033474  EMV034: .WORD   EMB,DHA,DTA,0,0,0,0,0,0,0        ;D-MODE EXERCISER  *    ERROR
413  002274  000000  000000  000000
414  002302  000000  000000  000000
415  002310  000000
416
417  002312  032175  033220  033514  EMV035: .WORD   EMC,DHB,DTD,OP1F,OP2F,OP3F,OP4F,OP5F,OP6F,0     ;F-MODE EXERCISER  *  RE
                                                                                                        SULT
418  002320  033642  033652  033662
419  002326  033672  033702  033712
420  002334  000000
421  002336  032235  033256  033526  EMV036: .WORD   EMD,DHC,DTE,OP1D,OP2D,OP3D,OP4D,OP5D,OP6D,0     ;D-MODE EXERCISER  *
                                                                                                        ERROR
422  002344  033722  033736  033752
423  002352  033766  034002  034016
424  002360  000000
425
426
427
428
429
430                          .SBTTL  PROGRAM DEFINED COMMON TAGS
431                          ;*VARIABLES
432  002362  000000          FPS:    .WORD   0               ;FPS STORED HERE AFTER STFPS
433  002364  000000          FEC:    .WORD   0               ;FEC STORED HERE AFTER STST
434  002366  000000          FEA:    .WORD   0               ;FEA STORED HERE AFTER STST
435  002370  000000          FPPOPC: .WORD   0               ;OLD PC SAVED HERE AFTER TRAP
436  002372  000000          FPPOPS: .WORD   0               ;OLD PS SAVED HERE AFTER TRAP
437  002374  000000          FPPOSP: .WORD   0               ;SP AFTER TRAP
438  002376  000000          EXPFEA: .WORD   0               ;EXPECTED FEA
439  002400  000000          $FPS:   .WORD   0               ;SOFTWARE FPS
440  002402  000000          $FEC:   .WORD   0               ;SOFTWARE FEC
441  002404  000000          $FEA:   .WORD   0               ;SOFTWARE FEA
442  002406  000000  000000  000000  ANS1:   .WORD   0,0,0,0           ;HARDWARE FLOATING POINT ANSWER
443  002414  000000
444  002416  000000  000000  000000  ANS2:   .WORD   0,0,0,0           ;SOFTWARE FLOATING POINT ANSWER
445  002424  000000
446  002426  027005  104552  111730  LONUM:  .WORD   027005,104552,111730,000555     ;RANDOM EXERCISER OPERAND LONUM
447  002434  000555
448  002436  102337  166330  007025  HINUM:  .WORD   102337,166330,007025,021553     ;RANDOM EXERCISER OPERAND HINUM
449  002444  021553
```

```
002446 175463 030712 105726 OP1:     .WORD   175463,030712,105726,124064     ;
002454 124064
002456 156607 002361 070707 OP2:     .WORD   156607,002361,070707,061111     ;
002464 061111
002466 003505 134261 062451 OP3:     .WORD   003505,134261,062451,052525     ;EXTRA RANDOM OPERANDS
002474 052525
002476 102466 123456 111111 OP4:     .WORD   102466,123456,111111,101010     ;
002504 101010
002506 076103 000346 060612 OP5:     .WORD   076103,000346,060612,125252     ;
002514 125252
002516 044100 112400 177777 OP6:     .WORD   044100,112400,177777,000006     ;
002524 000006

                             ;*ADDED COUNTERS FOR TRACING WHERE WE'VE BEEN
002526 000000                ADDC0:  .WORD   0               ;TOTAL NUMBER           *
002530 000000                ADDC1:  .WORD   0               ;A=0, B#0               *
002532 000000                ADDC2:  .WORD   0               ;A#0, B=0               *
002534 000000                ADDC3:  .WORD   0               ;A=0, B=0               *    FOR
002536 000000                ADDC4:  .WORD   0               ;NO SHIFT REQ'D         *    ADD
002540 000000                ADDC5:  .WORD   0               ;OVERFLOW               *    AND
002542 000000                ADDC6:  .WORD   0               ;OVERFLOW, ENABLED      *    SUBTRACT
002544 000000                ADDC7:  .WORD   0               ;UNDERFLOW              *
002546 000000                ADDC8:  .WORD   0               ;UNDERFLOW, ENABLED     *

002550 000000                MULC0:  .WORD   0               ;TOTAL NUMBER           *
002552 000000                MULC1:  .WORD   0               ;A=0 AND/OR B=0         *
002554 000000                MULC2:  .WORD   0               ;OVERFLOW               *    FOR
002556 000000                MULC3:  .WORD   0               ;OVERFLOW, ENABLED      *    MULTIPLY
002560 000000                MULC4:  .WORD   0               ;UNDERFLOW              *
002562 000000                MULC5:  .WORD   0               ;UNDERFLOW, ENABLED     *

002564 000000                DIVC0:  .WORD   0               ;TOTAL NUMBER           *
002566 000000                DIVC1:  .WORD   0               ;NUM A=0                *
002570 000000                DIVC2:  .WORD   0               ;DEN B=0                *    FOR
002572 000000                DIVC3:  .WORD   0               ;OVERFLOW               *    DIVIDE
002574 000000                DIVC4:  .WORD   0               ;OVERFLOW, ENABLED      *
002576 000000                DIVC5:  .WORD   0               ;UNDERFLOW              *
002600 000000                DIVC6:  .WORD   0               ;UNDERFLOW, ENABLED     *

                             ;*REGISTER CONTENTS, AT ERROR, STORED HERE
002602 000000                EREG0:  .WORD   0
002604 000000                EREG1:  .WORD   0
002606 000000                EREG2:  .WORD   0
002610 000000                EREG3:  .WORD   0
002612 000000                EREG4:  .WORD   0
002614 000000                EREG5:  .WORD   0
002616 000000                EREG6:  .WORD   0
002620 000000                EREG7:  .WORD   0

                             ;*MESSAGES FOR BEGIN PROGRAM/START OF PASS
002622 005015 005012 042115  BGNMES: .ASCII  <CR><LF><LF><LF>"MD-11-DQFPD-"
002630 030455 026461 050504
002636 050106 026504
002642 027102                        .ASCII  "B."
002644 027056                        .ASCII  ".."
002646 042120 026520 030461          .ASCIZ  "PDP-11/6X F.P.U. ADD/SUB/MUL/DIV EXERCISER"<CR><LF>
```

```
504  002654  032057  020130  027106
505  002662  027120  027125  040440
506  002670  042104  051457  041125
507  002676  046457  046125  042057
508  002704  053111  042440  042530
509  002712  041522  051511  051105
510  002720  005015     000
511  002723     015  050012  051501  NMPAS1: .ASCIZ  <CR><LF>"PASS #"
512  002730  020123  000043
```

```
                                .SBTTL  START OF PASS ROUTINE


                                ;;*****************************************************************
                                        .ENABL  AMA             ; ASSEMBLE ALL RELATIVE REFERENCES AS ABSOLUTE
                                ;;*****************************************************************

003000                          START:
                                .SBTTL  INITIALIZE THE COMMON TAGS
                                ;;CLEAR THE COMMON TAGS ($CMTAG) AREA
003000  012706  001100                  MOV     #$CMTAG,R6      ;;FIRST LOCATION TO BE CLEARED
003004  005026                          CLR     (R6)+           ;;CLEAR MEMORY LOCATION
003006  022706  001144                  CMP     #$WR,R6 ;;DONE?
003012  001374                          BNE     .-6             ;;LOOP BACK IF NO
003014  012706  001100                  MOV     #STACK,SP       ;;SETUP THE STACK POINTER
                                ;;INITIALIZE A FEW VECTORS
003020  012737  027672  000020          MOV     #$SCOPE,@#IOTVEC ;;IOT VECTOR FOR SCOPE ROUTINE
003026  012737  000340  000022          MOV     #340,@#IOTVEC+2 ;;LEVEL 7
003034  012737  030150  000030          MOV     #$ERROR,@#EMTVEC ;;EMT VECTOR FOR ERROR ROUTINE
003042  012737  000340  000032          MOV     #340,@#EMTVEC+2 ;;LEVEL 7
003050  012737  031630  000034          MOV     #$TRAP,@#TRAPVEC ;;TRAP VECTOR FOR TRAP CALLS
003056  012737  000340  000036          MOV     #340,@#TRAPVEC+2;LEVEL 7
003064  012737  031676  000024          MOV     #$PWRON,@#PWRVEC ;;POWER FAILURE VECTOR
003072  012737  000340  000026          MOV     #340,@#  VEC+2 ;;LEVEL 7
003100  013737  022042  022034          MOV     $ENDCT,$LOPCT   ;;SETUP END-OF-PROGRAM COUNTER
003106  005037  001166                  CLR     $TIMES          ;;INITIALIZE NUMBER OF ITERATIONS
003112  005037  001170                  CLR     $ESCAPE         ;;CLEAR THE ESCAPE ON ERROR ADDRESS
003116  012737  000001  001120          MOV     #1,$ERMAX       ;;ALLOW ONE ERROR PER TEST
003124  012737  003124  001110          MOV     #.,$LPADR       ;;INITIALIZE THE LOOP ADDRESS FOR SCOPE
003132  012737  003132  001112          MOV     #.,$LPERR       ;;SETUP THE ERROR LOOP ADDRESS
                                ;;SIZE FOR A HARDWARE SWITCH REGISTER. IF NOT FOUND OR IT IS
                                ;;EQUAL TO A "-1", SETUP FOR A SOFTWARE SWITCH REGISTER.
003140  013746  000004                  MOV     @#ERRVEC,-(SP)  ;;SAVE ERROR VECTOR
003144  012737  003200  000004          MOV     #64$,@#ERRVEC   ;;SET UP ERROR VECTOR
003152  012737  177570  001144          MOV     #OSWR,SWR       ;;SETUP FOR A HARDWARE SWICH REGISTER
003160  012737  177570  001146          MOV     #OOISP,DISPLAY  ;;AND A HARDWARE DISPLAY REGISTER
003166  022777  177777  175750          CMP     #-1,@SWR        ;;TRY TO REFERENCE HARDWARE SWR
003174  001012                          BNE     66$             ;;BRANCH IF NO TIMEOUT TRAP OCCURRED
                                                                ;;AND  THE HARDWARE SWR IS NOT = -1
003176  000403                          BR      65$             ;;BRANCH IF NO TIMEOUT
003200  012716  003206          64$:    MOV     #65$,(SP)       ;;SET UP FOR TRAP RETURN
003204  000002                          RTI
003206  012737  000176  001144  65$:    MOV     #SWREG,SWR      ;;POINT TO SOFTWARE SWR
003214  012737  000174  001146          MOV     #DISPREG,DISPLAY
003222  012637  000004          66$:    MOV     (SP)+,@#ERRVEC  ;;RESTORE ERROR VECTOR

003226  005037  001210                  CLR     $PASS           ;;CLEAR PASS COUNT
003232  132737  000200  001223          BITB    #APTSIZE,$ENVM  ;;TEST USER SIZE UNDER APT
003240  001403                          BEQ     67$             ;;YES,USE NON-APT SWITCH
003242  012737  001224  001144          MOV     #SSWREG,SWR     ;;NO,USE APT SWITCH REGISTER
003250                          67$:

                                ;SET UP FPP UNEXPECTED TRAP CATCHER - - - - - - - - -
003250  012737  023256  000244          MOV     #FPPILT,@#FPPVEC        ;NEW PC AT FPP TRAP
003256  005037  000246                  CLR     @#FPPVEC+2              ;NEW PS AT FPP TRAP

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```
                                        ;*CLEAR COUNTERS FOR TRACING INFO
003262  012700  002526                  MOV     #ADDCO,R0       ;FIRST LOCATION TO CLEAR
003266  012701  000026                  MOV     #26,R1          ;26(8) WORDS
003272  005020                  2$:     CLR     (R0)+           ;CLEAR AND BUMP
003274  077102                          SOB     R1,2$           ;DO AGAIN

003276  104401  002622                  TYPE    ,BGNMES         ;ID MESSAGE AT START

                                        ;////////////////////////////////////////////////////////////////////
                                        ;       MESSAGE ON WHETHER OR NOT HFP UNIT IS PRESENT

003302  076600  000022                  MED     @WHAMI                  ;WHAMI INTO R0
003306  032700  000020                  BIT     #BIT04,R0               ;IS THERE A HFP UNIT ?
003312  001403                          BEQ     70$                     ;NO, BR
003314  104401  003330                  TYPE    ,68$                    ;INDICATE FP11-E PRESENT
003320  000453                          BR      NEWPAS                  ;GO FOR SUBPASS INIT
003322  104401  003370          70$:    TYPE    ,69$                    ;INDICATE NO FP11-E
003326  000450                          BR      NEWPAS                  ;GO FOR SUBPASS INIT

003330  005015  020052  050106  68$:    .ASCIZ  <15><12>"# FP11-E HFP UNIT PRESENT #"<15><12>
003336  030461  042455  044040
003344  050106  052440  044516
003352  020124  051120  051505
003360  047105  020124  006452
003366  000012
003370  005015  020052  047516  69$:    .ASCIZ  <15><12>"# NO FP11-E HFP UNIT - ALL TESTS HFP ONLY #"<15><12>
003376  043040  030520  026461
003404  020105  043110  020120
003412  047125  052111  026440
003420  040440  046114  052040
003426  051505  051524  053440
003434  050106  047440  046116
003442  020131  006452  000012

                                .EVEN

                                ;////////////////////////////////////////////////////////////////////


                                ;;******************************************************************
                                        ;NEW PASS ENTERS HERE
                                ;;******************************************************************

003450  012706  001100          NEWPAS: MOV     #STACK,SP               ;RESET STACK PTR

003454  032777  010000  175462          BIT     #BIT12,@SWR             ;INHIBIT STATUS TYPEOUTS ?
003462  001015                          BNE     SUBPAS                  ;BR IF YES
003464  023737  022042  022034          CMP     $ENDCT,$EOPCT           ;TIME FOR A MESSAGE ?
003472  001011                          BNE     SUBPAS                  ;NO, NOT YET

003474  104401  002723                  TYPE    ,NWPAS1                 ;"PASS #"
003500  013746  001210                  MOV     $PASS,-(SP)             ;PASS COUNT INTO ...
003504  005216                          INC     (SP)                    ;  1-N RANGE
003506  104403                          TYPOS                           ;TYPE OCTAL
003510     006     000                  .BYTE   6,0                     ;  6 DIGITS, NO LEADING ZEROS
003512  104401  001177                  TYPE    ,$CRLF                  ;END THE LINE
```

```
                                ;;*****************************************************************
                                ;;      ;NEW SUBPASS ENTERS HERE
                                ;;*****************************************************************

003516  012706  001100          SUBPAS: MOV     #STACK,SP               ;RESET SP FOR INSURANCE

003522  076600  000022                  MFD     ,RWHAMI                 ;GET WHAMI INTO R0
003526  032700  000020                  BIT     #BIT04,R0               ;1=HFP PRESENT, 0=NO
003532  001430                          BEQ     20$                     ;IF NO HFP, TEST WARM ONLY

003534  076600  000144                  MFD     ,RFLAG                  ;GET FLAGS INTO R0

003540  032777  000002  175376          BIT     #SW01,@SWR              ;SW01:  1=HFP OR HFP TEST ONLY
003546  001413                          BEQ     1$                      ;       0=ALTERNATE HFP/WFP PER PASS

003550  032777  000001  175366          BIT     #SW00,@SWR              ;SW00:  1=HFP ONLY
003556  001403                          BEQ     2$                      ;       0=HFP ONLY
003560  042700  010000                  BIC     #BIT12,R0               ;CLEAR HFP ENABLE FLAG(5) FOR WFP
003564  000402                          BR      3$                      ;
003566  052700  010000          2$:     BIS     #BIT12,R0               ;SET HFP ENABLE FLAG(5) FOR HFP
003572  076600  000344          3$:     MFD     ,WFLAG                  ;REWRITE FLAGS

003576  032700  010000          1$:     BIT     #BIT12,R0               ;TEST WHO'S ENABLED: HOT, WARM
003602  001404                          BEQ     20$                     ;SET APPROPRIATE HEADER:

003604  012737  032066  030414  19$:     MOV     #ASCHOT,HOTWRM          ;"HOT: "
003612  000403                          BR      21$                     ;
003614  012737  032074  030414  20$:     MOV     #ASCWRM,HOTWRM          ;"WARM: "
003622                          21$:
```

```
                                    ;;*****************************************************
                                    ;*TEST 1         EXERCISE ADDF, ALL INTERRUPTS ON, ROUNDING MODE
                                    ;;*****************************************************
003622  000004                      TST1:   SCOPE
003624  012737  003756  002376              MOV     #ARET1,EXPFEA       ;ADDR OF INSTR BEING TESTED
003632  012737  007400  002400              MOV     #007400,$FPS        ;SET IE BITS IN FORTRAN ANSWER
003640  005037  002402                      CLR     $FEC                ;CLR FORTRAN FEC
003644  005037  002404                      CLR     $FEA                ;CLR FORTRAN FEA
003650  005037  002362                      CLR     FPS                 ;CLR FPU FPS BUFFER
003654  005037  002364                      CLR     FEC                 ;CLR FPU FEC BUFFER
003660  005037  002366                      CLR     FEA                 ;CLR FPU FEA BUFFER
003664  004737  023342                      JSR     PC,RANDL2           ;GET RANDOM INPUT DATA
003670  002426  002436                      .WORD   LONUM,HINUM         ;
003674  004437  023506                      JSR     R4,$POLSH           ;ENTER POLISH MODE
003700  023510  002426                      $PUSH   ,LONUM              ;PUSH 2 WORDS ON STACK (LONUM)
003704  023510  002436                      $PUSH   ,HINUM              ;PUSH 2 WORDS ON STACK (HINUM)
003710  023566                              $ADD                        ;ADDRESS OF FORTRAN ADD
003712  023540  002416                      $POPX   ,ANS2               ;POP 2 WORDS AND EXIT POLISH MODE

003716  013700  002400                      MOV     $FPS,R0             ;DISPLAY FLOATING POINT STATUS
003722  170127  040000                      LDFPS   #040000             ;LOAD FPS, INTERRUPT DISABLE
003726  172437  002426                      LDF     LONUM,AC0           ;LOAD AC0 WITH A RANDOM NUMBER
003732  172537  002436                      LDF     HINUM,AC1           ;LOAD AC1 WITH A RANDOM NUMBER
003736  172737  002416                      LDF     ANS2,AC3            ;LOAD AC3 WITH THE SUM
003742  170127  007400                      LDFPS   #007400             ;TURN INTERRUPTS ON
003746  012737  003754  001110              MOV     #.+6,$LPADR         ;RESET LOOP ADDRESS

                                            ;*****************************************************

003754  172600                              LDF     AC0,AC2             ;LOAD AC0 INTO AC2
003756  172201                      ARET1:  ADDF    AC1,AC2             ;ADD AC1 BY AC2
003760  170237  002362                      STFPS   FPS                 ;STORE FLOATING POINT STATUS
003764  023737  002362  002400              CMP     FPS,$FPS            ;CHECK FPS
003772  001403                              BEQ     AERR1               ;BRANCH IF OK
003774  174237  002406                      STF     AC2,ANS1            ;SAVE FPU ANSWER
004000  104001                              ERROR   1                   ;FPS ERROR

004002  005737  002400              AERR1:  TST     $FPS                ;ERROR BIT SET ?
004006  100014                              BPL     ATST1               ;NO, DONT GET FEC/FEA
004010  170337  002364                      STST    FEC                 ;YES, CHECK STATUS

004014  023737  002364  002402              CMP     FEC,$FEC            ;CHECK THE FLOATING EXCEPTION CODES
004022  001401                              BEQ     1$                  ;BRANCH IF OK
004024  104023                              ERROR   23                  ;FEC IS WRONG

004026  023737  002366  002404      1$:     CMP     FEA,$FEA            ;CHECK FLOATING PC
004034  001401                              BEQ     ATST1               ;BRANCH IF OK
004036  104023                              ERROR   23                  ;WRONG ADDRESS IN FEA

004040  173702                      ATST1:  CMPF    AC2,AC3             ;COMPARE FPU ANSWER TO FORTRAN ANSWER
004042  170000                              CFCC                        ;COPY FLOATING CONDITION CODES
004044  001416                              BEQ     AEND1               ;ANSWERS CHECK
                                            ;COMPENSATE FOR FORTRAN INACCURACIES.
004046  174237  002406                      STF     AC2,ANS1            ;SAVE FPU ANSWER
004052  162737  000001  002410              SUB     #1,ANS1+2           ;DECREMENT FPU ANSWER
004060  005637  002406                      SBC     ANS1
```

```
                                                CMPF    ANS1,AC3        ;CHECK ANSWERS AGAIN
                                                CFCC                    ;COPY FLOATING CONDITION CODES
                                                BEQ     AEND1           ;BRANCH IF OK
                                                STF     AC2,ANS1        ;SAVE FPU ANSWER
                                                ERROR   5               ;FPU AND FORTRAN DISAGREE

                                AEND1:  CLR     FPS             ;CLR FPU FPS BUFFER



                                ;;*****************************************************************
                                ;*TEST 2         EXERCISE ADDD, ALL INTERRUPTS ON, ROUNDING MODE
                                ;;*****************************************************************
                                TST2:   SCOPE
                                        MOV     #ARET2,EXPFEA   ;ADDR OF INSTR BEING TESTED
                                        MOV     #007600,$FPS    ;SET IE BITS IN FORTRAN ANSWER
                                        CLR     $FEC            ;CLR FORTRAN FEC
                                        CLR     $FEA            ;CLR FORTRAN FEA
                                        CLR     FPS             ;CLR FPU FPS BUFFER
                                        CLR     FEC             ;CLR FPU FEC BUFFER
                                        CLR     FEA             ;CLR FPU FEA BUFFER
                                        JSR     PC,RANDL4       ;GET RANDOM INPUT DATA
                                        .WORD   LONUM,HINUM     ;
                                        JSR     R4,$POLSH       ;ENTER POLISH MODE
                                        $PUSH   ,LONUM          ;PUSH 4 WORDS ON STACK (LONUM)
                                        $PUSH   ,HINUM          ;PUSH 4 WORDS ON STACK (HINUM)
                                        $ADD                    ;ADDRESS OF FORTRAN ADD
                                        $POPX   ,ANS2           ;POP 4 WORDS AND EXIT POLISH MODE

                                        MOV     $FPS,R0         ;DISPLAY FLOATING POINT STATUS
                                        LDFPS   #040200         ;LOAD FPS, INTERRUPT DISABLE AND FD
                                        LDD     LONUM,AC0       ;LOAD AC0 WITH A RANDOM NUMBER
                                        LDD     HINUM,AC1       ;LOAD AC1 WITH A RANDOM NUMBER
                                        LDD     ANS2,AC3        ;LOAD AC3 WITH THE SUM
                                        LDFPS   #007600         ;TURN INTERRUPTS ON
                                        MOV     #.+6,$LPADR     ;RESET LOOP ADDRESS

                                        ;*****************************************************************

                                        LDD     AC0,AC2         ;LOAD AC0 INTO AC2
                                ARET2:  ADDD    AC1,AC2         ;ADD AC1 BY AC2
                                        STFPS   FPS             ;STORE FLOATING POINT STATUS
                                        CMP     FPS,$FPS        ;CHECK FPS
                                        BEQ     AERR2           ;BRANCH IF OK
                                        STD     AC2,ANS1        ;SAVE FPU ANSWER
                                        ERROR   17              ;FPS ERROR

                                AERR2:  TST     $FPS            ;ERROR BIT SET ?
                                        BPL     ATST2           ;NO, DONT GET FEC/FEA
                                        STST    FEC             ;YES, CHECK STATUS

                                        CMP     FEC,$FEC        ;CHECK THE FLOATING EXCEPTION CODES
                                        BEQ     1$              ;BRANCH IF OK
                                        ERROR   27              ;FEC IS WRONG

                                1$:     CMP     FEA,$FEA        ;CHECK FLOATING PC
```

```
                                        BEQ     ATST2           ;BRANCH IF OK
                                        ERROR   27              ;WRONG ADDRESS IN FEA

                                ATST2:  CMPD    AC2,AC3         ;COMPARE FPU ANSWER TO FORTRAN ANSWER
                                        CFCC                    ;COPY FLOATING CONDITION CODES
                                        BEQ     AEND2           ;ANSWERS CHECK
                                        ;COMPENSATE FOR FORTRAN INACCURACIES.
                                        STD     AC2,ANS1        ;SAVE FPU ANSWER
                                        SUB     #1,ANS1+6       ;DECREMENT FPU ANSWER
                                        SBC     ANS1+4
                                        SBC     ANS1+2
                                        SBC     ANS1
                                        CMPD    ANS1,AC3        ;CHECK ANSWERS AGAIN
                                        CFCC                    ;COPY FLOATING CONDITION CODES
                                        BEQ     AEND2           ;BRANCH IF OK
                                        STD     AC2,ANS1        ;SAVE FPU ANSWER
                                        ERROR   6               ;FPU AND FORTRAN DISAGREE

                                AEND2:  CLR     FPS             ;CLR FPU FPS BUFFER



                                ;;*****************************************************************
                                ;*TEST 3        EXERCISE ADDF, OVERFLOW AND UNDERFLOW INTERRUPTS OFF, ROUNDING MODE
                                ;;*****************************************************************
                                TST3:   SCOPE
                                        MOV     #ARET3,EXPFEA   ;ADDR OF INSTR BEING TESTED
                                        MOV     #004400,$FPS    ;SET IE BITS IN FORTRAN ANSWER
                                        CLR     $FEC            ;CLR FORTRAN FEC
                                        CLR     $FEA            ;CLR FORTRAN FEA
                                        CLR     FPS             ;CLR FPU FPS BUFFER
                                        CLR     FEC             ;CLR FPU FEC BUFFER
                                        CLR     FEA             ;CLR FPU FEA BUFFER
                                        JSR     PC,RANDL2       ;GET RANDOM INPUT DATA
                                        .WORD   LONUM,HINUM     ;
                                        JSR     R4,$POLSH       ;ENTER POLISH MODE
                                        $PUSH   ,LONUM          ;PUSH 2 WORDS ON STACK (LONUM)
                                        $PUSH   ,HINUM          ;PUSH 2 WORDS ON STACK (HINUM)
                                        $ADD                    ;ADDRESS OF FORTRAN ADD
                                        $POPX   ,ANS2           ;POP 2 WORDS AND EXIT POLISH MODE

                                        MOV     $FPS,R0         ;DISPLAY FLOATING POINT STATUS
                                        LDFPS   #040000         ;LOAD FPS, INTERRUPT DISABLE
                                        LDF     LONUM,AC0       ;LOAD AC0 WITH A RANDOM NUMBER
                                        LDF     HINUM,AC1       ;LOAD AC1 WITH A RANDOM NUMBER
                                        LDF     ANS2,AC3        ;LOAD AC3 WITH THE SUM
                                        LDFPS   #004400         ;TURN INTERRUPTS ON, EXCEPT OVERFLOW AND UNDERFLOW
                                        MOV     #.+6,$LPADR     ;RESET LOOP ADDRESS

                                        ;*****************************************************************

                                        LDF     AC0,AC2         ;LOAD AC0 INTO AC2
                                ARET3:  ADDF    AC1,AC2         ;ADD AC1 BY AC2
                                        STFPS   FPS             ;STORE FLOATING POINT STATUS
                                        CMP     FPS,$FPS        ;CHECK FPS
```

```
                                                BEQ     ATST3           ;BRANCH IF OK
004552  001403
                                                STF     AC2,ANS1        ;SAVE FPU ANSWER
004554  174237  002406
                                                ERROR   1               ;FPS ERROR
004560  104001
                                ATST3:  CMPF    AC2,AC3         ;COMPARE FPU ANSWER TO FORTRAN ANSWER
004562  173702
                                        CFCC                    ;COPY FLOATING CONDITION CODES
004564  170000
                                        BEQ     AEND3           ;ANSWERS CHECK
004566  001416
                                        ;COMPENSATE FOR FORTRAN INACCURACIES.
                                        STF     AC2,ANS1        ;SAVE FPU ANSWER
004570  174237  002406
                                        SUB     #1,ANS1+2       ;DECREMENT FPU ANSWER
004574  162737  000001  002410
                                        SBC     ANS1
004602  005637  002406
                                        CMPF    ANS1,AC3        ;CHECK ANSWERS AGAIN
004606  173737  002406
                                        CFCC                    ;COPY FLOATING CONDITION CODES
004612  170000
                                        BEQ     AEND3           ;BRANCH IF OK
004614  001403
                                        STF     AC2,ANS1        ;SAVE FPU ANSWER
004616  174237  002406
                                        ERROR   5               ;FPU AND FORTRAN DISAGREE
004622  104005
                                AEND3:  CLR     FPS             ;CLR FPU FPS BUFFER
004624  005037  002362
```

```
                        ;;*****************************************************
                        ;*TEST 4         EXERCISE ADDD, OVERFLOW AND UNDERFLOW INTERRUPTS OFF, ROUNDING MODE
                        ;;*****************************************************
                        TST4:   SCOPE
000004
                                MOV     #ARET4,EXPFEA   ;ADDR OF INSTR BEING TESTED
004632  012737  004764  002376
                                MOV     #004600,$FPS    ;SET IE BITS IN FORTRAN ANSWER
004640  012737  004600  002400
                                CLR     $FEC            ;CLR FORTRAN FEC
004646  005037  002402
                                CLR     $FEA            ;CLR FORTRAN FEA
004652  005037  002404
                                CLR     FPS             ;CLR FPU FPS BUFFER
004656  005037  002362
                                CLR     FEC             ;CLR FPU FEC BUFFER
004662  005037  002364
                                CLR     FEA             ;CLR FPU FEA BUFFER
004666  005037  002366
                                JSR     PC,RANDL4       ;GET RANDOM INPUT DATA
004672  004737  023332
                                .WORD   LONUM,HINUM     ;
004676  002426  002436
                                JSR     R4,$POLSH       ;ENTER POLISH MODE
004702  004437  023506
                                $PUSH   ,LONUM          ;PUSH 4 WORDS ON STACK (LONUM)
004706  023510  002426
                                $PUSH   ,HINUM          ;PUSH 4 WORDS ON STACK (HINUM)
004712  023510  002436
                                $ADD                    ;ADDRESS OF FORTRAN ADD
004716  023566
                                $POPX   ,ANS2           ;POP 4 WORDS AND EXIT POLISH MODE
004720  023540  002416
                                MOV     $FPS,R0         ;DISPLAY FLOATING POINT STATUS
004724  013700  002400
                                LDFPS   #040200         ;LOAD FPS, INTERRUPT DISABLE AND FD
004730  170127  040200
                                LDD     LONUM,AC0       ;LOAD AC0 WITH A RANDOM NUMBER
004734  172437  002426
                                LDD     HINUM,AC1       ;LOAD AC1 WITH A RANDOM NUMBER
004740  172537  002436
                                LDD     ANS2,AC3        ;LOAD AC3 WITH THE SUM
004744  172737  002416
                                LDFPS   #004600         ;TURN INTERRUPTS ON, EXCEPT OVER AND UNDERFLOW
004750  170127  004600
                                MOV     #.+6,$LPADR     ;RESET LOOP ADDRESS
004754  012737  004762  001110
                        ;*****************************************************************
                        ARET4:  LDD     AC0,AC2         ;LOAD AC0 INTO AC2
004762  172600
                                ADDD    AC1,AC2         ;ADD AC1 BY AC2
004764  172201
                                STFPS   FPS             ;STORE FLOATING POINT STATUS
004766  170237  002362
                                CMP     FPS,$FPS        ;CHECK FPS
004772  023737  002362  002400
                                BEQ     ATST4           ;BRANCH IF OK
005000  001403
```

```
                005002  174237  002406          STD     AC2,ANS1        ;SAVE FPU ANSWER
                005006  104017                  ERROR   17              ;FPS ERROR
                
                005010  173702          ATST4:  CMPD    AC2,AC3         ;COMPARE FPU ANSWER TO FORTRAN ANSWER
                005012  170000                  CFCC                    ;COPY FLOATING CONDITION CODES
                005014  001422                  BEQ     AEND4           ;ANSWERS CHECK
                                                ;COMPENSATE FOR FORTRAN INACCURACIES.
                005016  174237  002406          STD     AC2,ANS1        ;SAVE FPU ANSWER
                005022  162737  000001  002414  SUB     #1,ANS1+6       ;DECREMENT FPU ANSWER
                005030  005637  002412          SBC     ANS1+4
                005034  005637  002410          SBC     ANS1+2
                005040  005637  002406          SBC     ANS1
                005044  173737  002406          CMPD    ANS1,AC3        ;CHECK ANSWERS AGAIN
                005050  170000                  CFCC                    ;COPY FLOATING CONDITION CODES
                005052  001403                  BEQ     AEND4           ;BRANCH IF OK
                005054  174237  002406          STD     AC2,ANS1        ;SAVE FPU ANSWER
                005060  104006                  ERROR   6               ;FPU AND FORTRAN DISAGREE
                
                005062  005037  002362  AEND4:  CLR     FPS             ;CLR FPU FPS BUFFER
                
                
                
                
                                        ;;*****************************************************************
                                        ;*TEST 5        EXERCISE ADDF, ALL INTERRUPTS ON, TRUNCATE MODE
                                        ;;*****************************************************************
                005066  000004          TST5:   SCOPE
                005070  012737  005222  002376          MOV     #ARET5,EXPFEA   ;ADDR OF INSTR BEING TESTED
                005076  012737  007440  002400          MOV     #007440,$FPS    ;SET IE BITS IN FORTRAN ANSWER
                005104  005037  002402                  CLR     $FEC            ;CLR FORTRAN FEC
                005110  005037  002404                  CLR     $FEA            ;CLR FORTRAN FEA
                005114  005037  002362                  CLR     FPS             ;CLR FPU FPS BUFFER
                005120  005037  002364                  CLR     FEC             ;CLR FPU FEC BUFFER
                005124  005037  002366                  CLR     FEA             ;CLR FPU FEA BUFFER
                005130  004737  023342                  JSR     PC,RANDL2       ;GET RANDOM INPUT DATA
                005134  002426  002436                  .WORD   LONUM,HINUM     ;
                005140  004437  023506                  JSR     R4,$POLSH       ;ENTER POLISH MODE
                005144  023510  002426                  $PUSH   ,LONUM          ;PUSH 2 WORDS ON STACK (LONUM)
                005150  023510  002436                  $PUSH   ,HINUM          ;PUSH 2 WORDS ON STACK (HINUM)
                005154  023566                          $ADD                    ;ADDRESS OF FORTRAN ADD
                005156  023540  002416                  $POPX   ,ANS2           ;POP 2 WORDS AND EXIT POLISH MODE
                
                005162  013700  002400                  MOV     $FPS,R0         ;DISPLAY FLOATING POINT STATUS
                005166  170127  040000                  LDFPS   #040000         ;LOAD FPS, INTERRUPT DISABLE
                005172  172437  002426                  LDF     LONUM,AC0       ;LOAD AC0 WITH A RANDOM NUMBER
                005176  172537  002436                  LDF     HINUM,AC1       ;LOAD AC1 WITH A RANDOM NUMBER
                005202  172737  002416                  LDF     ANS2,AC3        ;LOAD AC3 WITH THE SUM
                005206  170127  007440                  LDFPS   #007440         ;TURN INTERRUPTS ON
                005212  012737  005220  001110          MOV     #.+6,$LPADR     ;RESET LOOP ADDRESS
                
                                        ;*****************************************************************
                
                005220  172600                  LDF     AC0,AC2         ;LOAD AC0 INTO AC2
                005222  172201          ARET5:  ADDF    AC1,AC2         ;ADD AC1 BY AC2
                005224  170237  002362          STFPS   FPS             ;STORE FLOATING POINT STATUS
                005230  023737  002362  002400  CMP     FPS,$FPS        ;CHECK FPS
```

```
005236  001403                          BEQ     AERR5           ;BRANCH IF OK
005240  174237  002406                  STF     AC2,ANS1        ;SAVE FPU ANSWER
005244  104001                          ERROR   1               ;FPS ERROR

005246  005737  002400          AERR5:  TST     $FPS            ;ERROR BIT SET ?
005252  100014                          BPL     ATST5           ;NO, DONT GET FEC/FEA
005254  170337  002364                  STST    FEC             ;YES, CHECK STATUS

005260  023737  002364  002402          CMP     FEC,$FEC        ;CHECK THE FLOATING EXCEPTION CODES
005266  001401                          BEQ     1$              ;BRANCH IF OK
005270  104023                          ERROR   23              ;FEC IS WRONG

005272  023737  002366  002404  1$:     CMP     FEA,$FEA        ;CHECK FLOATING PC
005300  001401                          BEQ     ATST5           ;BRANCH IF OK
005302  104023                          ERROR   [illegible]     ;WRONG ADDRESS IN FEA

005304  173702                  ATST5:  CMPF    AC2,AC3         ;COMPARE FPU ANSWER TO FORTRAN ANSWER
005306  170000                          CFCC                    ;COPY FLOATING CONDITION CODES
005310  001427                          BEQ     AEND5           ;ANSWERS CHECK
                                        ;COMPENSATE FOR FORTRAN INACCURACIES.
005312  174237  002406                  STF     AC2,ANS1        ;SAVE FPU ANSWER
005316  062737  000001  002410          ADD     #1,ANS1+2       ;INCREMENT FPU ANSWER
005324  005537  002406                  ADC     ANS1
005330  173737  002406                  CMPF    ANS1,AC3        ;CHECK ANSWERS AGAIN
005334  170000                          CFCC                    ;COPY FLOATING CONDITION CODES
005336  001414                          BEQ     AEND5           ;BRANCH IF OK
005340  162737  000002  002410          SUB     #2,ANS1+2       ;DECREMENT FPU ANSWER
005346  005637  002406                  SBC     ANS1
005352  173737  002406                  CMPF    ANS1,AC3        ;CHECK ANSWERS AGAIN
005356  170000                          CFCC                    ;COPY FLOATING CONDITION CODES
005360  001403                          BEQ     AEND5           ;BRANCH IF OK
005362  174237  002406                  STF     AC2,ANS1        ;SAVE FPU ANSWER
005366  104005                          ERROR   5               ;FPU AND FORTRAN DISAGREE

005370  005037  002362          AEND5:  CLR     FPS             ;CLR FPU FPS BUFFER





                                ;;**************************************************************
                                ;*TEST 6        EXERCISE ADDD, ALL INTERRUPTS ON, TRUNCATE MODE
                                ;;**************************************************************
005374  000004                  TST6:   SCOPE
005376  012737  005530  002376          MOV     #ARET6,EXPFEA   ;ADDR OF INSTR BEING TESTED
005404  012737  007640  002400          MOV     #007640,$FPS    ;SET IE BITS IN FORTRAN ANSWER
005412  005037  002402                  CLR     $FEC            ;CLR FORTRAN FEC
005416  005037  002404                  CLR     $FEA            ;CLR FORTRAN FEA
005422  005037  002362                  CLR     FPS             ;CLR FPU FPS BUFFER
005426  005037  002364                  CLR     FEC             ;CLR FPU FEC BUFFER
005432  005037  002366                  CLR     FEA             ;CLR FPU FEA BUFFER
005436  004737  023332                  JSR     PC,RANDL4       ;GET RANDOM INPUT DATA
005442  002426  002436                  .WORD   LONUM,HINUM     ;
005446  004437  023506                  JSR     R4,$POLSH       ;ENTER POLISH MODE
005452  023510  002426                  $PUSH   ,LONUM          ;PUSH 4 WORDS ON STACK (LONUM)
005456  023510  002436                  $PUSH   ,HINUM          ;PUSH 4 WORDS ON STACK (HINUM)
```

```
  991  005462  023566                        $ADD                    ;ADDRESS OF FORTRAN ADD
  992  005464  023540  002416                $POPX   ,ANS2           ;POP 4 WORDS AND EXIT POLISH MODE
  993
  994  005470  013700  002400                MOV     $FPS,R0         ;DISPLAY FLOATING POINT STATUS
  995  005474  170127  040200                LDFPS   #040200         ;LOAD FPS, INTERRUPT DISABLE AND FD
  996  005500  172437  002426                LDD     LONUM,AC0       ;LOAD AC0 WITH A RANDOM NUMBER
  997  005504  172537  002436                LDD     HINUM,AC1       ;LOAD AC1 WITH A RANDOM NUMBER
  998  005510  172737  002416                LDD     ANS2,AC3        ;LOAD AC3 WITH THE SUM
  999  005514  170127  007640                LDFPS   #007640         ;TURN INTERRUPTS ON
 1000  005520  012737  005526  001110        MOV     #.+6,$LPADR     ;RESET LOOP ADDRESS
 1001
 1002                                        ;*****************************************************************
 1003
 1004  005526  172600                        LDD     AC0,AC2         ;LOAD AC0 INTO AC2
 1005  005530  172201                ARET6:  ADDD    AC1,AC2         ;ADD AC1 BY AC2
 1006  005532  170237  002362                STFPS   FPS             ;STORE FLOATING POINT STATUS
 1007  005536  023737  002362  002400        CMP     FPS,$FPS        ;CHECK FPS
 1008  005544  001403                        BEQ     AERR6           ;BRANCH IF OK
 1009  005546  174237  002406                STD     AC2,ANS1        ;SAVE FPU ANSWER
 1010  005552  104017                        ERROR   17              ;FPS ERROR
 1011
 1012  005554  005737  002400        AERR6:  TST     $FPS            ;ERROR BIT SET ?
 1013  005560  100014                        BPL     ATST6           ;NO, DONT GET FEC/FEA
 1014  005562  170337  002364                STST    FEC             ;YES, CHECK STATUS
 1015
 1016  005566  023737  002364  002402        CMP     FEC,$FEC        ;CHECK THE FLOATING EXCEPTION CODES
 1017  005574  001401                        BEQ     1$              ;BRANCH IF OK
 1018  005576  104027                        ERROR   27              ;FEC IS WRONG
 1019
 1020  005600  023737  002366  002404  1$:   CMP     FEA,$FEA        ;CHECK FLOATING PC
 1021  005606  001401                        BEQ     ATST6           ;BRANCH IF OK
 1022  005610  104027                        ERROR   27              ;WRONG ADDRESS IN FEA
 1023
 1024  005612  173702                ATST6:  CMPD    AC2,AC3         ;COMPARE FPU ANSWER TO FORTRAN ANSWER
 1025  005614  170000                        CFCC                    ;COPY FLOATING CONDITION CODES
 1026  005616  001437                        BEQ     AEND6           ;ANSWERS CHECK
 1027                                        ;COMPENSATE FOR FORTRAN INACCURACIES.
 1028  005620  174237  002406                STD     AC2,ANS1        ;SAVE FPU ANSWER
 1029  005624  062737  000001  002414        ADD     #1,ANS1+6       ;INCREMENT FPU ANSWER
 1030  005632  005537  002412                ADC     ANS1+4
 1031  005636  005537  002410                ADC     ANS1+2
 1032  005642  005537  002406                ADC     ANS1
 1033  005646  173737  002406                CMPD    ANS1,AC3        ;CHECK ANSWERS AGAIN
 1034  005652  170000                        CFCC                    ;COPY FLOATING CONDITION CODES
 1035  005654  001420                        BEQ     AEND6           ;BRANCH IF OK
 1036  005656  162737  000002  002414        SUB     #2,ANS1+6       ;DECREMENT FPU ANSWER
 1037  005664  005637  002412                SBC     ANS1+4
 1038  005670  005637  002410                SBC     ANS1+2
 1039  005674  005637  002406                SBC     ANS1
 1040  005700  173737  002406                CMPD    ANS1,AC3        ;CHECK ANSWERS AGAIN
 1041  005704  170000                        CFCC                    ;COPY FLOATING CONDITION CODES
 1042  005706  001403                        BEQ     AEND6           ;BRANCH IF OK
 1043  005710  174237  002406                STD     AC2,ANS1        ;SAVE FPU ANSWER
 1044  005714  104006                        ERROR   6               ;FPU AND FORTRAN DISAGREE
 1045
 1046  005716  005037  002362        AEND6:  CLR     FPS             ;CLR FPU FPS BUFFER
```

```
                                ;;*****************************************************************
                                ;*TEST 7         EXERCISE ADDF, OVERFLOW AND UNDERFLOW INTERRUPTS OFF, TRUNCATE MODE
                                ;;*****************************************************************
005722  000004               TST7:   SCOPE
005724  012737  006056  002376        MOV     #ARET7,EXPFEA   ;ADDR OF INSTR BEING TESTED
005732  012737  004440  002400        MOV     #004440,$FPS    ;SET IE BITS IN FORTRAN ANSWER
005740  005037  002402                CLR     $FEC            ;CLR FORTRAN FEC
005744  005037  002404                CLR     $FEA            ;CLR FORTRAN FEA
005750  005037  002362                CLR     FPS             ;CLR FPU FPS BUFFER
005754  005037  002364                CLR     FEC             ;CLR FPU FEC BUFFER
005760  005037  002366                CLR     FEA             ;CLR FPU FEA BUFFER
005764  004737  023342                JSR     PC,RANDL2       ;GET RANDOM INPUT DATA
005770  002426  002436                .WORD   LONUM,HINUM
005774  004437  023506                JSR     R4,$POLSH       ;ENTER POLISH MODE
006000  023510  002426                $PUSH   ,LONUM          ;PUSH 2 WORDS ON STACK (LONUM)
006004  023510  002436                $PUSH   ,HINUM          ;PUSH 2 WORDS ON STACK (HINUM)
006010  023566                        $ADDD                   ;ADDRESS OF FORTRAN ADD
006012  023540  002416                $POPX   ,ANS2           ;POP 2 WORDS AND EXIT POLISH MODE

006016  013700  002400                MOV     $FPS,R0         ;DISPLAY FLOATING POINT STATUS
006022  170127  040000                LDFPS   #040000         ;LOAD FPS, INTERRUPT DISABLE
006026  172437  002426                LDD     LONUM,AC0       ;LOAD AC0 WITH A RANDOM NUMBER
006032  172537  002436                LDD     HINUM,AC1       ;LOAD AC1 WITH A RANDOM NUMBER
006036  172737  002416                LDD     ANS2,AC3        ;LOAD AC3 WITH THE SUM
006042  170127  004440                LDFPS   #004440         ;TURN INTERRUPTS ON, EXCEPT OVERFLOW AND UNDERFLOW
006046  012737  006054  001110        MOV     #.+6,$LPADR     ;RESET LOOP ADDRESS

                                ;*****************************************************************

006054  172600                ARET7:  LDD     AC0,AC2         ;LOAD AC0 INTO AC2
006056  172201                        ADDD    AC1,AC2         ;ADD AC1 BY AC2
006060  170237  002362                STFPS   FPS             ;STORE FLOATING POINT STATUS
006064  023737  002362  002400        CMP     FPS,$FPS        ;CHECK FPS
006072  001403                        BEQ     ATST7           ;BRANCH IF OK
006074  174237  002406                STD     AC2,ANS1        ;SAVE FPU ANSWER
006100  104001                        ERROR   1               ;FPS ERROR

006102  173702                ATST7:  CMPD    AC2,AC3         ;COMPARE FPU ANSWER TO FORTRAN ANSWER
006104  170000                        CFCC                    ;COPY FLOATING CONDITION CODES
006106  001427                        BEQ     AEND7           ;ANSWERS CHECK
                                        ;COMPENSATE FOR FORTRAN INACCURACIES.
006110  174237  002406                STD     AC2,ANS1        ;SAVE FPU ANSWER
006114  062737  000001  002410        ADD     #1,ANS1+2       ;INCREMENT FPU ANSWER
006122  005537  002406                ADC     ANS1
006126  173737  002406                CMPD    ANS1,AC3        ;CHECK ANSWERS AGAIN
006132  170000                        CFCC                    ;COPY FLOATING CONDITION CODES
006134  001414                        BEQ     GEND7           ;BRANCH IF OK
006136  162737  000002  002410        SUB     #2,ANS1+2       ;DECREMENT FPU ANSWER
006144  005637  002406                SBC     ANS1
006150  173737  002406                CMPD    ANS1,AC3        ;CHECK ANSWERS AGAIN
006154  170000                        CFCC                    ;COPY FLOATING CONDITION CODES
```

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1103  006156  001403                          BEQ     AEND7           ;BRANCH IF OK
1104  006160  174237  002406                  STF     AC2,ANS1        ;SAVE FPU ANSWER
1105  006164  104005                          ERROR   5               ;FPU AND FORTRAN DISAGREE
1106
1107  006166  005037  002362          AEND7:  CLR     FPS             ;CLR FPU FPS BUFFER
1108
1109
1110
1111
1112                                    ;;*****************************************************************
1113                                    ;*TEST 10        EXERCISE ADDD, OVERFLOW AND UNDERFLOW INTERRUPTS OFF, TRUNCATE MODE
1114                                    ;;*****************************************************************
1115  006172  000004                   TST10:  SCOPE
1116  006174  012737  006326  002376           MOV     #ARET10,EXPFEA  ;ADDR OF INSTR BEING TESTED
1117  006202  012737  004640  002400           MOV     #004640,$FPS    ;SET IE BITS IN FORTRAN ANSWER
1118  006210  005037  002402                  CLR     $FEC            ;CLR FORTRAN FEC
1119  006214  005037  002404                  CLR     $FEA            ;CLR FORTRAN FEA
1120  006220  005037  002362                  CLR     FPS             ;CLR FPU FPS BUFFER
1121  006224  005037  002364                  CLR     FEC             ;CLR FPU FEC BUFFER
1122  006230  005037  002366                  CLR     FEA             ;CLR FPU FEA BUFFER
1123  006234  004737  023332                  JSR     PC,RANDL4       ;GET RANDOM INPUT DATA
1124  006240  002426  002436                  .WORD   LONUM,HINUM     ;
1125  006244  004437  023506                  JSR     R4,$POLSH       ;ENTER POLISH MODE
1126  006250  023510  002426                  $PUSH   ,LONUM          ;PUSH 4 WORDS ON STACK (LONUM)
1127  006254  023510  002436                  $PUSH   ,HINUM          ;PUSH 4 WORDS ON STACK (HINUM)
1128  006260  023566                          $ADD                    ;ADDRESS OF FORTRAN ADD
1129  006262  023540  002416                  $POPX   ,ANS2           ;POP 4 WORDS AND EXIT POLISH MODE
1130
1131  006266  013700  002400                  MOV     $FPS,R0         ;DISPLAY FLOATING POINT STATUS
1132  006272  170127  040200                  LDFPS   #040200         ;LOAD FPS, INTERRUPT DISABLE AND FD
1133  006276  172437  002426                  LDD     LONUM,AC0       ;LOAD AC0 WITH A RANDOM NUMBER
1134  006302  172537  002436                  LDD     HINUM,AC1       ;LOAD AC1 WITH A RANDOM NUMBER
1135  006306  172737  002416                  LDD     ANS2,AC3        ;LOAD AC3 WITH THE SUM
1136  006312  170127  004640                  LDFPS   #004640         ;TURN INTERRUPTS ON, EXCEPT OVER AND UNDERFLOW
1137  006316  012737  006324  001110          MOV     #.+6,$LPADR     ;RESET LOOP ADDRESS
1138
1139                                    ;*****************************************************************
1140
1141  006324  172600                   ARET10: LDD     AC0,AC2         ;LOAD AC0 INTO AC2
1142  006326  172201                           ADDD    AC1,AC2         ;ADD AC1 BY AC2
1143  006330  170237  002362                  STFPS   FPS             ;STORE FLOATING POINT STATUS
1144  006334  023737  002362  002400          CMP     FPS,$FPS        ;CHECK FPS
1145  006342  001403                          BEQ     ATST10          ;BRANCH IF OK
1146  006344  174237  002406                  STD     AC2,ANS1        ;SAVE FPU ANSWER
1147  006350  104017                          ERROR   17              ;FPS ERROR
1148
1149  006352  173702                   ATST10: CMPD    AC2,AC3         ;COMPARE FPU ANSWER TO FORTRAN ANSWER
1150  006354  170000                           CFCC                    ;COPY FLOATING CONDITION CODES
1151  006356  001437                          BEQ     AEND10          ;ANSWERS CHECK
1152                                          ;COMPENSATE FOR FORTRAN INACCURACIES.
1153  006360  174237  002406                  STD     AC2,ANS1        ;SAVE FPU ANSWER
1154  006364  062737  000001  002414          ADD     #1,ANS1+6       ;INCREMENT FPU ANSWER
1155  006372  005537  002412                  ADC     ANS1+4
1156  006376  005537  002410                  ADC     ANS1+2
1157  006402  005537  002406                  ADC     ANS1
1158  006406  173737  002406                  CMPD    ANS1,AC3        ;CHECK ANSWERS AGAIN
```

```
1159  006412  170000                          CFCC                    ;COPY FLOATING CONDITION CODES
1160  006414  001420                          BEQ     AEND10          ;BRANCH IF OK
1161  006416  162737  000002  002414          SUB     #2,ANS1+6       ;DECREMENT FPU ANSWER
1162  006424  005637  002412                  SBC     ANS1+4
1163  006430  005637  002410                  SBC     ANS1+2
1164  006434  005637  002406                  SBC     ANS1
1165  006440  173737  002406                  CMPD    ANS1,AC3        ;CHECK ANSWERS AGAIN
1166  006444  170000                          CFCC                    ;COPY FLOATING CONDITION CODES
1167  006446  001403                          BEQ     AEND10          ;BRANCH IF OK
1168  006450  174237  002406                  STD     AC2,ANS1        ;SAVE FPU ANSWER
1169  006454  104006                          ERROR   6               ;FPU AND FORTRAN DISAGREE
1170
1171  006456  005037  002362          AEND10: CLR     FPS             ;CLR FPU FPS BUFFER
1172
```

```
                                ;;*****************************************************************
                                ;*TEST 11        EXERCISE SUBF, ALL INTERRUPTS ON, ROUNDING MODE
                                ;;*****************************************************************
006462  000004                  TST11:  SCOPE
006464  012737  006616  002376          MOV     #ARET11,EXPFEA  ;ADDR OF INSTR BEING TESTED
006472  012737  007400  002400          MOV     #007400,$FPS    ;SET IE BITS IN FORTRAN ANSWER
006500  005037  002402                  CLR     $FEC            ;CLR FORTRAN FEC
006504  005037  002404                  CLR     $FEA            ;CLR FORTRAN FEA
006510  005037  002362                  CLR     FPS             ;CLR FPU FPS BUFFER
006514  005037  002364                  CLR     FEC             ;CLR FPU FEC BUFFER
006520  005037  002366                  CLR     FEA             ;CLR FPU FEA BUFFER
006524  004737  023342                  JSR     PC,RANDL2       ;GET RANDOM INPUT DATA
006530  002436  002436                  .WORD   LONUM,HINUM     ;
006534  004437  023506                  JSR     R4,$POLSH       ;ENTER POLISH MODE
006540  023510  002426                  $PUSH   ,LONUM          ;PUSH 2 WORDS ON STACK (LONUM)
006544  023510  002436                  $PUSH   ,HINUM          ;PUSH 2 WORDS ON STACK (HINUM)
006550  023562                          $SUB                    ;ADDRESS OF FORTRAN SUBTRACT
006552  023540  002416                  $POPX   ,ANS2           ;POP 2 WORDS AND EXIT POLISH MODE
006556  013700  002400                  MOV     $FPS,R0         ;DISPLAY FLOATING POINT STATUS
006562  170127  040000                  LDFPS   #040000         ;LOAD FPS, INTERRUPT DISABLE
006566  172437  002426                  LDF     LONUM,AC0       ;LOAD AC0 WITH A RANDOM NUMBER
006572  172537  002436                  LDF     HINUM,AC1       ;LOAD AC1 WITH A RANDOM NUMBER
006576  172737  002416                  LDF     ANS2,AC3        ;LOAD AC3 WITH THE SUM
006602  170127  007400                  LDFPS   #007400         ;TURN INTERRUPTS ON
006606  012737  006614  001110          MOV     #.+6,$LPADR     ;RESET LOOP ADDRESS

                                ;*****************************************************************

006614  172600                  ARET11: LDF     AC0,AC2         ;LOAD AC0 INTO AC2
006616  173201                          SUBF    AC1,AC2         ;SUBTRACT AC1 BY AC2
006620  170237  002362                  STFPS   FPS             ;STORE FLOATING POINT STATUS
006624  023737  002362  002400          CMP     FPS,$FPS        ;CHECK FPS
006632  001403                          BEQ     AERR11          ;BRANCH IF OK
006634  174237  002406                  STF     AC2,ANS1        ;SAVE FPU ANSWER
006640  104002                          ERROR   2               ;FPS ERROR

006642  005737  002400          AERR11: TST     $FPS            ;ERROR BIT SET ?
006646  100014                          BPL     ATST11          ;NO, DONT GET FEC/FEA
006650  170337  002364                  STST    FEC             ;YES, CHECK STATUS

006654  023737  002364  002402          CMP     FEC,$FEC        ;CHECK THE FLOATING EXCEPTION CODES
006662  001401                          BEQ     1$              ;BRANCH IF OK
006664  104024                          ERROR   24              ;FEC IS WRONG

006666  023737  002366  002404  1$:     CMP     FEA,$FEA        ;CHECK FLOATING PC
006674  001401                          BEQ     ATST11          ;BRANCH IF OK
006676  104024                          ERROR   24              ;WRONG ADDRESS IN FEA

006700  173702                  ATST11: CMPF    AC2,AC3         ;COMPARE FPU ANSWER TO FORTRAN ANSWER
006702  170000                          CFCC                    ;COPY FLOATING CONDITION CODES
006704  001416                          BEQ     AEND11          ;ANSWERS CHECK
                                        ;COMPENSATE FOR FORTRAN INACCURACIES.
006706  174237  002406                  STF     AC2,ANS1        ;SAVE FPU ANSWER
006712  162737  000001  002410          SUB     #1,ANS1+2       ;DECREMENT FPU ANSWER
006720  005637  002406                  SBC     ANS1
```

```
                                        CMPF    ANS1,AC3        ;CHECK ANSWERS AGAIN
                                        CFCC                    ;COPY FLOATING CONDITION CODES
                                        BEQ     AEND11          ;BRANCH IF OK
                                        STF     AC2,ANS1        ;SAVE FPU ANSWER
                                        ERROR   7               ;FPU AND FORTRAN DISAGREE

                AEND11: CLR     FPS             ;CLR FPU FPS BUFFER



                ;;*************************************************************
                ;*TEST 12        EXERCISE SUBD, ALL INTERRUPTS ON, ROUNDING MODE
                ;;*************************************************************
                T12:    SCOPE
                        MOV     #ARET12,EXPFEA  ;ADDR OF INSTR BEING TESTED
                        MOV     #007600,$FPS    ;SET IE BITS IN FORTRAN ANSWER
                        CLR     $FEC            ;CLR FORTRAN FEC
                        CLR     $FEA            ;CLR FORTRAN FEA
                        CLR     FPS             ;CLR FPU FPS BUFFER
                        CLR     FEC             ;CLR FPU FEC BUFFER
                        CLR     FEA             ;CLR FPU FEA BUFFER
                        JSR     PC,RANDL4       ;GET RANDOM INPUT DATA
                        .WORD   LONUM,HINUM     ;
                        JSR     R4,$POLSH       ;ENTER POLISH MODE
                        $PUSH   ,LONUM          ;PUSH 4 WORDS ON STACK (LONUM)
                        $PUSH   ,HINUM          ;PUSH 4 WORDS ON STACK (HINUM)
                        $SUB                    ;ADDRESS OF FORTRAN SUBTRACT
                        $POPX   ,ANS2           ;POP 4 WORDS AND EXIT POLISH MODE

                        MOV     $FPS,R0         ;DISPLAY FLOATING POINT STATUS
                        LDFPS   #040200         ;LOAD FPS, INTERRUPT DISABLE AND FD
                        LDD     LONUM,AC0       ;LOAD AC0 WITH A RANDOM NUMBER
                        LDD     HINUM,AC1       ;LOAD AC1 WITH A RANDOM NUMBER
                        LDD     ANS2,AC3        ;LOAD AC3 WITH THE SUM
                        LDFPS   #007600         ;TURN INTERRUPTS ON
                        MOV     #.+6,$LPADR     ;RESET LOOP ADDRESS

                        ;*************************************************************

                        LDD     AC0,AC2         ;LOAD AC0 INTO AC2
                ARET12: SUBD    AC1,AC2         ;SUBTRACT AC1 BY AC2
                        STFPS   FPS             ;STORE FLOATING POINT STATUS
                        CMP     FPS,$FPS        ;CHECK FPS
                        BEQ     AERR12          ;BRANCH IF OK
                        STD     AC2,ANS1        ;SAVE FPU ANSWER
                        ERROR   20              ;FPS ERROR

                AERR12: TST     $FPS            ;ERROR BIT SET ?
                        BPL     ATST12          ;NO, DONT GET FEC/FEA
                        STST    FEC             ;YES, CHECK STATUS

                        CMP     FEC,$FEC        ;CHECK THE FLOATING EXCEPTION CODES
                        BEQ     1$              ;BRANCH IF OK
                        ERROR   30              ;FEC IS WRONG
```

```
1285  007152  023737  002366  002404  1$:     CMP     FEA,$FEA        ;CHECK FLOATING PC
1286  007160  001401                          BEQ     ATST12          ;BRANCH IF OK
1287  007162  104030                          ERROR   30              ;WRONG ADDRESS IN FEA
1288
1289  007164  173702                  ATST12: CMPD    AC2,AC3         ;COMPARE FPU ANSWER TO FORTRAN ANSWER
1290  007166  170000                          CFCC                    ;COPY FLOATING CONDITION CODES
1291  007170  001422                          BEQ     AEND12          ;ANSWERS CHECK
1292                                          ;COMPENSATE FOR FORTRAN INACCURACIES.
1293  007172  174237  002406                  STD     AC2,ANS1        ;SAVE FPU ANSWER
1294  007176  162737  000001  002414          SUB     #1,ANS1+6       ;DECREMENT FPU ANSWER
1295  007204  005637  002412                  SBC     ANS1+4
1296  007210  005637  002410                  SBC     ANS1+2
1297  007214  005637  002406                  SBC     ANS1
1298  007220  173737  002406                  CMPD    ANS1,AC3        ;CHECK ANSWERS AGAIN
1299  007224  170000                          CFCC                    ;COPY FLOATING CONDITION CODES
1300  007226  001403                          BEQ     AEND12          ;BRANCH IF OK
1301  007230  174237  002406                  STD     AC2,ANS1        ;SAVE FPU ANSWER
1302  007234  104010                          ERROR   10              ;FPU AND FORTRAN DISAGREE
1303
1304  007236  005037  002362          AEND12: CLR     FPS             ;CLR FPU FPS BUFFER
1305
1306
1307
1308
1309                                  ;;*****************************************************************
1310                                  ;*TEST 13       EXERCISE SUBF, OVERFLOW AND UNDERFLOW INTERRUPTS OFF, ROUNDING MODE
1311                                  ;;*****************************************************************
1312  007242  000004          TST13:  SCOPE
1313  007244  012737  007376  002376          MOV     #ARET13,EXPFEA  ;ADDR OF INSTR BEING TESTED
1314  007252  012737  004400  002400          MOV     #004400,$FPS    ;SET IE BITS IN FORTRAN ANSWER
1315  007260  005037  002402                  CLR     $FEC            ;CLR FORTRAN FEC
1316  007264  005037  002404                  CLR     $FEA            ;CLR FORTRAN FEA
1317  007270  005037  002362                  CLR     FPS             ;CLR FPU FPS BUFFER
1318  007274  005037  002364                  CLR     FEC             ;CLR FPU FEC BUFFER
1319  007300  005037  002366                  CLR     FEA             ;CLR FPU FEA BUFFER
1320  007304  004737  023342                  JSR     PC,RANDL2       ;GET RANDOM INPUT DATA
1321  007310  002426  002436                  .WORD   LONUM,HINUM     ;
1322  007314  004437  023506                  JSR     R4,$POLSH       ;ENTER POLISH MODE
1323  007320  023510  002426                  $PUSH   ,LONUM          ;PUSH 2 WORDS ON STACK (LONUM)
1324  007324  023510  002436                  $PUSH   ,HINUM          ;PUSH 2 WORDS ON STACK (HINUM)
1325  007330  023562                          $SUB                    ;ADDRESS OF FORTRAN SUBTRACT
1326  007332  023540  002416                  $POPX   ,ANS2           ;POP 2 WORDS AND EXIT POLISH MODE
1327
1328  007336  013700  002400                  MOV     $FPS,R0         ;DISPLAY FLOATING POINT STATUS
1329  007342  170127  040000                  LDFPS   #040000         ;LOAD FPS, INTERRUPT DISABLE
1330  007346  172437  002426                  LDF     LONUM,AC0       ;LOAD AC0 WITH A RANDOM NUMBER
1331  007352  172537  002436                  LDF     HINUM,AC1       ;LOAD AC1 WITH A RANDOM NUMBER
1332  007356  172737  002416                  LDF     ANS2,AC3        ;LOAD AC3 WITH THE SUM
1333  007362  170127  004400                  LDFPS   #004400         ;TURN INTERRUPTS ON, EXCEPT OVERFLOW AND UNDERFLOW
1334  007366  012737  007374  001110          MOV     #.+6,$LPADR     ;RESET LOOP ADDRESS
1335
1336                                          ;*****************************************************************
1337
1338  007374  172600                          LDF     AC0,AC2         ;LOAD AC0 INTO AC2
1339  007376  173201                  ARET13: SUBF    AC1,AC2         ;SUBTRACT AC1 BY AC2
1340  007400  170237  002362                  STFPS   FPS             ;STORE FLOATING POINT STATUS
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1341  007404  023737  002362  002400          CMP     FPS,$FPS        ;CHECK FPS
1342  007412  001403                          BEQ     ATST13          ;BRANCH IF OK
1343  007414  174237  002406                  STF     AC2,ANS1        ;SAVE FPU ANSWER
1344  007420  104002                          ERROR   2               ;FPS ERROR
1345
1346  007422  173702                ATST13:   CMPF    AC2,AC3         ;COMPARE FPU ANSWER TO FORTRAN ANSWER
1347  007424  170000                          CFCC                    ;COPY FLOATING CONDITION CODES
1348  007426  001416                          BEQ     AEND13          ;ANSWERS CHECK
1349                                          ;COMPENSATE FOR FORTRAN INACCURACIES.
1350  007430  174237  002406                  STF     AC2,ANS1        ;SAVE FPU ANSWER
1351  007434  162737  000001  002410          SUB     #1,ANS1+2       ;DECREMENT FPU ANSWER
1352  007442  005637  002406                  SBC     ANS1
1353  007446  173737  002406                  CMPF    ANS1,AC3        ;CHECK ANSWERS AGAIN
1354  007452  170000                          CFCC                    ;COPY FLOATING CONDITION CODES
1355  007454  001403                          BEQ     AEND13          ;BRANCH IF OK
1356  007456  174237  002406                  STF     AC2,ANS1        ;SAVE FPU ANSWER
1357  007462  104007                          ERROR   7               ;FPU AND FORTRAN DISAGREE
1358
1359  007464  005037  002362          AEND13: CLR     FPS             ;CLR FPU FPS BUFFER
1360
1361
1362
1363
1364                                          ;;*****************************************************************
1365                                          ;*TEST 14       EXERCISE SUBD, OVERFLOW AND UNDERFLOW INTERRUPTS OFF, ROUNDING MODE
1366                                          ;;*****************************************************************
1367  007470  000004                TST14:    SCOPE
1368  007472  012737  007624  002376          MOV     #ARET14,EXPFEA  ;ADDR OF INSTR BEING TESTED
1369  007500  012737  004600  002400          MOV     #004600,$FPS    ;SET IE BITS IN FORTRAN ANSWER
1370  007506  005037  002402                  CLR     $FEC            ;CLR FORTRAN FEC
1371  007512  005037  002404                  CLR     $FEA            ;CLR FORTRAN FEA
1372  007516  005037  002362                  CLR     FPS             ;CLR FPU FPS BUFFER
1373  007522  005037  002364                  CLR     FEC             ;CLR FPU FEC BUFFER
1374  007526  005037  002366                  CLR     FEA             ;CLR FPU FEA BUFFER
1375  007532  004737  023332                  JSR     PC,RANDL4       ;GET RANDOM INPUT DATA
1376  007536  002426  002436                  .WORD   LONUM,HINUM     ;
1377  007542  004437  023506                  JSR     R4,$POLSH       ;ENTER POLISH MODE
1378  007546  023510  002426                  $PUSH   ,LONUM          ;PUSH 4 WORDS ON STACK (LONUM)
1379  007552  023510  002436                  $PUSH   ,HINUM          ;PUSH 4 WORDS ON STACK (HINUM)
1380  007556  023562                          $SUB                    ;ADDRESS OF FORTRAN SUBTRACT
1381  007560  023540  002416                  $POPX   ,ANS2           ;POP 4 WORDS AND EXIT POLISH MODE
1382
1383  007564  013700  002400                  MOV     $FPS,R0         ;DISPLAY FLOATING POINT STATUS
1384  007570  170127  040200                  LDFPS   #040200         ;LOAD FPS, INTERRUPT DISABLE AND FD
1385  007574  172437  002426                  LDD     LONUM,AC0       ;LOAD AC0 WITH A RANDOM NUMBER
1386  007600  172537  002436                  LDD     HINUM,AC1       ;LOAD AC1 WITH A RANDOM NUMBER
1387  007604  172737  002416                  LDD     ANS2,AC3        ;LOAD AC3 WITH THE SUM
1388  007610  170127  004600                  LDFPS   #004600         ;TURN INTERRUPTS ON, EXCEPT OVER AND UNDERFLOW
1389  007614  012737  007622  001110          MOV     #.+6,$LPADR     ;RESET LOOP ADDRESS
1390
1391                                          ;*****************************************************************
1392
1393  007622  172600                          LDD     AC0,AC2         ;LOAD AC0 INTO AC2
1394  007624  173201                ARET14:   SUBD    AC1,AC2         ;SUBTRACT AC1 BY AC2
1395  007626  170237  002362                  STFPS   FPS             ;STORE FLOATING POINT STATUS
1396  007632  023737  002362  002400          CMP     FPS,$FPS        ;CHECK FPS
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1397  007640  001403                        BEQ     ATST14          ;BRANCH IF OK
1398  007642  174237  002406                STD     AC2,ANS1        ;SAVE FPU ANSWER
1399  007646  104020                        ERROR   20              ;FPS ERROR
1400
1401  007650  173702              ATST14:   CMPD    AC2,AC3         ;COMPARE FPU ANSWER TO FORTRAN ANSWER
1402  007652  170000                        CFCC                    ;COPY FLOATING CONDITION CODES
1403  007654  001422                        BEQ     AEND14          ;ANSWERS CHECK
1404                                        ;COMPENSATE FOR FORTRAN INACCURACIES.
1405  007656  174237  002406                STD     AC2,ANS1        ;SAVE FPU ANSWER
1406  007662  162737  000001  002414        SUB     #1,ANS1+6       ;DECREMENT FPU ANSWER
1407  007670  005637  002412                SBC     ANS1+4
1408  007674  005637  002410                SBC     ANS1+2
1409  007700  005637  002406                SBC     ANS1
1410  007704  173737  002406                CMPD    ANS1,AC3        ;CHECK ANSWERS AGAIN
1411  007710  170000                        CFCC                    ;COPY FLOATING CONDITION CODES
1412  007712  001403                        BEQ     AEND14          ;BRANCH IF OK
1413  007714  174237  002406                STD     AC2,ANS1        ;SAVE FPU ANSWER
1414  007720  104010                        ERROR   10              ;FPU AND FORTRAN DISAGREE
1415
1416  007722  005037  002362    AEND14:     CLR     FPS             ;CLR FPU FPS BUFFER
1417
1418
1419
1420
1421                              ;;*****************************************************************
1422                              ;*TEST 15        EXERCISE SUBF, ALL INTERRUPTS ON, TRUNCATE MODE
1423                              ;;*****************************************************************
1424  007726  000004              TST15:  SCOPE
1425  007730  012737  010062  002374      MOV     #ARET15,EXPFEA  ;ADDR OF INSTR BEING TESTED
1426  007736  012737  007440  002400      MOV     #007440,$FPS    ;SET IE BITS IN FORTRAN ANSWER
1427  007744  005037  002402              CLR     $FEC            ;CLR FORTRAN FEC
1428  007750  005037  002404              CLR     $FEA            ;CLR FORTRAN FEA
1429  007754  005037  002362              CLR     FPS             ;CLR FPU FPS BUFFER
1430  007760  005037  002364              CLR     FEC             ;CLR FPU FEC BUFFER
1431  007764  005037  002366              CLR     FEA             ;CLR FPU FEA BUFFER
1432  007770  004737  023342              JSR     PC,RANDL2       ;GET RANDOM INPUT DATA
1433  007774  002426  002436              .WORD   LONUM,HINUM     ;
1434  010000  004437  023506              JSR     R4,$POLSH       ;ENTER POLISH MODE
1435  010004  023510  002426              $PUSH   ,LONUM          ;PUSH 2 WORDS ON STACK (LONUM)
1436  010010  023510  002436              $PUSH   ,HINUM          ;PUSH 2 WORDS ON STACK (HINUM)
1437  010014  023562                      $SUB                    ;ADDRESS OF FORTRAN SUBTRACT
1438  010016  023540  002416              $POPX   ,ANS2           ;POP 2 WORDS AND EXIT POLISH MODE
1439
1440  010022  013700  002400              MOV     $FPS,R0         ;DISPLAY FLOATING POINT STATUS
1441  010026  170127  040000              LDFPS   #040000         ;LOAD FPS, INTERRUPT DISABLE
1442  010032  172437  002426              LDF     LONUM,AC0       ;LOAD AC0 WITH A RANDOM NUMBER
1443  010036  172537  002436              LDF     HINUM,AC1       ;LOAD AC1 WITH A RANDOM NUMBER
1444  010042  172737  002416              LDF     ANS2,AC3        ;LOAD AC3 WITH THE SUM
1445  010046  170127  007440              LDFPS   #007440         ;TURN INTERRUPTS ON
1446  010052  012737  010060  001110      MOV     #.+6,$LPADR     ;RESET LOOP ADDRESS
1447
1448                                      ;*****************************************************************
1449
1450  010060  172600                      LDF     AC0,AC2         ;LOAD AC0 INTO AC2
1451  010062  173201              ARET15: SUBF    AC1,AC2         ;SUBTRACT AC1 BY AC2
1452  010064  170237  002362              STFPS   FPS             ;STORE FLOATING POINT STATUS
```

```
1453  010070  023737  002362  002400          CMP     FPS,$FPS        ;CHECK FPS
1454  010076  001403                          BEQ     AERR15          ;BRANCH IF OK
1455  010100  174237  002406                  STF     AC2,ANS1        ;SAVE FPU ANSWER
1456  010104  104002                          ERROR   2               ;FPS ERROR
1457
1458  010106  005737  002400          AERR15: TST     $FPS            ;ERROR BIT SET ?
1459  010112  100014                          BPL     ATST15          ;NO, DONT GET FEC/FEA
1460  010114  170337  002364                  STST    FEC             ;YES, CHECK STATUS
1461
1462  010120  023737  002364  002402          CMP     FEC,$FEC        ;CHECK THE FLOATING EXCEPTION CODES
1463  010126  001401                          BEQ     1$              ;BRANCH IF OK
1464  010130  104024                          ERROR   24              ;FEC IS WRONG
1465
1466  010132  023737  002366  002404  1$:     CMP     FEA,$FEA        ;CHECK FLOATING PC
1467  010140  001401                          BEQ     ATST15          ;BRANCH IF OK
1468  010142  104024                          ERROR   24              ;WRONG ADDRESS IN FEA
1469
1470  010144  173702                  ATST15: CMPF    AC2,AC3         ;COMPARE FPU ANSWER TO FORTRAN ANSWER
1471  010146  170000                          CFCC                    ;COPY FLOATING CONDITION CODES
1472  010150  001427                          BEQ     AEND15          ;ANSWERS CHECK
1473                                          ;COMPENSATE FOR FORTRAN INACCURACIES.
1474  010152  174237  002406                  STF     AC2,ANS1        ;SAVE FPU ANSWER
1475  010156  062737  000001  002410          ADD     #1,ANS1+2       ;INCREMENT FPU ANSWER
1476  010164  005537  002406                  ADC     ANS1
1477  010170  173737  002406                  CMPF    ANS1,AC3        ;CHECK ANSWERS AGAIN
1478  010174  170000                          CFCC                    ;COPY FLOATING CONDITION CODES
1479  010176  001414                          BEQ     AEND15          ;BRANCH IF OK
1480  010200  162737  000002  002410          SUB     #2,ANS1+2       ;DECREMENT FPU ANSWER
1481  010206  005637  002406                  SBC     ANS1
1482  010212  173737  002406                  CMPF    ANS1,AC3        ;CHECK ANSWERS AGAIN
1483  010216  170000                          CFCC                    ;COPY FLOATING CONDITION CODES
1484  010220  001403                          BEQ     AEND15          ;BRANCH IF OK
1485  010222  174237  002406                  STF     AC2,ANS1        ;SAVE FPU ANSWER
1486  010226  104007                          ERROR   7               ;FPU AND FORTRAN DISAGREE
1487
1488  010230  005037  002362          AEND15: CLR     FPS             ;CLR FPU FPS BUFFER
1489
1490
1491
1492
1493                                          ;;*****************************************************************
1494                                          ;*TEST 16       EXERCISE SUBD, ALL INTERRUPTS ON, TRUNCATE MODE
1495                                          ;;*****************************************************************
1496  010234  000004                  TST16:  SCOPE
1497  010236  012737  010370  002376          MOV     #ARET16,EXPFEA  ;ADDR OF INSTR BEING TESTED
1498  010244  012737  007640  002400          MOV     #007640,$FPS    ;SET IE BITS IN FORTRAN ANSWER
1499  010252  005037  002402                  CLR     $FEC            ;CLR FORTRAN FEC
1500  010256  005037  002404                  CLR     $FEA            ;CLR FORTRAN FEA
1501  010262  005037  002362                  CLR     FPS             ;CLR FPU FPS BUFFER
1502  010266  005037  002364                  CLR     FEC             ;CLR FPU FEC BUFFER
1503  010272  005037  002366                  CLR     FEA             ;CLR FPU FEA BUFFER
1504  010276  004737  023332                  JSR     PC,RANDL4       ;GET RANDOM INPUT DATA
1505  010302  002426  002436                  .WORD   LONUM,HINUM
1506  010306  004437  023506                  JSR     R4,$POLSH       ;ENTER POLISH MODE
1507  010312  023510  002426                  $PUSH   ,LONUM          ;PUSH 4 WORDS ON STACK (LONUM)
1508  010316  023510  002436                  $PUSH   ,HINUM          ;PUSH 4 WORDS ON STACK (HINUM)
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1509  010322  023562                        $SUB                    ;ADDRESS OF FORTRAN SUBTRACT
1510  010324  023540  002416                $POP    ,ANS2           ;POP 4 WORDS AND EXIT POLISH MODE
1511
1512  010330  013700  002400                MOV     $FPS,R0         ;DISPLAY FLOATING POINT STATUS
1513  010334  170127  040200                LDFPS   #040200         ;LOAD FPS, INTERRUPT DISABLE AND FD
1514  010340  172437  002426                LDD     LONUM,AC0       ;LOAD AC0 WITH A RANDOM NUMBER
1515  010344  172537  002436                LDD     HINUM,AC1       ;LOAD AC1 WITH A RANDOM NUMBER
1516  010350  172737  002416                LDD     ANS2,AC3        ;LOAD AC3 WITH THE SUM
1517  010354  170127  007640                LDFPS   #007640         ;TURN INTERRUPTS ON
1518  010360  012737  010366  001110        MOV     #.+6,$LPADR     ;RESET LOOP ADDRESS
1519
1520                                        ;*****************************************************************
1521
1522  010366  172600                ARET16: LDD     AC0,AC2         ;LOAD AC0 INTO AC2
1523  010370  173201                        SUBD    AC1,AC2         ;SUBTRACT AC1 BY AC2
1524  010372  170237  002362                STFPS   FPS             ;STORE FLOATING POINT STATUS
1525  010376  023737  002362  002400        CMP     FPS,$FPS        ;CHECK FPS
1526  010404  001403                        BEQ     AERR16          ;BRANCH IF OK
1527  010406  174237  002406                STD     AC2,ANS1        ;SAVE FPU ANSWER
1528  010412  104020                        ERROR   20              ;FPS ERROR
1529
1530  010414  005737  002400        AERR16: TST     $FPS            ;ERROR BIT SET ?
1531  010420  100014                        BPL     ATST16          ;NO, DONT GET FEC/FEA
1532  010422  170337  002364                STST    FEC             ;YES, CHECK STATUS
1533
1534  010426  023737  002364  002402        CMP     FEC,$FEC        ;CHECK THE FLOATING EXCEPTION CODES
1535  010434  001401                        BEQ     1$              ;BRANCH IF OK
1536  010436  104030                        ERROR   30              ;FEC IS WRONG
1537
1538  010440  023737  002366  002404  1$:   CMP     FEA,$FEA        ;CHECK FLOATING PC
1539  010446  001401                        BEQ     ATST16          ;BRANCH IF OK
1540  010450  104030                        ERROR   30              ;WRONG ADDRESS IN FEA
1541
1542  010452  173702                ATST16: CMPD    AC2,AC3         ;COMPARE FPU ANSWER TO FORTRAN ANSWER
1543  010454  170000                        CFCC                    ;COPY FLOATING CONDITION CODES
1544  010456  001437                        BEQ     AEND16          ;ANSWERS CHECK
1545                                        ;COMPENSATE FOR FORTRAN INACCURACIES.
1546  010460  174237  002406                STD     AC2,ANS1        ;SAVE FPU ANSWER
1547  010464  062737  000001  002414        ADD     #1,ANS1+6       ;INCREMENT FPU ANSWER
1548  010472  005537  002412                ADC     ANS1+4
1549  010476  005537  002410                ADC     ANS1+2
1550  010502  005537  002406                ADC     ANS1
1551  010506  173737  002406                CMPD    ANS1,AC3        ;CHECK ANSWERS AGAIN
1552  010512  170000                        CFCC                    ;COPY FLOATING CONDITION CODES
1553  010514  001420                        BEQ     AEND16          ;BRANCH IF OK
1554  010516  162737  000002  002414        SUB     #2,ANS1+6       ;DECREMENT FPU ANSWER
1555  010524  005637  002412                SBC     ANS1+4
1556  010530  005637  002410                SBC     ANS1+2
1557  010534  005637  002406                SBC     ANS1
1558  010540  173737  002406                CMPD    ANS1,AC3        ;CHECK ANSWERS AGAIN
1559  010544  170000                        CFCC                    ;COPY FLOATING CONDITION CODES
1560  010546  001403                        BEQ     AEND16          ;BRANCH IF OK
1561  010550  174237  002406                STD     AC2,ANS1        ;SAVE FPU ANSWER
1562  010554  104010                        ERROR   10              ;FPU AND FORTRAN DISAGREE
1563
1564  010556  005037  002362        AEND16: CLR     FPS             ;CLR FPU FPS BUFFER
```

```
                                        ;;*****************************************************************
                                        ;*TEST 17       EXERCISE SUBF, OVERFLOW AND UNDERFLOW INTERRUPTS OFF, TRUNCATE MODE
                                        ;;*****************************************************************
010562  000004                  TST17:  SCOPE
010564  012737  010716  002376          MOV     #ARET17,EXPFEA  ;ADDR OF INSTR BEING TESTED
010572  012737  004440  002400          MOV     #004440,$FPS    ;SET IE BITS IN FORTRAN ANSWER
010600  005037  002402                  CLR     $FEC            ;CLR FORTRAN FEC
010604  005037  002404                  CLR     $FEA            ;CLR FORTRAN FEA
010610  005037  002362                  CLR     FPS             ;CLR FPU FPS BUFFER
010614  005037  002364                  CLR     FEC             ;CLR FPU FEC BUFFER
010620  005037  002366                  CLR     FEA             ;CLR FPU FEA BUFFER
010624  004737  023342                  JSR     PC,RANDL2       ;GET RANDOM INPUT DATA
010630  002426  002436                  .WORD   LONUM,HINUM     ;
010634  004437  023506                  JSR     R4,$POLSH       ;ENTER POLISH MODE
010640  023510  002426                  $PUSH   ,LONUM          ;PUSH 2 WORDS ON STACK (LONUM)
010644  023510  002436                  $PUSH   ,HINUM          ;PUSH 2 WORDS ON STACK (HINUM)
010650  023562                          $SUB                    ;ADDRESS OF FORTRAN SUBTRACT
010652  023540  002416                  $POPX   ,ANS2           ;POP 2 WORDS AND EXIT POLISH MODE
                                        ;
010656  013700  002400                  MOV     $FPS,R0         ;DISPLAY FLOATING POINT STATUS
010662  170127  040000                  LDFPS   #040000         ;LOAD FPS, INTERRUPT DISABLE
010666  172437  002426                  LDF     LONUM,AC0       ;LOAD AC0 WITH A RANDOM NUMBER
010672  172537  002436                  LDF     HINUM,AC1       ;LOAD AC1 WITH A RANDOM NUMBER
010676  172737  002416                  LDF     ANS2,AC3        ;LOAD AC3 WITH THE SUM
010702  170127  004440                  LDFPS   #004440         ;TURN INTERRUPTS ON, EXCEPT OVERFLOW AND UNDERFLOW
010706  012737  010714  001110          MOV     #.+6,$LPADR     ;RESET LOOP ADDRESS
                                        ;
                                        ;*****************************************************************
                                        ;
010714  172600                  ARET17: LDF     AC0,AC2         ;LOAD AC0 INTO AC2
010716  173201                          SUBF    AC1,AC2         ;SUBTRACT AC1 BY AC2
010720  170237  002362                  STFPS   FPS             ;STORE FLOATING POINT STATUS
010724  023737  002362  002400          CMP     FPS,$FPS        ;CHECK FPS
010732  001403                          BEQ     ATST17          ;BRANCH IF OK
010734  174237  002406                  STF     AC2,ANS1        ;SAVE FPU ANSWER
010740  104002                          ERROR   2               ;FPS ERROR
                                        ;
010742  173702                  ATST17: CMPF    AC2,AC3         ;COMPARE FPU ANSWER TO FORTRAN ANSWER
010744  170000                          CFCC                    ;COPY FLOATING CONDITION CODES
010746  001427                          BEQ     AEND17          ;ANSWERS CHECK
                                        ;COMPENSATE FOR FORTRAN INACCURACIES.
010750  174237  002406                  STF     AC2,ANS1        ;SAVE FPU ANSWER
010754  062737  000001  002410          ADC     #1,ANS1+2       ;INCREMENT FPU ANSWER
010762  005537  002406                  ADC     ANS1
010766  173737  002406                  CMPF    ANS1,AC3        ;CHECK ANSWERS AGAIN
010772  170000                          CFCC                    ;COPY FLOATING CONDITION CODES
010774  001414                          BEQ     AEND17          ;BRANCH IF OK
010776  162737  000002  002410          SUB     #2,ANS1+2       ;DECREMENT FPU ANSWER
011004  005637  002406                  SBC     ANS1
011010  173737  002406                  CMPF    ANS1,AC3        ;CHECK ANSWERS AGAIN
011014  170000                          CFCC                    ;COPY FLOATING CONDITION CODES
011016  001403                          BEQ     AEND17          ;BRANCH IF OK
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1621  011020  174237  002406                  STF     AC2,ANS1        ;SAVE FPU ANSWER
1622  011024  104007                          ERROR   7               ;FPU AND FORTRAN DISAGREE
1623
1624  011026  005037  002362          AEND17: CLR     FPS             ;CLR FPU FPS BUFFER
1625
1626
1627
1628
1629                                    ;;*****************************************************************
1630                                    ;*TEST 20        EXERCISE SUBD, OVERFLOW AND UNDERFLOW INTERRUPTS OFF, TRUNCATE MODE
1631                                    ;;*****************************************************************
1632  011032  000004                    TST20:  SCOPE
1633  011034  012737  011166  002376            MOV     #ARET20,EXPFEA  ;ADDR OF INSTR BEING TESTED
1634  011042  012737  004640  002400            MOV     #004640,$FPS    ;SET IE BITS IN FORTRAN ANSWER
1635  011050  005037  002402                    CLR     $FEC            ;CLR FORTRAN FEC
1636  011054  005037  002404                    CLR     $FEA            ;CLR FORTRAN FEA
1637  011060  005037  002362                    CLR     FPS             ;CLR FPU FPS BUFFER
1638  011064  005037  002364                    CLR     FEC             ;CLR FPU FEC BUFFER
1639  011070  005037  002366                    CLR     FEA             ;CLR FPU FEA BUFFER
1640  011074  004737  023332                    JSR     PC,RANDL4       ;GET RANDOM INPUT DATA
1641  011100  002426  002436                    .WORD   LONUM,HINUM     ;
1642  011104  004437  023506                    JSR     R4,$POLSH       ;ENTER POLISH MODE
1643  011110  023510  002426                    $PUSH   ,LONUM          ;PUSH 4 WORDS ON STACK (LONUM)
1644  011114  023510  002436                    $PUSH   ,HINUM          ;PUSH 4 WORDS ON STACK (HINUM)
1645  011120  023562                          $SUB                    ;ADDRESS OF FORTRAN SUBTRACT
1646  011122  023540  002416                  $POPX   ,ANS2           ;POP 4 WORDS AND EXIT POLISH MODE
1647
1648  011126  013700  002400                  MOV     $FPS,R0         ;DISPLAY FLOATING POINT STATUS
1649  011132  170127  040200                  LDFPS   #040200         ;LOAD FPS, INTERRUPT DISABLE AND FD
1650  011136  172437  002426                  LDD     LONUM,AC0       ;LOAD AC0 WITH A RANDOM NUMBER
1651  011142  172537  002436                  LDD     HINUM,AC1       ;LOAD AC1 WITH A RANDOM NUMBER
1652  011146  172737  002416                  LDD     ANS2,AC3        ;LOAD AC3 WITH THE SUM
1653  011152  170127  004640                  LDFPS   #004640         ;TURN INTERRUPTS ON, EXCEPT OVER AND UNDERFLOW
1654  011156  012737  011164  001110          MOV     #.+6,$LPADR     ;RESET LOOP ADDRESS
1655
1656                                    ;*****************************************************************
1657
1658  011164  172600                  ARET20: LDD     AC0,AC2         ;LOAD AC0 INTO AC2
1659  011166  173201                          SUBD    AC1,AC2         ;SUBTRACT AC1 BY AC2
1660  011170  170237  002362                  STFPS   FPS             ;STORE FLOATING POINT STATUS
1661  011174  023737  002362  002400          CMP     FPS,$FPS        ;CHECK FPS
1662  011202  001403                          BEQ     ATST20          ;BRANCH IF OK
1663  011204  174237  002406                  STF     AC2,ANS1        ;SAVE FPU ANSWER
1664  011210  104020                          ERROR   20              ;FPS ERROR
1665
1666  011212  173702                  ATST20: CMPD    AC2,AC3         ;COMPARE FPU ANSWER TO FORTRAN ANSWER
1667  011214  170000                          CFCC                    ;COPY FLOATING CONDITION CODES
1668  011216  001437                          BEQ     AEND20          ;ANSWERS CHECK
1669                                          ;  MPENSATE FOR FORTRAN INACCURACIES,
1670  011220  174237  002406                  STD     AC2,ANS1        ;SAVE FPU ANSWER
1671  011224  062737  000001  002414          ADD     #1,ANS1+6       ;INCREMENT FPU ANSWER
1672  011232  005537  002412                  ADC     ANS1+4
1673  011236  005537  002410                  ADC     ANS1+2
1674  011242  005537  002406                  ADC     ANS1
1675  011246  173737  002406                  CMPD    ANS1,AC3        ;CHECK ANSWERS AGAIN
1676  011252  170000                          CFCC                    ;COPY FLOATING CONDITION CODES
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 1677  011254  001420                          BEQ     AEND20          ;BRANCH IF OK
 1678  011256  162737  000002  002414          SUB     #2,ANS1+6       ;DECREMENT FPU ANSWER
 1679  011264  005637  002412                  SBC     ANS1+4
 1680  011270  005637  002410                  SBC     ANS1+2
 1681  011274  005637  002406                  SBC     ANS1
 1682  011300  173737  002406                  CMPD    ANS1,AC3        ;CHECK ANSWERS AGAIN
 1683  011304  170000                          CFCC                    ;COPY FLOATING CONDITION CODES
 1684  011306  001403                          BEQ     AEND20          ;BRANCH IF OK
 1685  011310  174237  002406                  STD     AC2,ANS1        ;SAVE FPU ANSWER
 1686  011314  104010                          ERROR   10              ;FPU AND FORTRAN DISAGREE
 1687
 1688  011316  005037  002362          AEND20: CLR     FPS             ;CLR FPU FPS BUFFER
 1689
```

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1690                                    ;;*****************************************************************
1691                                    ;*TEST 21       EXERCISE MULF, ALL INTERRUPTS ON, ROUNDING MODE
1692                                    ;;*****************************************************************
1693  011322  000004                    TST21:  SCOPE
1694  011324  012737  011456  002376            MOV     #MRET1,EXPFEA   ;ADDR OF INSTR BEING TESTED
1695  011332  012737  007400  002400            MOV     #007400,$FPS    ;SET IE BITS IN FORTRAN ANSWER
1696  011340  005037  002402                    CLR     $FEC            ;CLR FORTRAN FEC
1697  011344  005037  002404                    CLR     $FEA            ;CLR FORTRAN FEA
1698  011350  005037  002362                    CLR     FPS             ;CLR FPU FPS BUFFER
1699  011354  005037  002364                    CLR     FEC             ;CLR FPU FEC BUFFER
1700  011360  005037  002366                    CLR     FEA             ;CLR FPU FEA BUFFER
1701  011364  004737  023342                    JSR     PC,RANDL2       ;GET RANDOM INPUT DATA
1702  011370  002426  002436                    .WORD   LONUM,HINUM     ;
1703  011374  004437  023506                    JSR     R4,$POLSH       ;ENTER POLISH MODE
1704  011400  023510  002426                    $PUSH   ,LONUM          ;PUSH 2 WORDS ON STACK (LONUM)
1705  011404  023510  002436                    $PUSH   ,HINUM          ;PUSH 2 WORDS ON STACK (HINUM)
1706  011410  025244                            $MUL                    ;ADDRESS OF FORTRAN MULTIPLY
1707  011412  023540  002416                    $POPX   ,ANS2           ;POP 2 WORDS AND EXIT POLISH MODE
1708
1709  011416  013700  002400                    MOV     $FPS,R0         ;DISPLAY FLOATING POINT STATUS
1710  011422  170127  040000                    LDFPS   #040000         ;CLEAR THE FPS, INTERRUPT DISABLE
1711  011426  172437  002426                    LDF     LONUM,AC0       ;LOAD AC0 WITH A RANDOM NUMBER
1712  011432  172537  002436                    LDF     HINUM,AC1       ;LOAD AC1 WITH A RANDOM NUMBER
1713  011436  172737  002416                    LDF     ANS2,AC3        ;LOAD AC3 WITH THE SUM
1714  011442  170127  007400                    LDFPS   #007400         ;TURN INTERRUPTS ON
1715  011446  012737  011454  001110            MOV     #.+6,$LPADR     ;RESET LOOP ADDRESS
1716
1717                                    ;*****************************************************************
1718
1719  011454  172600                    MRET1:  LDF     AC0,AC2         ;LOAD AC0 INTO AC2
1720  011456  171201                            MULF    AC1,AC2         ;MULTIPLY AC1 BY AC2
1721  011460  170237  002362                    STFPS   FPS             ;STORE FLOATING POINT STATUS
1722  011464  023737  002362  002400            CMP     FPS,$FPS        ;CHECK FPS
1723  011472  001403                            BEQ     MERR1           ;BRANCH IF OK
1724  011474  174237  002406                    STF     AC2,ANS1        ;SAVE FPU ANSWER
1725  011500  104003                            ERROR   3               ;FPS ERROR
1726
1727  011502  005737  002400            MERR1:  TST     $FPS            ;ERROR BIT SET ?
1728  011506  100014                            BPL     MTST1           ;NO, DONT GET FEC/FEA
1729  011510  170337  002364                    STST    FEC             ;YES, CHECK STATUS
1730
1731  011514  023737  002364  002402            CMP     FEC,$FEC        ;CHECK THE FLOATING EXCEPTION CODES
1732  011522  001401                            BEQ     1$              ;BRANCH IF OK
1733  011524  104025                            ERROR   25              ;FEC IS WRONG
1734
1735  011526  023737  002366  002404    1$:     CMP     FEA,$FEA        ;CHECK FLOATING PC
1736  011534  001401                            BEQ     MTST1           ;BRANCH IF OK
1737  011536  104025                            ERROR   25              ;WRONG ADDRESS IN FEA
1738
1739  011540  173702                    MTST1:  CMPF    AC2,AC3         ;COMPARE FPU ANSWER TO FORTRAN ANSWER
1740  011542  170000                            CFCC                    ;COPY FLOATING CONDITION CODES
1741  011544  001416                            BEQ     MEND1           ;ANSWERS CHECK
1742                                            ;COMPENSATE FOR FORTRAN INACCURACIES.
1743  011546  174237  002406                    STF     AC2,ANS1        ;SAVE FPU ANSWER
1744  011552  162737  000001  002410            SUB     #1,ANS1+2       ;DECREMENT FPU ANSWER
1745  011560  005637  002406                    SBC     ANS1
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1746  011564  173737  002406                    CMPF    ANS1,AC3        ;CHECK ANSWERS AGAIN
1747  011570  170000                            CFCC                    ;COPY FLOATING CONDITION CODES
1748  011572  001403                            BEQ     MEND1           ;BRANCH IF OK
1749  011574  174237  002406                    STF     AC2,ANS1        ;SAVE FPU ANSWER
1750  011600  104011                            ERROR   11              ;FPU AND FORTRAN DISAGREE
1751
1752  011602  005037  002362          MEND1:    CLR     FPS             ;CLEAR FPP FPS BUFFER
1753
1754
1755
1756
1757                                    ;;*****************************************************************
1758                                    ;*TEST 22        EXERCISE MULD, ALL INTERRUPTS ON, ROUNDING MODE
1759                                    ;;*****************************************************************
1760  011606  000004                    TST22:  SCOPE
1761  011610  012737  011742  002376            MOV     #MRET2,EXPFEA   ;ADDR OF INSTR BEING TESTED
1762  011616  012737  007600  002400            MOV     #007600,$FPS    ;SET IE BITS IN FORTRAN ANSWER
1763  011624  005037  002402                    CLR     $FEC            ;CLR FORTRAN FEC
1764  011630  005037  002404                    CLR     $FEA            ;CLR FORTRAN FEA
1765  011634  005037  002362                    CLR     FPS             ;CLR FPU FPS BUFFER
1766  011640  005037  002364                    CLR     FEC             ;CLR FPU FEC BUFFER
1767  011644  005037  002366                    CLR     FEA             ;CLR FPU FEA BUFFER
1768  011650  004737  023332                    JSR     PC,RANDL4       ;GET RANDOM INPUT DATA
1769  011654  002426  002436                    .WORD   LONUM,HINUM     ;
1770  011660  004437  023506                    JSR     R4,$POLSH       ;ENTER POLISH MODE
1771  011664  023510  002426                    $PUSH   ,LONUM          ;PUSH 4 WORDS ON STACK (LONUM)
1772  011670  023510  002436                    $PUSH   ,HINUM          ;PUSH 4 WORDS ON STACK (HINUM)
1773  011674  025244                            $MUL                    ;ADDRESS OF FORTRAN MULTIPLY
1774  011676  023540  002416                    $POPX   ,ANS2           ;POP 4 WORDS AND EXIT POLISH MODE
1775
1776  011702  013700  002400                    MOV     $FPS,R0         ;DISPLAY FLOATING POINT STATUS
1777  011706  170127  040200                    LDFPS   #040200         ;SET FD OF FPS ONLY, INTERRUPT DISABLE
1778  011712  172437  002426                    LDD     LONUM,AC0       ;LOAD AC0 WITH A RANDOM NUMBER
1779  011716  172537  002436                    LDD     HINUM,AC1       ;LOAD AC1 WITH A RANDOM NUMBER
1780  011722  172737  002416                    LDD     ANS2,AC3        ;LOAD AC3 WITH THE SUM
1781  011726  170127  007600                    LDFPS   #007600         ;TURN INTERRUPTS ON
1782  011732  012737  011740  001110            MOV     #.+6,$LPADR     ;RESET LOOP ADDRESS
1783
1784                                    ;*****************************************************************
1785
1786  011740  172600                    MRET2:  LDD     AC0,AC2         ;LOAD AC0 INTO AC2
1787  011742  171201                            MULD    AC1,AC2         ;MULTIPLY AC1 BY AC2
1788  011744  170237  002362                    STFPS   FPS             ;STORE FLOATING POINT STATUS
1789  011750  023737  002362  002400            CMP     FPS,$FPS        ;CHECK FPS
1790  011756  001403                            BEQ     MERR2           ;BRANCH IF OK
1791  011760  174237  002406                    STD     AC2,ANS1        ;SAVE FPU ANSWER
1792  011764  104021                            ERROR   21              ;FPS ERROR
1793
1794  011766  005737  002[illegible]    MERR2:  TST     $FPS            ;ERROR BIT SET ?
1795  011772  100014                            BPL     MTST2           ;NO, DONT GET FEC/FEA
1796  011774  170337  002364                    STST    FEC             ;YES, CHECK STATUS
1797
1798  012000  023737  002364  002402            CMP     FEC,$FEC        ;CHECK THE FLOATING EXCEPTION CODES
1799  012006  001401                            BEQ     1$              ;BRANCH IF OK
1800  012010  104031                            ERROR   31              ;FEC IS WRONG
1801
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1802  012012  023737  002366  002404  1$:     CMP     FEA,$FEA        ;CHECK FLOATING PC
1803  012020  001401                          BEQ     MTST2           ;BRANCH IF OK
1804  012022  104031                          ERROR   31              ;WRONG ADDRESS IN FEA
1805
1806  012024  173702                  MTST2:  CMPD    AC2,AC3         ;COMPARE FPU ANSWER TO FORTRAN ANSWER
1807  012026  170000                          CFCC                    ;COPY FLOATING CONDITION CODES
1808  012030  001422                          BEQ     MEND2           ;ANSWERS CHECK
1809                                          ;COMPENSATE FOR FORTRAN INACCURACIES.
1810  012032  174237  002406                  STD     AC2,ANS1        ;SAVE FPU ANSWER
1811  012036  162737  000001  002414          SUB     #1,ANS1+6       ;DECREMENT FPU ANSWER
1812  012044  005637  002412                  SBC     ANS1+4
1813  012050  005637  002410                  SBC     ANS1+2
1814  012054  005637  002406                  SBC     ANS1
1815  012060  173737  002406                  CMPD    ANS1,AC3        ;CHECK ANSWERS AGAIN
1816  012064  170000                          CFCC                    ;COPY FLOATING CONDITION CODES
1817  012066  001403                          BEQ     MEND2           ;BRANCH IF OK
1818  012070  174237  002406                  STD     AC2,ANS1        ;SAVE FPU ANSWER
1819  012074  104012                          ERROR   12              ;FPU AND FORTRAN DISAGREE
1820
1821  012076  005037  002362          MEND2:  CLR     FPS             ;CLEAR FPP FPS BUFFER
1822
1823
1824
1825
1826                                  ;;**************************************************************
1827                                  ;*TEST 23       EXERCISE MULF, OVERFLOW AND UNDERFLOW INTERRUPTS OFF, ROUNDING MODE
1828                                  ;;**************************************************************
1829  012102  000004                  TST23:  SCOPE
1830  012104  012737  012236  002376          MOV     #MRET3,EXPFEA   ;ADDR OF INSTR BEING TESTED
1831  012112  012737  004400  002400          MOV     #004400,$FPS    ;SET IE BITS IN FORTRAN ANSWER
1832  012120  005037  002402                  CLR     $FEC            ;CLR FORTRAN FEC
1833  012124  005037  002404                  CLR     $FEA            ;CLR FORTRAN FEA
1834  012130  005037  002362                  CLR     FPS             ;CLR FPU FPS BUFFER
1835  012134  005037  002364                  CLR     FEC             ;CLR FPU FEC BUFFER
1836  012140  005037  002366                  CLR     FEA             ;CLR FPU FEA BUFFER
1837  012144  004737  023342                  JSR     PC,RANDL2       ;GET RANDOM INPUT DATA
1838  012150  002426  002436                  .WORD   LONUM,HINUM
1839  012154  004437  023506                  JSR     R4,$POLSH       ;ENTER POLISH MODE
1840  012160  023510  002426                  $PUSH   ,LONUM          ;PUSH 2 WORDS ON STACK (LONUM)
1841  012164  023510  002436                  $PUSH   ,HINUM          ;PUSH 2 WORDS ON STACK (HINUM)
1842  012170  025244                          $MUL                    ;ADDRESS OF FORTRAN MULTIPLY
1843  012172  023540  002416                  $POPX   ,ANS2           ;POP 2 WORDS AND EXIT POLISH MODE
1844
1845  012176  013700  002400                  MOV     $FPS,R0         ;DISPLAY FLOATING POINT STATUS
1846  012202  170127  040000                  LDFPS   #040000         ;CLEAR THE FPS, INTERRUPT DISABLE
1847  012206  172437  002426                  LDF     LONUM,AC0       ;LOAD AC0 WITH A RANDOM NUMBER
1848  012212  172537  002436                  LDF     HINUM,AC1       ;LOAD AC1 WITH A RANDOM NUMBER
1849  012216  172737  002416                  LDF     ANS2,AC3        ;LOAD AC3 WITH THE SUM
1850  012222  170127  004400                  LDFPS   #004400         ;TURN INTERRUPTS ON, EXCEPT OVERFLOW AND UNDERFLOW
1851  012226  012737  012234  001110          MOV     #.+6,$LPADR     ;RESET LOOP ADDRESS
1852
1853                                          ;**************************************************************
1854
1855  012234  172600                          LDF     AC0,AC2         ;LOAD AC0 INTO AC2
1856  012236  171201                  MRET3:  MULF    AC1,AC2         ;MULTIPLY AC1 BY AC2
1857  012240  170237  002362                  STFPS   FPS             ;STORE FLOATING POINT STATUS
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 1858  012244  023737  002362  002400          CMP     FPS,$FPS        ;CHECK FPS
 1859  012252  001403                          BEQ     MTST3           ;BRANCH IF OK
 1860  012254  174237  002406                  STF     AC2,ANS1        ;SAVE FPU ANSWER
 1861  012260  104003                          ERROR   3               ;FPS ERROR
 1862
 1863  012262  173702                  MTST3:  CMPF    AC2,AC3         ;COMPARE FPU ANSWER TO FORTRAN ANSWER
 1864  012264  170000                          CFCC                    ;COPY FLOATING CONDITION CODES
 1865  012266  001416                          BEQ     MEND3           ;ANSWERS CHECK
 1866                                          ;COMPENSATE FOR FORTRAN INACCURACIES.
 1867  012270  174237  002406                  STF     AC2,ANS1        ;SAVE FPU ANSWER
 1868  012274  162737  000001  002410          SUB     #1,ANS1+2       ;DECREMENT FPU ANSWER
 1869  012302  005637  002406                  SBC     ANS1
 1870  012306  173737  002406                  CMPF    ANS1,AC3        ;CHECK ANSWERS AGAIN
 1871  012312  170000                          CFCC                    ;COPY FLOATING CONDITION CODES
 1872  012314  001403                          BEQ     MEND3           ;BRANCH IF OK
 1873  012316  174237  002406                  STF     AC2,ANS1        ;SAVE FPU ANSWER
 1874  012322  104011                          ERROR   11              ;FPU AND FORTRAN DISAGREE
 1875
 1876  012324  005037  002362          MEND3:  CLR     FPS             ;CLEAR FPP FPS BUFFER
 1877
 1878
 1879
 1880
 1881                                  ;;**********************************************************************
 1882                                  ;*TEST 24        EXERCISE MULD, OVERFLOW AND UNDERFLOW INTERRUPTS OFF, ROUNDING MODE
 1883                                  ;;**********************************************************************
 1884  012330  000004                  TST24:  SCOPE
 1885  012332  012737  012464  002376          MOV     #MRET4,EXPFEA   ;ADDR OF INSTR BEING TESTED
 1886  012340  012737  004600  002400          MOV     #004600,$FPS    ;SET IE BITS IN FORTRAN ANSWER
 1887  012346  005037  002402                  CLR     $FEC            ;CLR FORTRAN FEC
 1888  012352  005037  002404                  CLR     $FEA            ;CLR FORTRAN FEA
 1889  012356  005037  002362                  CLR     FPS             ;CLR FPU FPS BUFFER
 1890  012362  005037  002364                  CLR     FEC             ;CLR FPU FEC BUFFER
 1891  012366  005037  002366                  CLR     FEA             ;CLR FPU FEA BUFFER
 1892  012372  004737  023332                  JSR     PC,RANDL4       ;GET RANDOM INPUT DATA
 1893  012376  002426  002436                  .WORD   LONUM,HINUM
 1894  012402  004437  023506                  JSR     R4,$POLSH       ;ENTER POLISH MODE
 1895  012406  023510  002426                  $PUSH   ,LONUM          ;PUSH 4 WORDS ON STACK (LONUM)
 1896  012412  023510  002436                  $PUSH   ,HINUM          ;PUSH 4 WORDS ON STACK (HINUM)
 1897  012416  025244                          $MUL                    ;ADDRESS OF FORTRAN MULTIPLY
 1898  012420  023540  002416                  $POPX   ,ANS2           ;POP 4 WORDS AND EXIT POLISH MODE
 1899
 1900  012424  013700  002400                  MOV     $FPS,R0         ;DISPLAY FLOATING POINT STATUS
 1901  012430  170127  040200                  LDFPS   #040200         ;SET FD OF FPS ONLY, INTERRUPT DISABLE
 1902  012434  172437  002426                  LDD     LONUM,AC0       ;LOAD AC0 WITH A RANDOM NUMBER
 1903  012440  172537  002436                  LDD     HINUM,AC1       ;LOAD AC1 WITH A RANDOM NUMBER
 1904  012444  172737  002416                  LDD     ANS2,AC3        ;LOAD AC3 WITH THE SUM
 1905  012450  170127  004600                  LDFPS   #004600         ;TURN INTERRUPTS ON, EXCEPT OVER AND UNDERFLOW
 1906  012454  012737  012462  001110          MOV     #.+6,$LPADR     ;RESET LOOP ADDRESS
 1907
 1908                                          ;**********************************************************************
 1909
 1910  012462  172600                  MRET4:  LDD     AC0,AC2         ;LOAD AC0 INTO AC2
 1911  012464  171201                          MULD    AC1,AC2         ;MULTIPLY AC1 BY AC2
 1912  012466  170237  002362                  STFPS   FPS             ;STORE FLOATING POINT STATUS
 1913  012472  023737  002362  002400          CMP     FPS,$FPS        ;CHECK FPS
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1914  012500  001403                        BEQ     MTST4           ;BRANCH IF OK
1915  012502  174237  002406                STD     AC2,ANS1        ;SAVE FPU ANSWER
1916  012506  104021                        ERROR   21              ;FPS ERROR
1917
1918  012510  173702                MTST4:  CMPD    AC2,AC3         ;COMPARE FPU ANSWER TO FORTRAN ANSWER
1919  012512  170000                        CFCC                    ;COPY FLOATING CONDITION CODES
1920  012514  001422                        BEQ     MEND4           ;ANSWERS CHECK
1921                                        ;COMPENSATE FOR FORTRAN INACCURACIES.
1922  012516  174237  002406                STD     AC2,ANS1        ;SAVE FPU ANSWER
1923  012522  162737  000001  002414        SUB     #1,ANS1+6       ;DECREMENT FPU ANSWER
1924  012530  005637  002412                SBC     ANS1+4
1925  012534  005637  002410                SBC     ANS1+2
1926  012540  005637  002406                SBC     ANS1
1927  012544  173737  002406                CMPD    ANS1,AC3        ;CHECK ANSWERS AGAIN
1928  012550  170000                        CFCC                    ;COPY FLOATING CONDITION CODES
1929  012552  001403                        BEQ     MEND4           ;BRANCH IF OK
1930  012554  174237  002406                STD     AC2,ANS1        ;SAVE FPU ANSWER
1931  012560  104012                        ERROR   12              ;FPU AND FORTRAN DISAGREE
1932
1933  012562  005037  002362        MEND4:  CLR     FPS     ,       ;CLEAR FPP FPS BUFFER
1934
1935
1936
1937                                ;;**************************************************************
1938                                ;*TEST 25       EXERCISE MULF, ALL INTERRUPTS ON, TRUNCATE MODE
1939                                ;;**************************************************************
1940  012566  000004                TST25:  SCOPE
1941  012570  012737  012722  002376        MOV     #MRET5,EXPFEA   ;ADDR OF INSTR BEING TESTED
1942  012576  012737  007440  002400        MOV     #007440,$FPS    ;SET IE BITS IN FORTRAN ANSWER
1943  012604  005037  002402                CLR     $FEC            ;CLR FORTRAN FEC
1944  012610  005037  002404                CLR     $FEA            ;CLR FORTRAN FEA
1945  012614  005037  002362                CLR     FPS             ;CLR FPU FPS BUFFER
1946  012620  005037  002364                CLR     FEC             ;CLR FPU FEC BUFFER
1947  012624  005037  002366                CLR     FEA             ;CLR FPU FEA BUFFER
1948  012630  004737  023342                JSR     PC,RANDL2       ;GET RANDOM INPUT DATA
1949  012634  002426  002436                .WORD   LONUM,HINUM
1950  012640  004437  023506                JSR     R4,$POLSH       ;ENTER POLISH MODE
1951  012644  023510  002426                $PUSH   ,LONUM          ;PUSH 2 WORDS ON STACK (LONUM)
1952  012650  023510  002436                $PUSH   ,HINUM          ;PUSH 2 WORDS ON STACK (HINUM)
1953  012654  025244                        $MUL                    ;ADDRESS OF FORTRAN MULTIPLY
1954  012656  023540  002416                $POPX   ,ANS2           ;POP 2 WORDS AND EXIT POLISH MODE
1955
1956  012662  013700  002400                MOV     $FPS,R0         ;DISPLAY FLOATING POINT STATUS
1957  012666  170127  040000                LDFPS   #040000         ;CLEAR THE FPS, INTERRUPT DISABLE
1958  012672  172437  002426                LDF     LONUM,AC0       ;LOAD AC0 WITH A RANDOM NUMBER
1959  012676  172537  002436                LDF     HINUM,AC1       ;LOAD AC1 WITH A RANDOM NUMBER
1960  012702  172737  002416                LDF     ANS2,AC3        ;LOAD AC3 WITH THE SUM
1961  012706  170127  007440                LDFPS   #007440         ;TURN INTERRUPTS ON
1962  012712  012737  012720  001110        MOV     #.+6,$LPADR     ;RESET LOOP ADDRESS
1963
1964                                        ;**************************************************************
1965
1966  012720  172600                MRET5:  LDF     AC0,AC2         ;LOAD AC0 INTO AC2
1967  012722  171201                        MULF    AC1,AC2         ;MULTIPLY AC1 BY AC2
1968  012724  170237  002362                STFPS   FPS             ;STORE FLOATING POINT STATUS
1969  012730  023737  002362  002400        CMP     FPS,$FPS        ;CHECK FPS
```

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1970  012736  001403                        BEQ     MERR5           ;BRANCH IF OK
1971  012740  174237  002406                STF     AC2,ANS1        ;SAVE FPU ANSWER
1972  012744  104003                        ERROR   3               ;FPS ERROR
1973
1974  012746  005737  002400        MERR5:  TST     $FPS            ;ERROR BIT SET ?
1975  012752  100014                        BPL     MTST5           ;NO, DONT GET FEC/FEA
1976  012754  170337  002364                STST    FEC             ;YES, CHECK STATUS
1977
1978  012760  023737  002364  002402        CMP     FEC,$FEC        ;CHECK THE FLOATING EXCEPTION CODES
1979  012766  001401                        BEQ     1$              ;BRANCH IF OK
1980  012770  104025                        ERROR   25              ;FEC IS WRONG
1981
1982  012772  023737  002366  002404  1$:   CMP     FEA,$FEA        ;CHECK FLOATING PC
1983  013000  001401                        BEQ     MTST5           ;BRANCH IF OK
1984  013002  104025                        ERROR   25              ;WRONG ADDRESS IN FEA
1985
1986  013004  173702                MTST5:  CMPF    AC2,AC3         ;COMPARE FPU ANSWER TO FORTRAN ANSWER
1987  013006  170000                        CFCC                    ;COPY FLOATING CONDITION CODES
1988  013010  001427                        BEQ     MENDS           ;ANSWERS CHECK
1989                                        ;COMPENSATE FOR FORTRAN INACCURACIES.
1990  013012  174237  002406                STF     AC2,ANS1        ;SAVE FPU ANSWER
1991  013016  062737  000001  002410        ADD     #1,ANS1+2       ;INCREMENT FPU ANSWER
1992  013024  005537  002406                ADC     ANS1
1993  013030  173737  002406                CMPF    ANS1,AC3        ;CHECK ANSWERS AGAIN
1994  013034  170000                        CFCC                    ;COPY FLOATING CONDITION CODES
1995  013036  001414                        BEQ     MENDS           ;BRANCH IF OK
1996  013040  162737  000002  002410        SUB     #2,ANS1+2       ;DECREMENT FPU ANSWER
1997  013046  005637  002406                SBC     ANS1
1998  013052  173737  002406                CMPF    ANS1,AC3        ;CHECK ANSWERS AGAIN
1999  013056  170000                        CFCC                    ;COPY FLOATING CONDITION CODES
2000  013060  001403                        BEQ     MENDS           ;BRANCH IF OK
2001  013062  174237  002406                STF     AC2,ANS1        ;SAVE FPU ANSWER
2002  013066  104011                        ERROR   11              ;FPU AND FORTRAN DISAGREE
2003
2004  013070  005037  002362        MENDS:  CLR     FPS             ;CLEAR FPP FPS BUFFER
2005
2006
2007
2008
2009                                        ;;*****************************************************************
2010                                        ;*TEST 26       EXERCISE MULD, ALL INTERRUPTS ON, TRUNCATE MODE
2011                                        ;;*****************************************************************
2012  013074  000004                TST26:  SCOPE
2013  013076  012737  013230  002376        MOV     #MRET6,EXPFEA   ;ADDR OF INSTR BEING TESTED
2014  013104  012737  007640  002400        MOV     #007640,$FPS    ;SET IE BITS IN FORTRAN ANSWER
2015  013112  005037  002402                CLR     $FEC            ;CLR FORTRAN FEC
2016  013116  005037  002404                CLR     $FEA            ;CLR FORTRAN FEA
2017  013122  005037  002362                CLR     FPS             ;CLR FPU FPS BUFFER
2018  013126  005037  002364                CLR     FEC             ;CLR FPU FEC BUFFER
2019  013132  005037  002366                CLR     FEA             ;CLR FPU FEA BUFFER
2020  013136  004737  023332                JSR     PC,RANDL4       ;GET RANDOM INPUT DATA
2021  013142  002426  002436                .WORD   LONUM,HINUM     ;
2022  013146  004437  023506                JSR     R4,$POLSH       ;ENTER POLISH MODE
2023  013152  023510  002426                $PUSH   ,LONUM          ;PUSH 4 WORDS ON STACK (LONUM)
2024  013156  023510  002436                $PUSH   ,HINUM          ;PUSH 4 WORDS ON STACK (HINUM)
2025  013162  025244                        $MUL                    ;ADDRESS OF FORTRAN MULTIPLY
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2026  013164  023540  002416                  SPOPX   ,ANS2           ;POP 4 WORDS AND EXIT POLISH MODE
2027
2028  013170  013700  002400                  MOV     $FPS,R0         ;DISPLAY FLOATING POINT STATUS
2029  013174  170127  040200                  LDFPS   #040200         ;SET FD OF FPS ONLY, INTERRUPT DISABLE
2030  013200  172437  002426                  LDD     LONUM,AC0       ;LOAD AC0 WITH A RANDOM NUMBER
2031  013204  172537  002436                  LDD     HINUM,AC1       ;LOAD AC1 WITH A RANDOM NUMBER
2032  013210  172737  002416                  LDD     ANS2,AC3        ;LOAD AC3 WITH THE SUM
2033  013214  170127  007640                  LDFPS   #007640         ;TURN INTERRUPTS ON
2034  013220  012737  013226  001110          MOV     #.+6,$LPADR     ;RESET LOOP ADDRESS
2035
2036                                          ;*****************************************************************
2037
2038  013226  172600                  MRET6:  LDD     AC0,AC2         ;LOAD AC0 INTO AC2
2039  013230  171201                          MULD    AC1,AC2         ;MULTIPLY AC1 BY AC2
2040  013232  170237  002362                  STFPS   FPS             ;STORE FLOATING POINT STATUS
2041  013236  023737  002362  002400          CMP     FPS,$FPS        ;CHECK FPS
2042  013244  001403                          BEQ     MERR6           ;BRANCH IF OK
2043  013246  174237  002406                  STD     AC2,ANS1        ;SAVE FPU ANSWER
2044  013252  104021                          ERROR   21              ;FPS ERROR
2045
2046  013254  005737  002400          MERR6:  TST     $FPS            ;ERROR BIT SET ?
2047  013260  100014                          BPL     MTST6           ;NO, DONT GET FEC/FEA
2048  013262  170337  002364                  STST    FEC             ;YES, CHECK STATUS
2049
2050  013266  023737  002364  002402          CMP     FEC,$FEC        ;CHECK THE FLOATING EXCEPTION CODES
2051  013274  001401                          BEQ     1$              ;BRANCH IF OK
2052  013276  104031                          ERROR   31              ;FEC IS WRONG
2053
2054  013300  023737  002366  002404  1$:     CMP     FEA,$FEA        ;CHECK FLOATING PC
2055  013306  001401                          BEQ     MTST6           ;BRANCH IF OK
2056  013310  104031                          ERROR   31              ;WRONG ADDRESS IN FEA
2057
2058  013312  173702                  MTST6:  CMPD    AC2,AC3         ;COMPARE FPU ANSWER TO FORTRAN ANSWER
2059  013314  170000                          CFCC                    ;COPY FLOATING CONDITION CODES
2060  013316  001437                          BEQ     MEND6           ;ANSWERS CHECK
2061                                          ;COMPENSATE FOR FORTRAN INACCURACIES.
2062  013320  174237  002406                  STD     AC2,ANS1        ;SAVE FPU ANSWER
2063  013324  062737  000001  002414          ADD     #1,ANS1+6       ;INCREMENT FPU ANSWER
2064  013332  005537  002412                  ADC     ANS1+4
2065  013336  005537  002410                  ADC     ANS1+2
2066  013342  005537  002406                  ADC     ANS1
2067  013346  173737  002406                  CMPD    ANS1,AC3        ;CHECK ANSWERS AGAIN
2068  013352  170000                          CFCC                    ;COPY FLOATING CONDITION CODES
2069  013354  001420                          BEQ     MEND6           ;BRANCH IF OK
2070  013356  162737  000002  002414          SUB     #2,ANS1+6       ;DECREMENT FPU ANSWER
2071  013364  005637  002412                  SBC     ANS1+4
2072  013370  005637  002410                  SBC     ANS1+2
2073  013374  005637  002406                  SBC     ANS1
2074  013400  173737  002406                  CMPD    ANS1,AC3        ;CHECK ANSWERS AGAIN
2075  013404  170000                          CFCC                    ;COPY FLOATING CONDITION CODES
2076  013406  001403                          BEQ     MEND6           ;BRANCH IF OK
2077  013410  174237  002406                  STD     AC2,ANS1        ;SAVE FPU ANSWER
2078  013414  104012                          ERROR   12              ;FPU AND FORTRAN DISAGREE
2079
2080  013416  005037  002362          MEND6:  CLR     FPS             ;CLEAR FPP FPS BUFFER
2081
```

```
2082
2083
2084
2085                                    ;;*****************************************************************
2086                                    ;*TEST 27       EXERCISE MULF, OVERFLOW AND UNDERFLOW INTERRUPTS OFF, TRUNCATE MODE
2087                                    ;;*****************************************************************
2088  013422  000004                    TST27:  SCOPE
2089  013424  012737  013556  002376            MOV     #MRET7,EXPFEA   ;ADDR OF INSTR BEING TESTED
2090  013432  012737  004440  002400            MOV     #004440,$FPS    ;SET IE BITS IN FORTRAN ANSWER
2091  013440  005037  002402                    CLR     $FEC            ;CLR FORTRAN FEC
2092  013444  005037  002404                    CLR     $FEA            ;CLR FORTRAN FEA
2093  013450  005037  002362                    CLR     FPS             ;CLR FPU FPS BUFFER
2094  013454  005037  002364                    CLR     FEC             ;CLR FPU FEC BUFFER
2095  013460  005037  002366                    CLR     FEA             ;CLR FPU FEA BUFFER
2096  013464  004737  023342                    JSR     PC,RANDL2       ;GET RANDOM INPUT DATA
2097  013470  002426  002436                    .WORD   LONUM,HINUM
2098  013474  004437  023506                    JSR     R4,$POLSH       ;ENTER POLISH MODE
2099  013500  023510  002426                    $PUSH   ,LONUM          ;PUSH 2 WORDS ON STACK (LONUM)
2100  013504  023510  002436                    $PUSH   ,HINUM          ;PUSH 2 WORDS ON STACK (HINUM)
2101  013510  025244                            $MUL                    ;ADDRESS OF FORTRAN MULTIPLY
2102  013512  023540  002416                    $POPX   ,ANS2           ;POP 2 WORDS AND EXIT POLISH MODE
2103
2104  013516  013700  002400                    MOV     $FPS,R0         ;DISPLAY FLOATING POINT STATUS
2105  013522  170127  040000                    LDFPS   #040000         ;CLEAR THE FPS, INTERRUPT DISABLE
2106  013526  172437  002426                    LDF     LONUM,AC0       ;LOAD AC0 WITH A RANDOM NUMBER
2107  013532  172537  002436                    LDF     HINUM,AC1       ;LOAD AC1 WITH A RANDOM NUMBER
2108  013536  172737  002416                    LDF     ANS2,AC3        ;LOAD AC3 WITH THE SUM
2109  013542  170127  004440                    LDFPS   #004440         ;TURN INTERRUPTS ON, EXCEPT OVERFLOW AND UNDERFLOW
2110  013546  012737  013554  001110            MOV     #.+6,$LPADR     ;RESET LOOP ADDRESS
2111
2112                                    ;*****************************************************************
2113
2114  013554  172600                    MRET7:  LDF     AC0,AC2         ;LOAD AC0 INTO AC2
2115  013556  171201                            MULF    AC1,AC2         ;MULTIPLY AC1 BY AC2
2116  013560  170237  002362                    STFPS   FPS             ;STORE FLOATING POINT STATUS
2117  013564  023737  002362  002400            CMP     FPS,$FPS        ;CHECK FPS
2118  013572  001403                            BEQ     MTST7           ;BRANCH IF OK
2119  013574  174237  002406                    STF     AC2,ANS1        ;SAVE FPU ANSWER
2120  013600  104003                            ERROR   3               ;FPS ERROR
2121
2122  013602  173702                    MTST7:  CMPF    AC2,AC3         ;COMPARE FPU ANSWER TO FORTRAN ANSWER
2123  013604  170000                            CFCC                    ;COPY FLOATING CONDITION CODES
2124  013606  001427                            BEQ     MEND7           ;ANSWERS CHECK
2125                                            ;COMPENSATE FOR FORTRAN INACCURACIES.
2126  013610  174237  002406                    STF     AC2,ANS1        ;SAVE FPU ANSWER
2127  013614  062737  000001  002410            ADD     #1,ANS1+2       ;INCREMENT FPU ANSWER
2128  013622  005537  002406                    ADC     ANS1
2129  013626  173737  002406                    CMPF    ANS1,AC3        ;CHECK ANSWERS AGAIN
2130  013632  170000                            CFCC                    ;COPY FLOATING CONDITION CODES
2131  013634  001414                            BEQ     MEND7           ;BRANCH IF OK
2132  013636  162737  000002  002410            SUB     #2,ANS1+2       ;DECREMENT FPU ANSWER
2133  013644  005637  002406                    SBC     ANS1
2134  013650  173737  002406                    CMPF    ANS1,AC3        ;CHECK ANSWERS AGAIN
2135  013654  170000                            CFCC                    ;COPY FLOATING CONDITION CODES
2136  013656  001403                            BEQ     MEND7           ;BRANCH IF OK
2137  013660  174237  002406                    STF     AC2,ANS1        ;SAVE FPU ANSWER
```

```
2138  013664  104011                          ERROR   11              ;FPU AND FORTRAN DISAGREE
2139
2140  013666  005037  002362          MEND7:  CLR     FPS             ;CLEAR FPP FPS BUFFER
2141
2142
2143
2144
2145                                  ;;*****************************************************************
2146                                  ;*TEST 30       EXERCISE MULD, OVERFLOW AND UNDERFLOW INTERRUPTS OFF, TRUNCATE MODE
2147                                  ;;*****************************************************************
2148  013672  000004                  TST30:  SCOPE
2149  013674  012737  014026  002376          MOV     #MRET10,EXPFEA  ;ADDR OF INSTR BEING TESTED
2150  013702  012737  004640  002400          MOV     #004640,$FPS    ;SET IE BITS IN FORTRAN ANSWER
2151  013710  005037  002402                  CLR     $FEC            ;CLR FORTRAN FEC
2152  013714  005037  002404                  CLR     $FEA            ;CLR FORTRAN FEA
2153  013720  005037  002362                  CLR     FPS             ;CLR FPU FPS BUFFER
2154  013724  005037  002364                  CLR     FEC             ;CLR FPU FEC BUFFER
2155  013730  005037  002366                  CLR     FEA             ;CLR FPU FEA BUFFER
2156  013734  004737  023332                  JSR     PC,RANDL4       ;GET RANDOM INPUT DATA
2157  013740  002426  002436                  .WORD   LONUM,HINUM     ;
2158  013744  004437  023506                  JSR     R4,$POLSH       ;ENTER POLISH MODE
2159  013750  023510  002426                  $PUSH   ,LONUM          ;PUSH 4 WORDS ON STACK (LONUM)
2160  013754  023510  002436                  $PUSH   ,HINUM          ;PUSH 4 WORDS ON STACK (HINUM)
2161  013760  025244                          $MUL                    ;ADDRESS OF FORTRAN MULTIPLY
2162  013762  023540  002416                  $POPX   ,ANS2           ;POP 4 WORDS AND EXIT POLISH MODE
2163
2164  013766  013700  002400                  MOV     $FPS,R0         ;DISPLAY FLOATING POINT STATUS
2165  013772  170127  040200                  LDFPS   #040200         ;SET FD OF FPS ONLY, INTERRUPT DISABLE
2166  013776  172437  002426                  LDD     LONUM,AC0       ;LOAD AC0 WITH A RANDOM NUMBER
2167  014002  172537  002436                  LDD     HINUM,AC1       ;LOAD AC1 WITH A RANDOM NUMBER
2168  014006  172737  002416                  LDD     ANS2,AC3        ;LOAD AC3 WITH THE SUM
2169  014012  170127  004640                  LDFPS   #004640         ;TURN INTERRUPTS ON, EXCEPT OVER AND UNDERFLOW
2170  014016  012737  014024  001110          MOV     #.+6,$LPADR     ;RESET LOOP ADDRESS
2171
2172                                  ;*****************************************************************
2173
2174  014024  172600                  MRET10: LDD     AC0,AC2         ;LOAD AC0 INTO AC2
2175  014026  171201                          MULD    AC1,AC2         ;MULTIPLY AC1 BY AC2
2176  014030  170237  002362                  STFPS   FPS             ;STORE FLOATING POINT STATUS
2177  014034  023737  002362  002400          CMP     FPS,$FPS        ;CHECK FPS
2178  014042  001403                          BEQ     MTST10          ;BRANCH IF OK
2179  014044  174237  002406                  STD     AC2,ANS1        ;SAVE FPU ANSWER
2180  014050  104021                          ERROR   21              ;FPS ERROR
2181
2182  014052  173702                  MTST10: CMPD    AC2,AC3         ;COMPARE FPU ANSWER TO FORTRAN ANSWER
2183  014054  170000                          CFCC                    ;COPY FLOATING CONDITION CODES
2184  014056  001437                          BEQ     MEND10          ;ANSWERS CHECK
2185                                          ;COMPENSATE FOR FORTRAN INACCURACIES.
2186  014060  174237  002406                  STD     AC2,ANS1        ;SAVE FPU ANSWER
2187  014064  062737  000001  002414          ADD     #1,ANS1+6       ;INCREMENT FPU ANSWER
2188  014072  005537  002412                  ADC     ANS1+4
2189  014076  005537  002410                  ADC     ANS1+2
2190  014102  005537  002406                  ADC     ANS1
2191  014106  173737  002406                  CMPD    ANS1,AC3        ;CHECK ANSWERS AGAIN
2192  014112  170000                          CFCC                    ;COPY FLOATING CONDITION CODES
2193  014114  001420                          BEQ     MEND10          ;BRANCH IF OK
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```
 2194  014116  162737  000002  002414          SUB     #2,ANS1+6       ;DECREMENT FPU ANSWER
 2195  014124  005637  002412                  SBC     ANS1+4
 2196  014130  005637  002410                  SBC     ANS1+2
 2197  014134  005637  002406                  SBC     ANS1
 2198  014140  173737  002406                  CMPD    ANS1,AC3        ;CHECK ANSWERS AGAIN
 2199  014144  170000                          CFCC                    ;COPY FLOATING CONDITION CODES
 2200  014146  001403                          BEQ     MEND10          ;BRANCH IF OK
 2201  014150  174237  002406                  STD     AC2,ANS1        ;SAVE FPU ANSWER
 2202  014154  104012                          ERROR   12              ;FPU AND FORTRAN DISAGREE
 2203
 2204  014156  005037  002362          MEND10: CLR     FPS             ;CLEAR FPP FPS BUFFER
 2205
```

```
                                ;;*****************************************************************
                                ;*TEST 31        EXERCISE DIVF, ALL INTERRUPTS ON, ROUNDING MODE
                                ;;*****************************************************************
014162  000004                  TST31:  SCOPE
014164  012737  014316  002376          MOV     #DRET1,EXPFEA   ;ADDR OF INSTR BEING TESTED
014172  012737  007400  002400          MOV     #007400,$FPS    ;SET IE BITS IN FORTRAN ANSWER
014200  005037  002402                  CLR     $FEC            ;CLR FORTRAN FEC
014204  005037  002404                  CLR     $FEA            ;CLR FORTRAN FEA
014210  005037  002362                  CLR     FPS             ;CLR FPU FPS BUFFER
014214  005037  002364                  CLR     FEC             ;CLR FPU FEC BUFFER
014220  005037  002366                  CLR     FEA             ;CLR FPU FEA BUFFER
014224  004737  023342                  JSR     PC,RANDL2       ;GET RANDOM INPUT DATA
014230  002426  002436                  .WORD   LONUM,HINUM     ;
014234  004437  023506                  JSR     R4,$POLSH       ;ENTER POLISH MODE
014240  023510  002426                  $PUSH   ,LONUM          ;PUSH 2 WORDS ON STACK (LONUM)
014244  023510  002436                  $PUSH   ,HINUM          ;PUSH 2 WORDS ON STACK (HINUM)
014250  026364                          $DIV                    ;ADDRESS OF FORTRAN DIVIDE
014252  023540  002416                  $POPX   ,ANS2           ;POP 2 WORDS AND EXIT POLISH MODE

014256  013700  002400                  MOV     $FPS,R0         ;DISPLAY FLOATING POINT STATUS
014262  170127  040000                  LDFPS   #040000         ;SET INTERRUPT DISABLE
014266  172437  002426                  LDF     LONUM,AC0       ;LOAD AC0 WITH A RANDOM NUMBER
014272  172537  002436                  LDF     HINUM,AC1       ;LOAD AC1 WITH A RANDOM NUMBER
014276  172737  002416                  LDF     ANS2,AC3        ;LOAD AC3 WITH THE SUM
014302  170127  007400                  LDFPS   #007400         ;TURN INTERRUPTS ON
014306  012737  014314  001110          MOV     #.+6,$LPADR     ;RESET LOOP ADDRESS

                                ;*****************************************************************

014314  172600                          LDF     AC0,AC2         ;LOAD AC0 INTO AC2
014316  174601                  DRET1:  DIVF    AC1,AC2         ;DIVIDE AC1 INTO AC2
014320  170237  002362                  STFPS   FPS             ;STORE FLOATING POINT STATUS
014324  023737  002362  002400          CMP     FPS,$FPS        ;CHECK FPS
014332  001403                          BEQ     DERR1           ;BRANCH IF OK
014334  174237  002406                  STF     AC2,ANS1        ;SAVE FPU ANSWER
014340  104016                          ERROR   16              ;FPS ERROR

014342  005737  002400          DERR1:  TST     $FPS            ;ERROR BIT SET ?
014346  100014                          BPL     DTST1           ;NO, DONT GET FEC/FEA
014350  170337  002364                  STST    FEC             ;YES, CHECK STATUS

014354  023737  002364  002402          CMP     FEC,$FEC        ;CHECK THE FLOATING EXCEPTION CODES
014362  001401                          BEQ     1$              ;BRANCH IF OK
014364  104026                          ERROR   26              ;FEC IS WRONG

014366  023737  002366  002404  1$:     CMP     FEA,$FEA        ;CHECK FLOATING PC
014374  001401                          BEQ     DTST1           ;BRANCH IF OK
014376  104026                          ERROR   26              ;WRONG ADDRESS IN FEA

014400  173702                  DTST1:  CMPF    AC2,AC3         ;COMPARE FPU ANSWER TO FORTRAN ANSWER
014402  170000                          CFCC                    ;COPY FLOATING CONDITION CODES
014404  001416                          BEQ     DEND1           ;ANSWERS CHECK
                                        ;COMPENSATE FOR FORTRAN INACCURACIES.
014406  174237  002406                  STF     AC2,ANS1        ;SAVE FPU ANSWER
014412  162737  000001  002410          SUB     #1,ANS1+2       ;DECREMENT FPU ANSWER
014420  005637  002406                  SBC     ANS1
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                                                CMPF    ANS1,AC3        ;CHECK ANSWERS AGAIN
                                                CFCC                    ;COPY FLOATING CONDITION CODES
                                                BEQ     DEND1           ;BRANCH IF OK
                                                STF     AC2,ANS1        ;SAVE FPU ANSWER
                                                ERROR   13              ;FPU AND FORTRAN DISAGREE

                        DEND1:  CLR     FPS             ;CLEAR FPP FPS BUFFER


                        ;;*****************************************************************
                        ;;TEST 32        EXERCISE DIVD, ALL INTERRUPTS ON, ROUNDING MODE
                        ;;*****************************************************************
                        TST32:  SCOPE
                                MOV     #DRET2,EXPFEA   ;ADDR OF INSTR BEING TESTED
                                MOV     #007600,$FPS    ;SET IE BITS IN FORTRAN ANSWER
                                CLR     $FEC            ;CLR FORTRAN FEC
                                CLR     $FEA            ;CLR FORTRAN FEA
                                CLR     FPS             ;CLR FPU FPS BUFFER
                                CLR     FEC             ;CLR FPU FEC BUFFER
                                CLR     FEA             ;CLR FPU FEA BUFFER
                                JSR     PC,RANDL4       ;GET RANDOM INPUT DATA
                                .WORD   LONUM,HINUM     ;
                                JSR     R4,$POLSH       ;ENTER POLISH MODE
                                $PUSH   ,LONUM          ;PUSH 4 WORDS ON STACK (LONUM)
                                $PUSH   ,HINUM          ;PUSH 4 WORDS ON STACK (HINUM)
                                $DIV                    ;ADDRESS OF FORTRAN DIVIDE
                                $POPX   ,ANS2           ;POP 4 WORDS AND EXIT POLISH MODE

                                MOV     $FPS,R0         ;DISPLAY FLOATING POINT STATUS
                                LDFPS   #040200         ;SET FID AND FD
                                LDD     LONUM,AC0       ;LOAD AC0 WITH A RANDOM NUMBER
                                LDD     HINUM,AC1       ;LOAD AC1 WITH A RANDOM NUMBER
                                LDD     ANS2,AC3        ;LOAD AC3 WITH THE SUM
                                LDFPS   #007600         ;TURN INTERRUPTS ON
                                MOV     #.+6,$LPADR     ;RESET LOOP ADDRESS

                                ;*****************************************************************

                                LDD     AC0,AC2         ;LOAD AC0 INTO AC2
                        DRET2:  DIVD    AC1,AC2         ;DIVIDE AC1 INTO AC2
                                STFPS   FPS             ;STORE FLOATING POINT STATUS
                                CMP     FPS,$FPS        ;CHECK FPS
                                BEQ     DERR2           ;BRANCH IF OK
                                STD     AC2,ANS1        ;SAVE FPU ANSWER
                                ERROR   22              ;FPS ERROR

                        DERR2:  TST     $FPS            ;ERROR BIT SET ?
                                BPL     DTST2           ;NO, DONT GET FEC/FEA
                                STST    FEC             ;YES, CHECK STATUS

                                CMP     FEC,$FEC        ;CHECK THE FLOATING EXCEPTION CODES
                                BEQ     1$              ;BRANCH IF OK
                                ERROR   32              ;FEC IS WRONG
```

```
2318  014652  023737  002366  002404  1$:     CMP     FEA,$FEA        ;CHECK FLOATING PC
2319  014660  001401                          BEQ     DTST2           ;BRANCH IF OK
2320  014662  104032                          ERROR   32              ;WRONG ADDRESS IN FEA
2321
2322  014664  173702                  DTST2:  CMPD    AC2,AC3         ;COMPARE FPU ANSWER TO FORTRAN ANSWER
2323  014666  170000                          CFCC                    ;COPY FLOATING CONDITION CODES
2324  014670  001422                          BEQ     DEND2           ;ANSWERS CHECK
2325                                          ;COMPENSATE FOR FORTRAN INACCURACIES.
2326  014672  174237  002406                  STD     AC2,ANS1        ;SAVE FPU ANSWER
2327  014676  162737  000001  002414          SUB     #1,ANS1+6       ;DECREMENT FPU ANSWER
2328  014704  005637  002412                  SBC     ANS1+4
2329  014710  005637  002410                  SBC     ANS1+2
2330  014714  005637  002406                  SBC     ANS1
2331  014720  173737  002406                  CMPD    ANS1,AC3        ;CHECK ANSWERS AGAIN
2332  014724  170000                          CFCC                    ;COPY FLOATING CONDITION CODES
2333  014726  001403                          BEQ     DEND2           ;BRANCH IF OK
2334  014730  174237  002406                  STD     AC2,ANS1        ;SAVE FPU ANSWER
2335  014734  104014                          ERROR   14              ;FPU AND FORTRAN DISAGREE
2336
2337  014736  005037  002362          DEND2:  CLR     FPS             ;CLEAR FPP FPS BUFFER
2338
2339
2340
2341
2342                                  ;;*****************************************************************
2343                                  ;*TEST 33       EXERCISE DIVF, OVERFLOW AND UNDERFLOW INTERRUPTS OFF, ROUNDING MODE
2344                                  ;;*****************************************************************
2345  014742  000004          TST33:  SCOPE
2346  014744  012737  015076  002376          MOV     #DRET3,EXPFEA   ;ADDR OF INSTR BEING TESTED
2347  014752  012737  004400  002400          MOV     #004400,$FPS    ;SET IE BITS IN FORTRAN ANSWER
2348  014760  005037  002402                  CLR     $FEC            ;CLR FORTRAN FEC
2349  014764  005037  002404                  CLR     $FEA            ;CLR FORTRAN FEA
2350  014770  005037  002362                  CLR     FPS             ;CLR FPU FPS BUFFER
2351  014774  005037  002364                  CLR     FEC             ;CLR FPU FEC BUFFER
2352  015000  005037  002366                  CLR     FEA             ;CLR FPU FEA BUFFER
2353  015004  004737  023342                  JSR     PC,RANDL2       ;GET RANDOM INPUT DATA
2354  015010  002426  002436                  .WORD   LONUM,HINUM     ;
2355  015014  004437  023506                  JSR     R4,$POLSH       ;ENTER POLISH MODE
2356  015020  023510  002426                  $PUSH   ,LONUM          ;PUSH 2 WORDS ON STACK (LONUM)
2357  015024  023510  002436                  $PUSH   ,HINUM          ;PUSH 2 WORDS ON STACK (HINUM)
2358  015030  026364                          $DIV                    ;ADDRESS OF FORTRAN DIVIDE
2359  015032  023540  002416                  $POPX   ,ANS2           ;POP 2 WORDS AND EXIT POLISH MODE
2360
2361  015036  013700  002400                  MOV     $FPS,R0         ;DISPLAY FLOATING POINT STATUS
2362  015042  170127  040000                  LDFPS   #040000         ;SET FID
2363  015046  172437  002426                  LDF     LONUM,AC0       ;LOAD AC0 WITH A RANDOM NUMBER
2364  015052  172537  002436                  LDF     HINUM,AC1       ;LOAD AC1 WITH A RANDOM NUMBER
2365  015056  172737  002416                  LDF     ANS2,AC3        ;LOAD AC3 WITH THE SUM
2366  015062  170127  004400                  LDFPS   #004400         ;TURN INTERRUPTS ON, EXCEPT OVERFLOW AND UNDERFLOW
2367  015066  012737  015074  001110          MOV     #.+6,$LPADR     ;RESET LOOP ADDRESS
2368
2369                                          ;*****************************************************************
2370
2371  015074  172600                  DRET3:  LDF     AC0,AC2         ;LOAD AC0 INTO AC2
2372  015076  174601                          DIVF    AC1,AC2         ;DIVIDE AC1 INTO AC2
2373  015100  170237  002362                  STFPS   FPS             ;STORE FLOATING POINT STATUS
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2374  015104  023737  002362  002400          CMP     FPS,$FPS        ;CHECK FPS
2375  015112  001403                          BEQ     DERR3           ;BRANCH IF OK
2376  015114  174237  002406                  STF     AC2,ANS1        ;SAVE FPU ANSWER
2377  015120  104016                          ERROR   16              ;FPS ERROR
2378
2379  015122  005737  002400          DERR3:  TST     $FPS            ;ERROR BIT SET ?
2380  015126  100014                          BPL     DTST3           ;NO, DONT GET FEC/FEA
2381  015130  170337  002364                  STST    FEC             ;YES, CHECK STATUS
2382
2383  015134  023737  002364  002402          CMP     FEC,$FEC        ;CHECK THE FLOATING EXCEPTION CODES
2384  015142  001401                          BEQ     1$              ;BRANCH IF OK
2385  015144  104026                          ERROR   26              ;FEC IS WRONG
2386
2387  015146  023737  002366  002404  1$:     CMP     FEA,$FEA        ;CHECK FLOATING PC
2388  015154  001401                          BEQ     DTST3           ;BRANCH IF OK
2389  015156  104026                          ERROR   26              ;WRONG ADDRESS IN FEA
2390
2391  015160  173702                  DTST3:  CMPF    AC2,AC3         ;COMPARE FPU ANSWER TO FORTRAN ANSWER
2392  015162  170000                          CFCC                    ;COPY FLOATING CONDITION CODES
2393  015164  001416                          BEQ     DEND3           ;ANSWERS CHECK
2394                                          ;COMPENSATE FOR FORTRAN INACCURACIES.
2395  015166  174237  002406                  STF     AC2,ANS1        ;SAVE FPU ANSWER
2396  015172  162737  000001  002410          SUB     #1,ANS1+2       ;DECREMENT FPU ANSWER
2397  015200  005637  002406                  SBC     ANS1
2398  015204  173737  002406                  CMPF    ANS1,AC3        ;CHECK ANSWERS AGAIN
2399  015210  170000                          CFCC                    ;COPY FLOATING CONDITION CODES
2400  015212  001403                          BEQ     DEND3           ;BRANCH IF OK
2401  015214  174237  002406                  STF     AC2,ANS1        ;SAVE FPU ANSWER
2402  015220  104013                          ERROR   13              ;FPU AND FORTRAN DISAGREE
2403
2404  015222  005037  002362          DEND3:  CLR     FPS             ;CLEAR FPP FPS BUFFER
2405
2406
2407
2408
2409                                  ;;*****************************************************************
2410                                  ;*TEST 34       EXERCISE DIVD, OVERFLOW AND UNDERFLOW INTERRUPTS OFF, ROUNDING MODE
2411                                  ;;*****************************************************************
2412  015226  000004                  TST34:  SCOPE
2413  015230  012737  015362  002376          MOV     #DRET4,EXPFEA   ;ADDR OF INSTR BEING TESTED
2414  015236  012737  004600  002400          MOV     #004600,$FPS    ;SET IE BITS IN FORTRAN ANSWER
2415  015244  005037  002402                  CLR     $FEC            ;CLR FORTRAN FEC
2416  015250  005037  002404                  CLR     $FEA            ;CLR FORTRAN FEA
2417  015254  005037  002362                  CLR     FPS             ;CLR FPU FPS BUFFER
2418  015260  005037  002364                  CLR     FEC             ;CLR FPU FEC BUFFER
2419  015264  005037  002366                  CLR     FEA             ;CLR FPU FEA BUFFER
2420  015270  004737  023332                  JSR     PC,RANDL4       ;GET RANDOM INPUT DATA
2421  015274  002426  002436                  .WORD   LONUM,HINUM     ;
2422  015300  004437  023506                  JSR     R4,$POLSH       ;ENTER POLISH MODE
2423  015304  023510  002426                  $PUSH   ,LONUM          ;PUSH 4 WORDS ON STACK (LONUM)
2424  015310  023510  002436                  $PUSH   ,HINUM          ;PUSH 4 WORDS ON STACK (HINUM)
2425  015314  026364                          $DIV                    ;ADDRESS OF FORTRAN DIVIDE
2426  015316  023540  002416                  $POPX   ,ANS2           ;POP 4 WORDS AND EXIT POLISH MODE
2427
2428  015322  013700  002400                  MOV     $FPS,R0         ;DISPLAY FLOATING POINT STATUS
2429  015326  170127  040200                  LDFPS   #040200         ;SET FID AND FD
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2430  015332  172437  002426                  LDD     LONUM,AC0       ;LOAD AC0 WITH A RANDOM NUMBER
2431  015336  172537  002436                  LDD     HINUM,AC1       ;LOAD AC1 WITH A RANDOM NUMBER
2432  015342  172737  002416                  LDD     ANS2,AC3        ;LOAD AC3 WITH THE SUM
2433  015346  170127  004600                  LDFPS   #004600         ;TURN INTERRUPTS ON, EXCEPT OVER AND UNDERFLOW
2434  015352  012737  015360  001110          MOV     #.+6,$LPADR     ;RESET LOOP ADDRESS
2435
2436                                          ;*****************************************************************
2437
2438  015360  172600                  DRET4:  LDD     AC0,AC2         ;LOAD AC0 INTO AC2
2439  015362  174601                          DIVD    AC1,AC2         ;DIVIDE AC1 INTO AC2
2440  015364  170237  002362                  STFPS   FPS             ;STORE FLOATING POINT STATUS
2441  015370  023737  002362  002400          CMP     FPS,$FPS        ;CHECK FPS
2442  015376  001403                          BEQ     DERR4           ;BRANCH IF OK
2443  015400  174237  002406                  STD     AC2,ANS1        ;SAVE FPU ANSWER
2444  015404  104022                          ERROR   22              ;FPS ERROR
2445
2446  015406  005737  002400          DERR4:  TST     $FPS            ;ERROR BIT SET ?
2447  015412  100014                          BPL     DTST4           ;NO, DONT GET FEC/FEA
2448  015414  170337  002364                  STST    FEC             ;YES, CHECK STATUS
2449
2450  015420  023737  002364  002402          CMP     FEC,$FEC        ;CHECK THE FLOATING EXCEPTION CODES
2451  015426  001401                          BEQ     1$              ;BRANCH IF OK
2452  015430  104032                          ERROR   32              ;FEC IS WRONG
2453
2454  015432  023737  002366  002404  1$:     CMP     FEA,$FEA        ;CHECK FLOATING PC
2455  015440  001401                          BEQ     DTST4           ;BRANCH IF OK
2456  015442  104032                          ERROR   32              ;WRONG ADDRESS IN FEA
2457
2458  015444  173702                  DTST4:  CMPD    AC2,AC3         ;COMPARE FPU ANSWER TO FORTRAN ANSWER
2459  015446  170000                          CFCC                    ;COPY FLOATING CONDITION CODES
2460  015450  001422                          BEQ     DEND4           ;ANSWERS CHECK
2461                                          ;COMPENSATE FOR FORTRAN INACCURACIES.
2462  015452  174237  002406                  STD     AC2,ANS1        ;SAVE FPU ANSWER
2463  015456  162737  000001  002414          SUB     #1,ANS1+6       ;DECREMENT FPU ANSWER
2464  015464  005637  002412                  SBC     ANS1+4
2465  015470  005637  002410                  SBC     ANS1+2
2466  015474  005637  002406                  SBC     ANS1
2467  015500  173737  002406                  CMPD    ANS1,AC3        ;CHECK ANSWERS AGAIN
2468  015504  170000                          CFCC                    ;COPY FLOATING CONDITION CODES
2469  015506  001403                          BEQ     DEND4           ;BRANCH IF OK
2470  015510  174237  002406                  STD     AC2,ANS1        ;SAVE FPU ANSWER
2471  015514  104014                          ERROR   14              ;FPU AND FORTRAN DISAGREE
2472
2473  015516  005037  002362          DEND4:  CLR     FPS             ;CLEAR FPP FPS BUFFER
2474
2475
2476
2477
2478                                          ;;*****************************************************************
2479                                          ;*TEST 35        EXERCISE DIVF, ALL INTERRUPTS ON, TRUNCATE MODE
2480                                          ;;*****************************************************************
2481  015522  000004                  TST35:  SCOPE
2482  015524  012737  015656  002376          MOV     #DRET5,EXPFEA   ;ADDR OF INSTR BEING TESTED
2483  015532  012737  007440  002400          MOV     #007440,$FPS    ;SET IE BITS IN FORTRAN ANSWER
2484  015540  005037  002402                  CLR     $FEC            ;CLR FORTRAN FEC
2485  015544  005037  002404                  CLR     $FEA            ;CLR FORTRAN FEA
```

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                                EXERCISE DIVF, ALL INTERRUPTS ON, TRUNCATE MODE

2486  015550  005037  002362          CLR     FPS             ;CLR FPU FPS BUFFER
2487  015554  005037  002364          CLR     FEC             ;CLR FPU FEC BUFFER
2488  015560  005037  002366          CLR     FEA             ;CLR FPU FEA BUFFER
2489  015564  004737  023342          JSR     PC,RANDL2       ;GET RANDOM INPUT DATA
2490  015570  002426  002436          .WORD   LONUM,HINUM     ;
2491  015574  004437  023506          JSR     R4,$POLSH       ;ENTER POLISH MODE
2492  015600  023510  002426          $PUSH   ,LONUM          ;PUSH 2 WORDS ON STACK (LONUM)
2493  015604  023510  002436          $PUSH   ,HINUM          ;PUSH 2 WORDS ON STACK (HINUM)
2494  015610  026364                  $DIV                    ;ADDRESS OF FORTRAN DIVIDE
2495  015612  023540  002416          $POPX   ,ANS2           ;POP 2 WORDS AND EXIT POLISH MODE
2496
2497  015616  013700  002400          MOV     $FPS,R0         ;DISPLAY FLOATING POINT STATUS
2498  015622  170127  040000          LDFPS   #040000         ;SET FID
2499  015626  172437  002426          LDF     LONUM,AC0       ;LOAD AC0 WITH A RANDOM NUMBER
2500  015632  172537  002436          LDF     HINUM,AC1       ;LOAD AC1 WITH A RANDOM NUMBER
2501  015636  172737  002416          LDF     ANS2,AC3        ;LOAD AC3 WITH THE SUM
2502  015642  170127  007440          LDFPS   #007440         ;TURN INTERRUPTS ON
2503  015646  012737  015654  001110  MOV     #.+6,$LPADR     ;RESET LOOP ADDRESS
2504
2505                                  ;*****************************************************************
2506
2507  015654  172600                  LDF     AC0,AC2         ;LOAD AC0 INTO AC2
2508  015656  174601          DRET5:  DIVF    AC1,AC2         ;DIVIDE AC1 INTO AC2
2509  015660  170237  002362          STFPS   FPS             ;STORE FLOATING POINT STATUS
2510  015664  023737  002362  002400  CMP     FPS,$FPS        ;CHECK FPS
2511  015672  001403                  BEQ     DERR5           ;BRANCH IF OK
2512  015674  174237  002406          STF     AC2,ANS1        ;SAVE FPU ANSWER
2513  015700  104016                  ERROR   16              ;FPS ERROR
2514
2515  015702  005737  002400  DERR5:  TST     $FPS            ;ERROR BIT SET ?
2516  015706  100014                  BPL     DTST5           ;NO, DONT GET FEC/FEA
2517  015710  170337  002364          STST    FEC             ;YES, CHECK STATUS
2518
2519  015714  023737  002364  002402  CMP     FEC,$FEC        ;CHECK THE FLOATING EXCEPTION CODES
2520  015722  001401                  BEQ     1$              ;BRANCH IF OK
2521  015724  104026                  ERROR   26              ;FEC IS WRONG
2522
2523  015726  023737  002366  002404  1$:     CMP     FEA,$FEA        ;CHECK FLOATING PC
2524  015734  001401                  BEQ     DTST5           ;BRANCH IF OK
2525  015736  104026                  ERROR   26              ;WRONG ADDRESS IN FEA
2526
2527  015740  173702          DTST5:  CMPF    AC2,AC3         ;COMPARE FPU ANSWER TO FORTRAN ANSWER
2528  015742  170000                  CFCC                    ;COPY FLOATING CONDITION CODES
2529  015744  001427                  BEQ     DEND5           ;ANSWERS CHECK
2530                                  ;COMPENSATE FOR FORTRAN INACCURACIES.
2531  015746  174237  002406          STF     AC2,ANS1        ;SAVE FPU ANSWER
2532  015752  062737  000001  002410  ADD     #1,ANS1+2       ;INCREMENT FPU ANSWER
2533  015760  005537  002406          ADC     ANS1
2534  015764  173737  002406          CMPF    ANS1,AC3        ;CHECK ANSWERS AGAIN
2535  015770  170000                  CFCC                    ;COPY FLOATING CONDITION CODES
2536  015772  001414                  BEQ     DEND5           ;BRANCH IF OK
2537  015774  162737  000002  002410  SUB     #2,ANS1+2       ;DECREMENT FPU ANSWER
2538  016002  005637  002406          SBC     ANS1
2539  016006  173737  002406          CMPF    ANS1,AC3        ;CHECK ANSWERS AGAIN
2540  016012  170000                  CFCC                    ;COPY FLOATING CONDITION CODES
2541  016014  001403                  BEQ     DEND5           ;BRANCH IF OK
```

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2542  016016  174237  002406                  STF     AC2,ANS1        ;SAVE FPU ANSWER
2543  016022  104013                          ERROR   13              ;FPU AND FORTRAN DISAGREE
2544
2545  016024  005037  002362          DEND5:  CLR     FPS             ;CLEAR FPP FPS BUFFER
2546
2547
2548
2549
2550                                  ;;*****************************************************************
2551                                  ;;*TEST 36       EXERCISE DIVD, ALL INTERRUPTS ON, TRUNCATE MODE
2552                                  ;;*****************************************************************
2553  016030  000004                  TST36:  SCOPE
2554  016032  012737  016164  002376          MOV     #DRET6,EXPFCA   ;ADDR OF INSTR BEING TESTED
2555  016040  012737  007640  002400          MOV     #007640,$FPS    ;SET IE BITS IN FORTRAN ANSWER
2556  016046  005037  002402                  CLR     $FEC            ;CLR FORTRAN FEC
2557  016052  005037  002404                  CLR     $FEA            ;CLR FORTRAN FEA
2558  016056  005037  002362                  CLR     FPS             ;CLR FPU FPS BUFFER
2559  016062  005037  002364                  CLR     FEC             ;CLR FPU FEC BUFFER
2560  016066  005037  002366                  CLR     FEA             ;CLR FPU FEA BUFFER
2561  016072  004737  023332                  JSR     PC,RANDL4       ;GET RANDOM INPUT DATA
2562  016076  002426  002436                  .WORD   LONUM,HINUM     ;
2563  016102  004437  023506                  JSR     R4,$POLSH       ;ENTER POLISH MODE
2564  016106  023510  002426                  $PUSH   ,LONUM          ;PUSH 4 WORDS ON STACK (LONUM)
2565  016112  023510  002436                  $PUSH   ,HINUM          ;PUSH 4 WORDS ON STACK (HINUM)
2566  016116  026364                          $DIV                    ;ADDRESS OF FORTRAN DIVIDE
2567  016120  023540  002416                  $POPX   ,ANS2           ;POP 4 WORDS AND EXIT POLISH MODE
2568
2569  016124  013700  002400                  MOV     $FPS,R0         ;DISPLAY FLOATING POINT STATUS
2570  016130  170127  040200                  LDFPS   #040200         ;SET FID AND FD
2571  016134  172437  002426                  LDD     LONUM,AC0       ;LOAD AC0 WITH A RANDOM NUMBER
2572  016140  172537  002436                  LDD     HINUM,AC1       ;LOAD AC1 WITH A RANDOM NUMBER
2573  016144  172737  002416                  LDD     ANS2,AC3        ;LOAD AC3 WITH THE SUM
2574  016150  170127  007640                  LDFPS   #007640         ;TURN INTERRUPTS ON
2575  016154  012737  016162  001110          MOV     #.+6,$LPADR     ;RESET LOOP ADDRESS
2576
2577                                  ;*****************************************************************
2578
2579  016162  172600                  DRET6:  LDD     AC0,AC2         ;LOAD AC0 INTO AC2
2580  016164  174601                          DIVD    AC1,AC2         ;DIVIDE AC1 INTO AC2
2581  016166  170237  002362                  STFPS   FPS             ;STORE FLOATING POINT STATUS
2582  016172  023737  002362  002400          CMP     FPS,$FPS        ;CHECK FPS
2583  016200  001403                          BEQ     DERR6           ;BRANCH IF OK
2584  016202  174237  002406                  STD     AC2,ANS1        ;SAVE FPU ANSWER
2585  016206  104022                          ERROR   22              ;FPS ERROR
2586
2587  016210  005737  002400          DERR6:  TST     $FPS            ;ERROR BIT SET ?
2588  016214  100014                          BPL     DTST6           ;NO, DONT GET FEC/FEA
2589  016216  170337  002364                  STST    FEC             ;YES, CHECK STATUS
2590
2591  016222  023737  002364  002402          CMP     FEC,$FEC        ;CHECK THE FLOATING EXCEPTION CODES
2592  016230  001401                          BEQ     1$              ;BRANCH IF OK
2593  016232  104032                          ERROR   32              ;FEC IS WRONG
2594
2595  016234  023737  002366  002404  1$:     CMP     FEA,$FEA        ;CHECK FLOATING PC
2596  016242  001401                          BEQ     DTST6           ;BRANCH IF OK
2597  016244  104032                          ERROR   32              ;WRONG ADDRESS IN FEA
```

```
                                                DTST6:  CMPD    AC2,AC3         ;COMPARE FPU ANSWER TO FORTRAN ANSWER
016246  173702                                        CFCC                    ;COPY FLOATING CONDITION CODES
016250  170000
016252  001437                                        BEQ     DEND6           ;ANSWERS CHECK
                                                    ;COMPENSATE FOR FORTRAN INACCURACIES.
016254  174237  002406                              STD     AC2,ANS1        ;SAVE FPU ANSWER
016260  062737  000001  002414                      ADD     #1,ANS1+6       ;INCREMENT FPU ANSWER
016266  005537  002412                              ADC     ANS1+4
016272  005537  002410                              ADC     ANS1+2
016276  005537  002406                              ADC     ANS1
016302  173737  002406                              CMPD    ANS1,AC3        ;CHECK ANSWERS AGAIN
016306  170000                                        CFCC                    ;COPY FLOATING CONDITION CODES
016310  001420                                        BEQ     DEND6           ;BRANCH IF OK
016312  162737  000002  002414                      SUB     #2,ANS1+6       ;DECREMENT FPU ANSWER
016320  005637  002412                              SBC     ANS1+4
016324  005637  002410                              SBC     ANS1+2
016330  005637  002406                              SBC     ANS1
016334  173737  002406                              CMPD    ANS1,AC3        ;CHECK ANSWERS AGAIN
016340  170000                                        CFCC                    ;COPY FLOATING CONDITION CODES
016342  001403                                        BEQ     DEND6           ;BRANCH IF OK
016344  174237  002406                              STD     AC2,ANS1        ;SAVE FPU ANSWER
016350  104014                                        ERROR   14              ;FPU AND FORTRAN DISAGREE

016352  005037  002362                      DEND6:  CLR     FPS             ;CLEAR FPP FPS BUFFER
```

```
                                        ;;*****************************************************************
                                        ;*TEST 37       EXERCISE DIVF, OVERFLOW AND UNDERFLOW INTERRUPTS OFF, TRUNCATE MODE
                                        ;;*****************************************************************
016356  000004                          TST37:  SCOPE
016360  012737  016512  002376                  MOV     #DRET7,EXPFEA   ;ADDR OF INSTR BEING TESTED
016366  012737  004440  002400                  MOV     #004440,$FPS    ;SET IE BITS IN FORTRAN ANSWER
016374  005037  002402                          CLR     $FEC            ;CLR FORTRAN FEC
016400  005037  002404                          CLR     $FEA            ;CLR FORTRAN FEA
016404  005037  002362                          CLR     FPS             ;CLR FPU FPS BUFFER
016410  005037  002364                          CLR     FEC             ;CLR FPU FEC BUFFER
016414  005037  002366                          CLR     FEA             ;CLR FPU FEA BUFFER
016420  004737  023342                          JSR     PC,RANDL2       ;GET RANDOM INPUT DATA
016424  002426  002436                          .WORD   LONUM,HINUM     ;
016430  004437  023506                          JSR     R4,$POLSH       ;ENTER POLISH MODE
016434  023610  002426                          $PUSH   ,LONUM          ;PUSH 2 WORDS ON STACK (LONUM)
016440  023610  002436                          $PUSH   ,HINUM          ;PUSH 2 WORDS ON STACK (HINUM)
016444  026364                                  $DIV                    ;ADDRESS OF FORTRAN DIVIDE
016446  023540  002416                          $POPX   ,ANS2           ;POP 2 WORDS AND EXIT POLISH MODE

016452  013700  002400                          MOV     $FPS,R0         ;DISPLAY FLOATING POINT STATUS
016456  170127  040000                          LDFPS   #040000         ;SET FID
016462  172437  002426                          LDF     LONUM,AC0       ;LOAD AC0 WITH A RANDOM NUMBER
016466  172537  002436                          LDF     HINUM,AC1       ;LOAD AC1 WITH A RANDOM NUMBER
016472  172737  002416                          LDF     ANS2,AC3        ;LOAD AC3 WITH THE SUM
016476  170127  004440                          LDFPS   #004440         ;TURN INTERRUPTS ON, EXCEPT OVERFLOW AND UNDERFLOW
016502  012737  016510  001110                  MOV     #.+6,$LPADR     ;RESET LOOP ADDRESS

                                        ;*****************************************************************
```

```
2654
2655  016510  172600                          LDF     AC0,AC2         ;LOAD AC0 INTO AC2
2656  016512  174601                  DRET7:  DIVF    AC1,AC2         ;DIVIDE AC1 INTO AC2
2657  016514  170237  002362                  STFPS   FPS             ;STORE FLOATING POINT STATUS
2658  016520  023737  002362  002400          CMP     FPS,$FPS        ;CHECK FPS
2659  016526  001403                          BEQ     DERR7           ;BRANCH IF OK
2660  016530  174237  002406                  STF     AC2,ANS1        ;SAVE FPU ANSWER
2661  016534  104016                          ERROR   16              ;FPS ERROR
2662
2663  016536  005737  002400          DERR7:  TST     $FPS            ;ERROR BIT SET ?
2664  016542  100014                          BPL     DTST7           ;NO, DONT GET FEC/FEA
2665  016544  170337  002364                  STST    FEC             ;YES, CHECK STATUS
2666
2667  016550  023737  002364  002402          CMP     FEC,$FEC        ;CHECK THE FLOATING EXCEPTION CODES
2668  016556  001401                          BEQ     1$              ;BRANCH IF OK
2669  016560  104026                          ERROR   26              ;FEC IS WRONG
2670
2671  016562  023737  002366  002404  1$:     CMP     FEA,$FEA        ;CHECK FLOATING PC
2672  016570  001401                          BEQ     DTST7           ;BRANCH IF OK
2673  016572  104026                          ERROR   26              ;WRONG ADDRESS IN FEA
2674
2675  016574  173702                  DTST7:  CMPF    AC2,AC3         ;COMPARE FPU ANSWER TO FORTRAN ANSWER
2676  016576  170000                          CFCC                    ;COPY FLOATING CONDITION CODES
2677  016600  001427                          BEQ     DEND7           ;ANSWERS CHECK
2678                                          ;COMPENSATE FOR FORTRAN INACCURACIES.
2679  016602  174237  002406                  STF     AC2,ANS1        ;SAVE FPU ANSWER
2680  016606  062737  000001  002410          ADD     #1,ANS1+2       ;INCREMENT FPU ANSWER
2681  016614  005537  002406                  ADC     ANS1
2682  016620  173737  002406                  CMPF    ANS1,AC3        ;CHECK ANSWERS AGAIN
2683  016624  170000                          CFCC                    ;COPY FLOATING CONDITION CODES
2684  016626  001414                          BEQ     DEND7           ;BRANCH IF OK
2685  016630  162737  000002  002410          SUB     #2,ANS1+2       ;DECREMENT FPU ANSWER
2686  016636  005637  002406                  SBC     ANS1
2687  016642  173737  002406                  CMPF    ANS1,AC3        ;CHECK ANSWERS AGAIN
2688  016646  170000                          CFCC                    ;COPY FLOATING CONDITION CODES
2689  016650  001403                          BEQ     DEND7           ;BRANCH IF OK
2690  016652  174237  002406                  STF     AC2,ANS1        ;SAVE FPU ANSWER
2691  016656  104013                          ERROR   13              ;FPU AND FORTRAN DISAGREE
2692
2693  016660  005037  002362          DEND7:  CLR     FPS             ;CLEAR FPP FPS BUFFER
2694
2695
2696
2697
2698                                          ;;*****************************************************************
2699                                          ;*TEST 40       EXERCISE DIVD, OVERFLOW AND UNDERFLOW INTERRUPTS OFF, TRUNCATE MODE
2700                                          ;;*****************************************************************
2701  016664  000004                  TST40:  SCOPE
2702  016666  012737  017020  002376          MOV     #DRET10,EXPFEA  ;ADDR OF INSTR BEING TESTED
2703  016674  012737  004640  002400          MOV     #004640,$FPS    ;SET IE BITS IN FORTRAN ANSWER
2704  016702  005037  002402                  CLR     $FEC            ;CLR FORTRAN FEC
2705  016706  005037  002404                  CLR     $FEA            ;CLR FORTRAN FEA
2706  016712  005037  002362                  CLR     FPS             ;CLR FPU FPS BUFFER
2707  016716  005037  002364                  CLR     FEC             ;CLR FPU FEC BUFFER
2708  016722  005037  002366                  CLR     FEA             ;CLR FPU FEA BUFFER
2709  016726  004737  023332                  JSR     PC,RANDL4       ;GET RANDOM INPUT DATA
```

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2710  016732  002426  002436                  .WORD   LONUM,HINUM
2711  016736  004437  023506                  JSR     R4,$POLSH       ;ENTER POLISH MODE
2712  016742  023510  002426                  $PUSH   ,LONUM          ;PUSH 4 WORDS ON STACK (LONUM)
2713  016746  023510  002436                  $PUSH   ,HINUM          ;PUSH 4 WORDS ON STACK (HINUM)
2714  016752  026364                          $DIV                    ;ADDRESS OF FORTRAN DIVIDE
2715  016754  023540  002416                  $POPX   ,ANS2           ;POP 4 WORDS AND EXIT POLISH MODE
2716
2717  016760  013700  002400                  MOV     $FPS,R0         ;DISPLAY FLOATING POINT STATUS
2718  016764  170127  040200                  LDFPS   #040200         ;SET FID AND FD
2719  016770  172437  002426                  LDD     LONUM,AC0       ;LOAD AC0 WITH A RANDOM NUMBER
2720  016774  172537  002436                  LDD     HINUM,AC1       ;LOAD AC1 WITH A RANDOM NUMBER
2721  017000  172737  002416                  LDD     ANS2,AC3        ;LOAD AC3 WITH THE SUM
2722  017004  170127  004640                  LDFPS   #004640         ;TURN INTERRUPTS ON, EXCEPT OVER AND UNDERFLOW
2723  017010  012737  017016  001110          MOV     #.+6,$LPADR     ;RESET LOOP ADDRESS
2724
2725                                          ;*****************************************************************
2726
2727  017016  172600                  DRET10: LDD     AC0,AC2         ;LOAD AC0 INTO AC2
2728  017020  174601                          DIVD    AC1,AC2         ;DIVIDE AC1 INTO AC2
2729  017022  170237  002362                  STFPS   FPS             ;STORE FLOATING POINT STATUS
2730  017026  023737  002362  002400          CMP     FPS,$FPS        ;CHECK FPS
2731  017034  001403                          BEQ     DERR10          ;BRANCH IF OK
2732  017036  174237  002406                  STD     AC2,ANS1        ;SAVE FPU ANSWER
2733  017042  104022                          ERROR   22              ;FPS ERROR
2734
2735  017044  005737  002400          DERR10: TST     $FPS            ;ERROR BIT SET ?
2736  017050  100014                          BPL     DTST10          ;NO, DONT GET FEC/FEA
2737  017052  170337  002364                  STST    FEC             ;YES, CHECK STATUS
2738
2739  017056  023737  002364  002402          CMP     FEC,$FEC        ;CHECK THE FLOATING EXCEPTION CODES
2740  017064  001401                          BEQ     1$              ;BRANCH IF OK
2741  017066  104032                          ERROR   32              ;FEC IS WRONG
2742
2743  017070  023737  002366  002404  1$:     CMP     FEA,$FEA        ;CHECK FLOATING PC
2744  017076  001443                          BEQ     DEND10          ;BRANCH IF OK
2745  017100  104032                          ERROR   32              ;WRONG ADDRESS IN FEA
2746
2747  017102  173702                  DTST10: CMPD    AC2,AC3         ;COMPARE FPU ANSWER TO FORTRAN ANSWER
2748  017104  170000                          CFCC                    ;COPY FLOATING CONDITION CODES
2749  017106  001437                          BEQ     DEND10          ;ANSWERS CHECK
2750                                          ;COMPENSATE FOR FORTRAN INACCURACIES.
2751  017110  174237  002406                  STD     AC2,ANS1        ;SAVE FPU ANSWER
2752  017114  062737  000001  002414          ADD     #1,ANS1+6       ;INCREMENT FPU ANSWER
2753  017122  005537  002412                  ADC     ANS1+4
2754  017126  005537  002410                  ADC     ANS1+2
2755  017132  005537  002406                  ADC     ANS1
2756  017136  173737  002406                  CMPD    ANS1,AC3        ;CHECK ANSWERS AGAIN
2757  017142  170000                          CFCC                    ;COPY FLOATING CONDITION CODES
2758  017144  001420                          BEQ     DEND10          ;BRANCH IF OK
2759  017146  162737  000002  002414          SUB     #2,ANS1+6       ;DECREMENT FPU ANSWER
2760  017154  005637  002412                  SBC     ANS1+4
2761  017160  005637  002410                  SBC     ANS1+2
2762  017164  005637  002406                  SBC     ANS1
2763  017170  173737  002406                  CMPD    ANS1,AC3        ;CHECK ANSWERS AGAIN
2764  017174  170000                          CFCC                    ;COPY FLOATING CONDITION CODES
2765  017176  001403                          BEQ     DEND10          ;BRANCH IF OK
```

```
2766  017200  174237  002406                  STD     AC2,ANS1        ;SAVE FPU ANSWER
2767  017204  104014                          ERROR   14              ;FPU AND FORTRAN DISAGREE
2768
2769  017206  005037  002362          DEND10. CLR     FPS             ;CLEAR FPP FPS BUFFER
2770
2771
2772
2773
2774                                  ;;*****************************************************************
2775                                  ;*TEST 41        EXERCISE DIVF, INTERRUPT DISABLE SET, ROUNDING MODE
2776                                  ;;*****************************************************************
2777  017212  000004                  TST41:  SCOPE
2778  017214  012737  017346  002376          MOV     #DRET11,EXPFEA  ;ADDR OF INSTR BEING TESTED
2779  017222  012737  047400  002400          MOV     #047400,$FPS    ;SET IE BITS IN FORTRAN ANSWER
2780  017230  005037  002402                  CLR     $FEC            ;CLR FORTRAN FEC
2781  017234  005037  002404                  CLR     $FEA            ;CLR FORTRAN FEA
2782  017240  005037  002362                  CLR     FPS             ;CLR FPU FPS BUFFER
2783  017244  005037  002364                  CLR     FEC             ;CLR FPU FEC BUFFER
2784  017250  005037  002366                  CLR     FEA             ;CLR FPU FEA BUFFER
2785  017254  004737  023342                  JSR     PC,RANDL2       ;GET RANDOM INPUT DATA
2786  017260  002426  002436                  .WORD   LONUM,HINUM     ;
2787  017264  004437  023506                  JSR     R4,$POLSH       ;ENTER POLISH MODE
2788  017270  023510  002426                  $PUSH   ,LONUM          ;PUSH 2 WORDS ON STACK (LONUM)
2789  017274  023510  002436                  $PUSH   ,HINUM          ;PUSH 2 WORDS ON STACK (HINUM)
2790  017300  026364                          $DIV                    ;ADDRESS OF FORTRAN DIVIDE
2791  017302  023540  002416                  $POPX   ,ANS2           ;POP 2 WORDS AND EXIT POLISH MODE
2792
2793  017306  013700  002400                  MOV     $FPS,R0         ;DISPLAY FLOATING POINT STATUS
2794  017312  170127  040000                  LDFPS   #040000         ;SET FID
2795  017316  172437  002426                  LDF     LONUM,AC0       ;LOAD AC0 WITH A RANDOM NUMBER
2796  017322  172537  002436                  LDF     HINUM,AC1       ;LOAD AC1 WITH A RANDOM NUMBER
2797  017326  172737  002416                  LDF     ANS2,AC3        ;LOAD AC3 WITH THE SUM
2798  017332  170127  047400                  LDFPS   #047400         ;SET INTERRUPT DISABLE AND INTERRUPT BITS
2799  017336  012737  017344  001110          MOV     #.+6,$LPADR     ;RESET LOOP ADDRESS
2800
2801                                  ;*****************************************************************
2802
2803  017344  172600                  DRET11: LDF     AC0,AC2         ;LOAD AC0 INTO AC2
2804  017346  174601                          DIVF    AC1,AC2         ;DIVIDE AC1 INTO AC2
2805  017350  170237  002362                  STFPS   FPS             ;STORE FLOATING POINT STATUS
2806  017354  023737  002362  002400          CMP     FPS,$FPS        ;CHECK FPS
2807  017362  001403                          BEQ     DERR11          ;BRANCH IF OK
2808  017364  174237  002406                  STF     AC2,ANS1        ;SAVE FPU ANSWER
2809  017370  104016                          ERROR   16              ;FPS ERROR
2810
2811  017372  005737  002400          DERR11: TST     $FPS            ;ERROR BIT SET ?
2812  017376  100014                          BPL     DTST11          ;NO, DONT GET FEC/FEA
2813  017400  170337  002364                  STST    FEC             ;YES, CHECK STATUS
2814
2815  017404  023737  002364  002402          CMP     FEC,$FEC        ;CHECK THE FLOATING EXCEPTION CODES
2816  017412  001401                          BEQ     1$              ;BRANCH IF OK
2817  017414  104026                          ERROR   26              ;FEC IS WRONG
2818
2819  017416  023737  002366  002404  1$:     CMP     FEA,$FEA        ;CHECK FLOATING PC
2820  017424  001401                          BEQ     DTST11          ;BRANCH IF OK
2821  017426  104026                          ERROR   26              ;WRONG ADDRESS IN FEA
```

```
                                                ;
017430  173702                  DTST11: CMPF    AC2,AC3         ;COMPARE FPU ANSWER TO FORTRAN ANSWER
017432  170000                          CFCC                    ;COPY FLOATING CONDITION CODES
017434  001416                          BEQ     DEND11          ;ANSWERS CHECK
                                        ;COMPENSATE FOR FORTRAN INACCURACIES.
017436  174237  002406                  STF     AC2,ANS1        ;SAVE FPU ANSWER
017442  162737  000001  002410          SUB     #1,ANS1+2       ;DECREMENT FPU ANSWER
017450  005637  002406                  SBC     ANS1
017454  173737  002406                  CMPF    ANS1,AC3        ;CHECK ANSWERS AGAIN
017460  170000                          CFCC                    ;COPY FLOATING CONDITION CODES
017462  001403                          BEQ     DEND11          ;BRANCH IF OK
017464  174237  002406                  STF     AC2,ANS1        ;SAVE FPU ANSWER
017470  104013                          ERROR   13              ;FPU AND FORTRAN DISAGREE
                                                ;
017472  005037  002362          DEND11: CLR     FPS             ;CLEAR FPP FPS BUFFER
                                                ;
                                                ;
                                                ;;*****************************************************************
                                                ;*TEST 42        EXERCISE DIVD, INTERRUPT DISABLE SET, ROUNDING MODE
                                                ;;*****************************************************************
017476  000004                  TST42:  SCOPE
017500  012737  017632  002376              MOV     #DRET12,EXPFEA  ;ADDR OF INSTR BEING TESTED
017506  012737  047600  002400              MOV     #047600,$FPS    ;SET FID AND IE BITS IN FORTRAN ANSWER
017514  005037  002402                      CLR     $FEC            ;CLR FORTRAN FEC
017520  005037  002404                      CLR     $FEA            ;CLR FORTRAN FEA
017524  005037  002362                      CLR     FPS             ;CLR FPU FPS BUFFER
017530  005037  002364                      CLR     FEC             ;CLR FPU FEC BUFFER
017534  005037  002366                      CLR     FEA             ;CLR FPU FEA BUFFER
017540  004737  023332                      JSR     PC,RANDL4       ;GET RANDOM INPUT DATA
017544  002426  002436                      .WORD   LONUM,HINUM     ;
017550  004437  023506                      JSR     R4,$POLSH       ;ENTER POLISH MODE
017554  023510  002426                      $PUSH   ,LONUM          ;PUSH 4 WORDS ON STACK (LONUM)
017560  023510  002436                      $PUSH   ,HINUM          ;PUSH 4 WORDS ON STACK (HINUM)
017564  026364                              $DIV                    ;ADDRESS OF FORTRAN DIVIDE
017566  023540  002416                      $POPX   ,ANS2           ;POP 4 WORDS AND EXIT POLISH MODE
                                                ;
017572  013700  002400                      MOV     $FPS,R0         ;DISPLAY FLOATING POINT STATUS
017576  170127  040200                      LDFPS   #040200         ;SET FID AND FD
017602  172437  002426                      LDD     LONUM,AC0       ;LOAD AC0 WITH A RANDOM NUMBER
017606  172537  002436                      LDD     HINUM,AC1       ;LOAD AC1 WITH A RANDOM NUMBER
017612  172737  002416                      LDD     ANS2,AC3        ;LOAD AC3 WITH THE SUM
017616  170127  047600                      LDFPS   #047600         ;SET INTERRUPT DISABLE AND INTERRUPT BITS
017622  012737  017630  001110              MOV     #.+6,$LPADR     ;RESET LOOP ADDRESS
                                                ;
                                                ;**************************************************************
                                                ;
017630  172600                  DRET12: LDD     AC0,AC2         ;LOAD AC0 INTO AC2
017632  174601                          DIVD    AC1,AC2         ;DIVIDE AC1 INTO AC2
017634  170237  002362                  STFPS   FPS             ;STORE FLOATING POINT STATUS
017640  023737  002362  002400          CMP     FPS,$FPS        ;CHECK FPS
017646  001403                          BEQ     DERR12          ;BRANCH IF OK
017650  174237  002406                  STD     AC2,ANS1        ;SAVE FPU ANSWER
017654  104022                          ERROR   22              ;FPS ERROR
                                                ;
017656  005737  002400          DERR12: TST     $FPS            ;ERROR BIT SET ?
```

```
2878  017662  100014                          BPL     DTST12          ;NO, DONT GET FEC/FEA
2879  017664  170337  002364                  STST    FEC             ;YES, CHECK STATUS
2880
2881  017670  023737  002364  002402          CMP     FEC,$FEC        ;CHECK THE FLOATING EXCEPTION CODES
2882  017676  001401                          BEQ     1$              ;BRANCH IF OK
2883  017700  104032                          ERROR   32              ;FEC IS WRONG
2884
2885  017702  023737  002366  002404  1$:     CMP     FEA,$FEA        ;CHECK FLOATING PC
2886  017710  001401                          BEQ     DTST12          ;BRANCH IF OK
2887  017712  104032                          ERROR   32              ;WRONG ADDRESS IN FEA
2888
2889  017714  173702                  DTST12: CMPD    AC2,AC3         ;COMPARE FPU ANSWER TO FORTRAN ANSWER
2890  017716  170000                          CFCC                    ;COPY FLOATING CONDITION CODES
2891  017720  001422                          BEQ     DEND12          ;ANSWERS CHECK
2892                                          ;COMPENSATE FOR FORTRAN INACCURACIES.
2893  017722  174237  002406                  STD     AC2,ANS1        ;SAVE FPU ANSWER
2894  017726  162737  000001  002414          SUB     #1,ANS1+6       ;DECREMENT FPU ANSWER
2895  017734  005637  002412                  SBC     ANS1+4
2896  017740  005637  002410                  SBC     ANS1+2
2897  017744  005637  002406                  SBC     ANS1
2898  017750  173737  002406                  CMPD    ANS1,AC3        ;CHECK ANSWERS AGAIN
2899  017754  170000                          CFCC                    ;COPY FLOATING CONDITION CODES
2900  017756  001403                          BEQ     DEND12          ;BRANCH IF OK
2901  017760  174237  002406                  STD     AC2,ANS1        ;SAVE FPU ANSWER
2902  017764  104014                          ERROR   14              ;FPU AND FORTRAN DISAGREE
2903
2904  017766  005037  002362          DEND12: CLR     FPS             ;CLEAR FPP FPS BUFFER
2905
2906
2907
2908
2909                                  ;;*****************************************************************
2910                                  ;*TEST 43       EXERCISE DIVF, INTERRUPT DISABLE SET, TRUNCATE MODE
2911                                  ;;*****************************************************************
2912  017772  000004                  TST43:  SCOPE
2913  017774  012737  020126  002376          MOV     #DRET13,EXPFEA  ;ADDR OF INSTR BEING TESTED
2914  020002  012737  047440  002400          MOV     #047440,$FPS    ;SET FID AND IE BITS IN FORTRAN ANSWER
2915  020010  005037  002402                  CLR     $FEC            ;CLR FORTRAN FEC
2916  020014  005037  002404                  CLR     $FEA            ;CLR FORTRAN FEA
2917  020020  005037  002362                  CLR     FPS             ;CLR FPU FPS BUFFER
2918  020024  005037  002364                  CLR     FEC             ;CLR FPU FEC BUFFER
2919  020030  005037  002366                  CLR     FEA             ;CLR FPU FEA BUFFER
2920  020034  004737  023342                  JSR     PC,RANDL2       ;GET RANDOM INPUT DATA
2921  020040  002426  002436                  .WORD   LONUM,HINUM     ;
2922  020044  004437  023506                  JSR     R4,$POLSH       ;ENTER POLISH MODE
2923  020050  023510  002426                  $PUSH   ,LONUM          ;PUSH 2 WORDS ON STACK (LONUM)
2924  020054  023510  002436                  $PUSH   ,HINUM          ;PUSH 2 WORDS ON STACK (HINUM)
2925  020060  026364                          $DIV                    ;ADDRESS OF FORTRAN DIVIDE
2926  020062  023540  002416                  $POPX   ,ANS2           ;POP 2 WORDS AND EXIT POLISH MODE
2927
2928  020066  013700  002400                  MOV     $FPS,R0         ;DISPLAY FLOATING POINT STATUS
2929  020072  170127  040000                  LDFPS   #040000         ;SET FID
2930  020076  172437  002426                  LDF     LONUM,AC0       ;LOAD AC0 WITH A RANDOM NUMBER
2931  020102  172537  002436                  LDF     HINUM,AC1       ;LOAD AC1 WITH A RANDOM NUMBER
2932  020106  172737  002416                  LDF     ANS2,AC3        ;LOAD AC3 WITH THE SUM
2933  020112  170127  047440                  LDFPS   #047440         ;SET INTERRUPT DISABLE AND INTERRUPT BITS
```

```
2934  020116  012737  020124  001110          MOV     #.+6,$LPADR     ;RESET LOOP ADDRESS
2935
2936                                          ;*****************************************************************
2937
2938  020124  172600                          LDF     AC0,AC2         ;LOAD AC0 INTO AC2
2939  020126  174601                  DRET13: DIVF    AC1,AC2         ;DIVIDE AC1 INTO AC2
2940  020130  170237  002362                  STFPS   FPS             ;STORE FLOATING POINT STATUS
2941  020134  023737  002362  002400          CMP     FPS,$FPS        ;CHECK FPS
2942  020142  001403                          BEQ     DERR13          ;BRANCH IF OK
2943  020144  174237  002406                  STF     AC2,ANS1        ;SAVE FPU ANSWER
2944  020150  104016                          ERROR   16              ;FPS ERROR
2945
2946  020152  005737  002400          DERR13: TST     $FPS            ;ERROR BIT SET ?
2947  020156  100014                          BPL     DTST13          ;NO, DONT GET FEC/FEA
2948  020160  170337  002364                  STST    FEC             ;YES, CHECK STATUS
2949
2950  020164  023737  002364  002402          CMP     FEC,$FEC        ;CHECK THE FLOATING EXCEPTION CODES
2951  020172  001401                          BEQ     1$              ;BRANCH IF OK
2952  020174  104026                          ERROR   26              ;FEC IS WRONG
2953
2954  020176  023737  002366  002404  1$:     CMP     FEA,$FEA        ;CHECK FLOATING PC
2955  020204  001401                          BEQ     DTST13          ;BRANCH IF OK
2956  020206  104026                          ERROR   26              ;WRONG ADDRESS IN FEA
2957
2958  020210  173702                  DTST13: CMPF    AC2,AC3         ;COMPARE FPU ANSWER TO FORTRAN ANSWER
2959  020212  170000                          CFCC                    ;COPY FLOATING CONDITION CODES
2960  020214  001427                          BEQ     DEND13          ;ANSWERS CHECK
2961                                          ;COMPENSATE FOR FORTRAN INACCURACIES.
2962  020216  174237  002406                  STF     AC2,ANS1        ;SAVE FPU ANSWER
2963  020222  062737  000001  002410          ADD     #1,ANS1+2       ;INCREMENT FPU ANSWER
2964  020230  005537  002406                  ADC     ANS1
2965  020234  173737  002406                  CMPF    ANS1,AC3        ;CHECK ANSWERS AGAIN
2966  020240  170000                          CFCC                    ;COPY FLOATING CONDITION CODES
2967  020242  001414                          BEQ     DEND13          ;BRANCH IF OK
2968  020244  162737  000002  002410          SUB     #2,ANS1+2       ;DECREMENT FPU ANSWER
2969  020252  005637  002406                  SBC     ANS1
2970  020256  173737  002406                  CMPF    ANS1,AC3        ;CHECK ANSWERS AGAIN
2971  020262  170000                          CFCC                    ;COPY FLOATING CONDITION CODES
2972  020264  001403                          BEQ     DEND13          ;BRANCH IF OK
2973  020266  174237  002406                  STF     AC2,ANS1        ;SAVE FPU ANSWER
2974  020272  104013                          ERROR   13              ;FPU AND FORTRAN DISAGREE
2975
2976  020274  005037  002362          DEND13: CLR     FPS             ;CLEAR FPP FPS BUFFER
2977
2978
2979
2980                                          ;;*****************************************************************
2981                                          ;*TEST 44        EXERCISE DIVD, INTERRUPT DISABLE SET, TRUNCATE MODE
2982                                          ;;*****************************************************************
2983  020300  000004                  $ST44:  SCOPE
2984  020302  012737  020434  002376          MOV     #DRET14,EXPFEA  ;ADDR OF INSTR BEING TESTED
2985  020310  012737  047640  002400          MOV     #047640,$FPS    ;SET FID AND IE BITS IN FORTRAN ANSWER
2986  020316  005037  002402                  CLR     $FEC            ;CLR FORTRAN FEC
2987  020322  005037  002404                  CLR     $FEA            ;CLR FORTRAN FEA
2988  020326  005037  002362                  CLR     FPS             ;CLR FPU FPS BUFFER
2989  020332  005037  002364                  CLR     FEC             ;CLR FPU FEC BUFFER
```

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2990  020336  005037  002366                  CLR     FEA             ;CLR FPU FEA BUFFER
2991  020342  004737  023332                  JSR     PC,RANDL4       ;GET RANDOM INPUT DATA
2992  020346  012426  002436                  .WORD   LONUM,HINUM
2993  020352  004437  023506                  JSR     R4,$POLSH       ;ENTER POLISH MODE
2994  020356  023510  002426                  $PUSH   ,LONUM          ;PUSH 4 WORDS ON STACK (LONUM)
2995  020362  023510  002436                  $PUSH   ,HINUM          ;PUSH 4 WORDS ON STACK (HINUM)
2996  020366  026364                          $DIV                    ;ADDRESS OF FORTRAN DIVIDE
2997  020370  023540  002416                  $POPX   ,ANS2           ;POP 4 WORDS AND EXIT POLISH MODE
2998
2999  020374  013700  002400                  MOV     $FPS,R0         ;DISPLAY FLOATING POINT STATUS
3000  020400  170127  040200                  LDFPS   #040200         ;SET FID AND FD
3001  020404  172437  002426                  LDD     LONUM,AC0       ;LOAD AC0 WITH A RANDOM NUMBER
3002  020410  172537  002436                  LDD     HINUM,AC1       ;LOAD AC1 WITH A RANDOM NUMBER
3003  020414  172737  002416                  LDD     ANS2,AC3        ;LOAD AC3 WITH THE SUM
3004  020420  170127  047640                  LDFPS   #047640         ;SET INTERRUPT DISABLE AND INTERRUPT BITS
3005  020424  012737  020432  001110          MOV     #.+6,$LPADR     ;RESET LOOP ADDRESS
3006
3007                                          ;*****************************************************************
3008
3009  020432  172600                  DRET14: LDD     AC0,AC2         ;LOAD AC0 INTO AC2
3010  020434  174601                          DIVD    AC1,AC2         ;DIVIDE AC1 INTO AC2
3011  020436  170237  002362                  STFPS   FPS             ;STORE FLOATING POINT STATUS
3012  020442  023737  002362  002400          CMP     FPS,$FPS        ;CHECK FPS
3013  020450  001403                          BEQ     DERR14          ;BRANCH IF OK
3014  020452  174237  002406                  STD     AC2,ANS1        ;SAVE FPU ANSWER
3015  020456  104022                          ERROR   22              ;FPS ERROR
3016
3017  020460  005737  002400          DERR14: TST     $FPS            ;ERROR BIT SET ?
3018  020464  100014                          BPL     DTST14          ;NO, DONT GET FEC/FEA
3019  020466  170337  002364                  STST    FEC             ;YES, CHECK STATUS
3020
3021  020472  023737  002364  002402          CMP     FEC,$FEC        ;CHECK THE FLOATING EXCEPTION CODES
3022  020500  001401                          BEQ     1$              ;BRANCH IF OK
3023  020502  104032                          ERROR   32              ;FEC IS WRONG
3024
3025  020504  023737  002366  002404  1$:     CMP     FEA,$FEA        ;CHECK FLOATING PC
3026  020512  001401                          BEQ     DTST14          ;BRANCH IF OK
3027  020514  104032                          ERROR   32              ;WRONG ADDRESS IN FEA
3028
3029  020516  173702                  DTST14: CMPD    AC2,AC3         ;COMPARE FPU ANSWER TO FORTRAN ANSWER
3030  020520  170000                          CFCC                    ;COPY FLOATING CONDITION CODES
3031  020522  001437                          BEQ     DEND14          ;ANSWERS CHECK
3032                                          ;COMPENSATE FOR FORTRAN INACCURACIES.
3033  020524  174237  002406                  STD     AC2,ANS1        ;SAVE FPU ANSWER
3034  020530  062737  000001  002414          ADD     #1,ANS1+6       ;INCREMENT FPU ANSWER
3035  020536  005537  002412                  ADC     ANS1+4
3036  020542  005537  002410                  ADC     ANS1+2
3037  020546  005537  002406                  ADC     ANS1
3038  020552  173737  002406                  CMPD    ANS1,AC3        ;CHECK ANSWERS AGAIN
3039  020556  170000                          CFCC                    ;COPY FLOATING CONDITION CODES
3040  020560  001420                          BEQ     DEND14          ;BRANCH IF OK
3041  020562  162737  000002  002414          SUB     #2,ANS1+6       ;DECREMENT FPU ANSWER
3042  020570  005637  002412                  SBC     ANS1+4
3043  020574  005637  002410                  SBC     ANS1+2
3044  020600  005637  002406                  SBC     ANS1
3045  020604  173737  002406                  CMPD    ANS1,AC3        ;CHECK ANSWERS AGAIN
```

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3046  020610  170000                        CFCC                    ;COPY FLOATING CONDITION CODES
3047  020612  001403                        BEQ     DEND14          ;BRANCH IF OK
3048  020614  174237  002406                STD     AC2,ANS1        ;SAVE FPU ANSWER
3049  020620  104014                        ERROR   14              ;FPU AND FORTRAN DISAGREE
3050
3051  020622  005027  002362        DEND14: CLR     FPS             ;CLEAR FPP FPS BUFFER
```

```
3052                                    ;;*****************************************************************
3053                                    ;*TEST 45       ADDF, SUBF, MULF, DIVF EXERCISER
3054                                    ;;*****************************************************************
3055  020626  000004                    TST45:  SCOPE
3056                                            ;*UNDERFLOW, OVERFLOW INTERRUPTS OFF; TRUNCATE MODE
3057
3058  020630  012737  000440  002400            MOV     #440,$FPS       ;SOFTWARE STATUS
3059  020636  005037  002402                    CLR     $FEC            ;CLEAR STATUS
3060  020642  005037  002404                    CLR     $FEA            ;
3061  020646  005037  002362                    CLR     FPS             ;
3062  020652  005037  002364                    CLR     FEC             ;
3063  020656  005037  002366                    CLR     FEA             ;
3064
3065  020662  004737  023342                    JSR     PC,RANDL2       ;GET 6 FLOAT RANDOM NUMBERS
3066  020666  002446  002476                    .WORD   OP1,OP4         ;
3067  020672  004737  023342                    JSR     PC,RANDL2       ;
3068  020676  002456  002506                    .WORD   OP2,OP5         ;
3069  020702  004737  023342            1$:     JSR     PC,RANDL2       ;
3070  020706  002466  002516                    .WORD   OP3,OP6         ;
3071  020712  032737  077600  002516            BIT     #077600,OP6     ;LET'S NEVER DIVIDE BY ZERO
3072  020720  001770                    BEQ     1$              ;EXPO OF OP6 IS ZERO, SO GET ANOTHER
3073
3074  020722  004437  023506                    JSR     R4,$POLSH       ;ENTER POLISH MODE TO CALCULATE:
3075  020726  023510  002446                    $PUSH   ,OP1            ;
3076  020732  023510  002456                    $PUSH   ,OP2            ;
3077  020736  023562                    $SUB                    ;   ANS2 = (OP1-OP2) * (OP3+OP4/OP6) * OP5
3078  020740  023510  002466                    $PUSH   ,OP3            ;
3079  020744  023510  002476                    $PUSH   ,OP4            ;
3080  020750  023510  002516                    $PUSH   ,OP6            ;
3081  020754  026364                    $DIV                    ;
3082  020756  023566                    $ADD                    ;
3083  020760  025244                    $MUL                    ;
3084  020762  023510  002506                    $PUSH   ,OP5            ;
3085  020766  025244                    $MUL                    ;
3086  020770  023540  002416                    $POPX   ,ANS2           ;
3087
3088  020774  170127  040000                    LDFPS   #040000         ;NO CHECKS
3089  021000  172437  002416                    LDF     ANS2,AC0        ;GET SOFTWARE ANSWER
3090  021004  013700  002400                    MOV     $FPS,R0         ;DISPLAY $FPS
3091  021010  012737  021016  001110            MOV     #.+6,$LPADR     ;RESET LOOP ADDRESS
3092
3093                                    ;;*****************************************************************
3094
3095  021016  170127  000440                    LDFPS   #000440         ;INITIAL FPS
3096  021022  172537  002446                    LDF     OP1,AC1         ;AC1 <- OP1
3097  021026  173137  002456                    SUBF    OP2,AC1         ;AC1 <- OP1-OP2
3098  021032  172637  002476                    LDF     OP4,AC2         ;AC2 <- OP4
3099  021036  174637  002516                    DIVF    OP6,AC2         ;AC2 <- OP4/OP6
3100  021042  172237  002466                    ADDF    OP3,AC2         ;AC2 <- OP3+OP4/OP6
3101  021046  171102                    MULF    AC2,AC1         ;AC1 <- (OP1-OP2)*(OP3+OP4/OP6)
3102  021050  171137  002506                    MULF    OP5,AC1         ;AC1 <- (OP1-OP2)*(OP3+OP4/OP6)*OP5
3103
3104  021054  170237  002362                    STFPS   FPS             ;STORE STATUS AFTERWARD
3105  021060  023737  002362  002400            CMP     FPS,$FPS        ;CHECK STATUS
3106  021066  001403                    BEQ     ETST1           ;BRANCH IF OK
3107  021070  174137  002406                    STF     AC1,ANS1        ;SAVE FPU ANSWER
```

```
3108  021074  104033                          ERROR   33              ;FPS ERROR
3109
3110  021076  173401                  ETST1:  CMPF    AC1,AC0         ;ANSWER OK ? (FPU:SOFTWARE)
3111  021100  170000                          CFCC                    ;COPY CC-S
3112  021102  001436                          BEQ     EEND1           ;ANSWER CHECKS
3113
3114                                          ;COMPENSATE IN LOB FOR INACCURACIES
3115  021104  174137  002406                  STF     AC1,ANS1        ;FPU ANSWER
3116
3117  021110  163737  002420  002410          SUB     ANS2+2,ANS1+2   ;GET (SOFT-ANS) - (FPU-ANS)
3118  021116  005637  002406                  SBC     ANS1+0          ;
3119  021122  163737  002416  002406          SUB     ANS2+0,ANS1+0   ;
3120  021130  100011                          BPL     10$             ;ALWAYS MAKE +
3121  021132  005137  002410                  COM     ANS1+2          ;
3122  021136  005137  002406                  COM     ANS1+0          ;
3123  021142  062737  000001  002410          ADD     #1,ANS1+2       ;
3124  021150  005537  002406                  ADC     ANS1+0          ;
3125
3126  021154  005737  002406          10$:    TST     ANS1+0          ;
3127  021160  001004                          BNE     EERR1           ;IF NONZERO IN 16 HOB, SIGN/EXP/FRAC DIFFERS
3128
3129  021162  023727  002410  000006          CMP     ANS1+2,#6       ;ALLOW +/- 6 IN LSB OF FRAC
3130  021170  003403                          BLE     EEND1           ;BR IF OK
3131
3132  021172  174137  002406          EERR1:  STF     AC1,ANS1        ;FPU ANSWER
3133  021176  104035                          ERROR   35              ;ANSWERS DON'T CHECK
3134
3135  021200  005037  002362          EEND1:  CLR     FPS             ;CLEAR BUFFER
3136
3137
3138
3139
3140                                          ;;*****************************************************************
3141                                          ;*TEST 46       ADDD, SUBD, MULD, DIVD EXERCISER
3142                                          ;;*****************************************************************
3143  021204  000004                  TST46:  SCOPE
3144                                          ;*UNDERFLOW, OVERFLOW INTERRUPTS OFF; ROUND MODE
3145
3146  021206  012737  000600  002400          MOV     #600,$FPS       ;SOFTWARE STATUS
3147  021214  005037  002402                  CLR     $FEC            ;CLEAR STATUS
3148  021220  005037  002404                  CLR     $FEA            ;
3149  021224  005037  002362                  CLR     FPS             ;
3150  021230  005037  002364                  CLR     FEC             ;
3151  021234  005037  002366                  CLR     FEA             ;
3152
3153  021240  004737  023332                  JSR     PC,RANDL4       ;GET 6 DOUBLE FLOAT RANDOM NUMBERS
3154  021244  002446  002476                  .WORD   OP1,OP4         ;
3155  021250  004737  023332                  JSR     PC,RANDL4       ;
3156  021254  002466  002456                  .WORD   OP3,OP2         ;
3157  021260  004737  023332          1$:     JSR     PC,RANDL4       ;
3158  021264  002506  002516                  .WORD   OP5,OP6         ;
3159  021270  032737  077600  002506          BIT     #077600,OP5     ;LET'S NEVER DIVIDE BY ZERO
3160  021276  001770                          BEQ     1$              ;OP5 IS ZERO, TRY AGAIN
3161  021300  032737  077600  002516          BIT     #077600,OP6     ;
3162  021306  001764                          BEQ     1$              ;OP6 IS ZERO, TRY AGAIN
3163
```

```
3164  021310  004437  023506                  JSR     R4,$POLSH       ;ENTER POLISH MODE TO CALCULATE:
3165  021314  023510  002446                  $PUSH   ,OP1            ;
3166  021320  023510  002466                  $PUSH   ,OP3            ;          /OP1+OP3\   /OP2-OP4\
3167  021324  026566                          $ADD                    ;  ANS2 = I-------I * I-------I
3168  021326  023510  002506                  $PUSH   ,OP5            ;          \  OP5  /   \  OP6  /
3169  021332  026364                          $DIV                    ;
3170  021334  023510  002456                  $PUSH   ,OP2            ;
3171  021340  023510  002476                  $PUSH   ,OP4            ;
3172  021344  026562                          $SUB                    ;
3173  021346  023510  002516                  $PUSH   ,OP6            ;
3174  021352  026364                          $DIV                    ;
3175  021354  025244                          $MUL                    ;
3176  021356  023540  002416                  $POPX   ,ANS2           ;
3177
3178  021362  170127  040200                  LDFPS   #040200         ;NO CHECKS
3179  021366  172437  002416                  LDD     ANS2,AC0        ;GET SOFTWARE ANSWER
3180  021372  013700  002400                  MOV     $FPS,R0         ;DISPLAY $FPS
3181  021376  012737  021404  001110          MOV     #.+6,$LPADR     ;RESET LOOP ADDRESS
3182
3183                          ;;**************************************************************
3184
3185  021404  170127  000600                  LDFPS   #000600         ;INITIAL FPS
3186  021410  172537  002446                  LDD     OP1,AC1         ;AC1 <- OP1
3187  021414  172137  002466                  ADDD    OP3,AC1         ;AC1 <- OP1+OP3
3188  021420  174537  002506                  DIVD    OP5,AC1         ;AC1 <- (OP1+OP3)/OP5
3189  021424  172637  002456                  LDD     OP2,AC2         ;AC2 <- OP2
3190  021430  173237  002476                  SUBD    OP4,AC2         ;AC2 <- OP2-OP4
3191  021434  174637  002516                  DIVD    OP6,AC2         ;AC2 <- (OP2-OP4)/OP6
3192  021440  171102                          MULD    AC2,AC1         ;AC1 <- (OP1+OP3)/OP5*(OP2-OP4)/OP6
3193
3194  021442  170237  002362                  STFPS   FPS             ;STORE STATUS AFTERWARD
3195  021446  023737  002362  002400          CMP     FPS,$FPS        ;CHECK STATUS
3196  021454  001403                          BEQ     ETST2           ;BRANCH IF OK
3197  021456  174137  002406                  STD     AC1,ANS1        ;SAVE FPU ANSWER
3198  021462  104034                          ERROR   34              ;FPS ERROR
3199
3200  021464  173401          ETST2:  CMPD    AC1,AC0         ;ANSWER OK ? (FPU:SOFTWARE)
3201  021466  170000                  CFCC                    ;COPY CC-S
3202  021470  001474                  BEQ     EEND2           ;ANSWER CHECKS
3203
3204                                  ;COMPENSATE IN LOB FOR INACCURACIES
3205  021472  174137  002406                  STD     AC1,ANS1        ;FPU ANSWER
3206
3207  021476  163737  002424  002414            JB      ANS2+6,ANS1+6   ;GET (SOFT-ANS) - (FPU-ANS)
3208  021504  005637  002412                  SBC     ANS1+4          ;
3209  021510  005637  002410                  SBC     ANS1+2          ;
3210  021514  005637  002406                  SBC     ANS1+0          ;
3211  021520  163737  002422  002412          SUB     ANS2+4,ANS1+4   ;
3212  021526  005637  002410                  SBC     ANS1+2          ;
3213  021532  005637  002406                  SBC     ANS1+0          ;
3214  021536  163737  002420  002410          SUB     ANS2+2,ANS1+2   ;
3215  021544  005637  002406                  SBC     ANS1+0          ;
3216  021550  163737  002416  002406          SUB     ANS2+0,ANS1+0   ;
3217  021556  100021                          BPL     10$             ;ALWAYS MAKE +
3218  021560  005137  002414                  COM     ANS1+6          ;
3219  021564  005137  002412                  COM     ANS1+4          ;
```

```
3220  021570  005137  002410           COM     ANS1+2          ;
3221  021574  005137  002406           COM     ANS1+0          ;
3222  021600  062737  000001  002414   ADD     #1,ANS1+6       ;
3223  021606  005537  002412           ADC     ANS1+4          ;
3224  021612  005537  002410           ADC     ANS1+2          ;
3225  021616  005537  002406           ADC     ANS1+0          ;
3226
3227  021622  005737  002406   10$:    TST     ANS1+0          ;
3228  021626  001012                   BNE     EERR2           ;IF NONZERO IN 16 MOB, SIGN/EXP/FRAC DIFFERS
3229  021630  005737  002410           TST     ANS1+2          ;
3230  021634  001007                   BNE     EERR2           ;IF NONZERO IN 16 M-MOB, FRAC-B DIFFERS
3231  021636  005737  002412           TST     ANS1+4          ;
3232  021642  001004                   BNE     EERR2           ;IF NONZERO IN 16 L-MOB, FRAC-C DIFFERS
3233
3234  021644  023727  002414  000005   CMP     ANS1+6,#5       ;ALLOW +/- 5 IN LSB OF FRAC
3235  021652  003403                   BLE     EEND2           ;BR IF OK
3236
3237  021654  174137  002406   EERR2:  STD     AC1,ANS1        ;FPU ANSWER
3238  021660  104036                   ERROR   36              ;ANSWERS DON'T CHECK
3239
3240  021662  005037  002362   EEND2:  CLR     FPS             ;CLEAR BUFFER
```

```
                                ;;*****************************************************************
                                .SBTTL  SUB PASS END CONTROL

                                        SCOPE           ;CHECK FOR TEST ITERATIONS HERE
021666  000004                        CLR     $TIMES          ;DONT ITERATE THIS "TEST"
021670  005037  001166                CLR     $ERFLG          ;NO ERRORS HERE
021674  005037  001104                CLR     $TSTNM          ;ZAP TEST # WHEN DONE WITH A PASS
021700  005037  001102

                                        ;IF TEST ONLY EITHER HFP OR WFP, ENTER "EOP" ROUTINE DIRECTLY

                                        ; IF IN ALTERNATE HFP/WFP MODE,
                                        ;   COMPLEMENT FLAG(5), HFP ENABLE BIT,
                                        ;   ENTER EOP ROUTINE ONLY IF ABOUT TO TEST HFP NEXT,
                                        ;       TESTING SEQUENCE IS:  PASS#1  HFP SUB-PASS
                                        ;                             PASS#1  WFP SUB-PASS
                                        ;                             PASS#2  HFP SUB-PASS
                                        ;                               ...

021704  076600  000022                MFD     @WHOAMI         ;GET WHOAMI INTO R0
021710  032700  000020                BIT     #BIT04,R0       ;1=HFP PRESENT, 0=NONE
021714  001423                        BEQ     $EOP            ;EXIT IF NONE

021716  032777  000002  157220        BIT     #SW01,@SWR      ;1=HFP OR WFP TEST ONLY
021724  001017                        BNE     $EOP            ;0=ALTERNATE HFP AND WFP TESTS

021726  012701  010000                MOV     #BIT12,R1       ;HFP PRESENT, AND IN ALTERNATE MODE;
021732  076600  000144                MFD     @FLAG           ;SO READ FLAGS,
021736  030100                        BIT     R1,R0           ;COMPLEMENT FLAG(5)=BIT12=HFP ENABLE FLAG
021740  001402                        BEQ     1$              ;
021742  040100                        BIC     R1,R0           ;CLEAR BIT 12
021744  000401                        BR      2$              ;
021746  050100                1$:     BIS     R1,R0           ;SET BIT 12
021750  076600  000344        2$:     MFD     @WFLAG          ;REWRITE FLAGS

021754  030100                        BIT     R1,R0           ;HFP OR WFP NEXT ?
021756  001002                        BNE     $EOP            ;IF HFP AGAIN, START NEW PASS
021760  000137  003516                JMP     @#SUBPAS        ;IF WFP, NEXT SUBPASS


                                ;;*****************************************************************

                                .SBTTL  END OF PASS ROUTINE (MODIFIED SYSMAC)

                                ;*INCREMENT THE PASS NUMBER ($PASS)
                                ;*LOOP FOR 256. SUBPASSES TO MAKE A PASS
                                ;*IF SW(10)=0, DING BELL ON PASS END
                                ;*IF SW(12)=0, TYPE STATISTICS ON PASS END
                                ;*IF THERE'S A MONITOR, GO TO IT
                                ;*  ELSE JUMP TO NEWPAS

021764                          $EOP:                   ;
021764  005037  001104                CLR     $ERFLG          ;ZERO ERROR FLAG
021770  005037  001102                CLR     $TSTNM          ;ZERO TEST NUMBER
021774  005037  001166                CLR     $TIMES          ;ZERO NUMBER OF ITERATIONS

022000  005327                        DEC     (PC)+           ;SUBPASS LOOP ?
```

```
3297  022002  000400                 10$:    .WORD   256.            ;USE 256. SUBPASSES PER LOOP
3298  022004  003402                         BLE     11$             ;NO, GO BUMP PASS COUNTER
3299  022006  000137  003516                 JMP     @#SUBPAS        ;NEXT SUB PASS
3300  022012  012737                 11$:    MOV     (PC)+,@(PC)+    ;RESTORE COUNTER
3301  022014  000400                         .WORD   256.
3302  022016  022002                         .WORD   10$             ;
3303
3304  022020  005237  001210                 INC     $PASS           ;INCREMENT PASS COUNT,
3305  022024  042737  100000  001210         BIC     #100000,$PASS   ;  BUT NEVER LET IN GO NEGATIVE
3306  022032  005327                         DEC     (PC)+           ;PASS LOOP ?
3307  022034  000001                 $EOPCT: .WORD   1               ;FALL THRU
3308  022036  003027                         BGT     $DOAGN          ;YES
3309  022040  012737                         MOV     (PC)+,@(PC)+    ;RESTORE COUNTER
3310  022042  000001                 $ENDCT: .WORD   1
3311  022044  022034                         .WORD   $EOPCT          ;
3312
3313  022046  032777  002000  157070         BIT     #SW10,@SWR      ;BELL ON PASS END ?
3314  022054  001002                         BNE     1$              ;NO
3315  022056  104401  001172                 TYPE    ,$BELL          ;YES
3316
3317  022062  032777  010000  157054 1$:     BIT     #SW12,@SWR      ;INHIBIT MESSAGE ?
3318  022070  001002                         BNE     $GET42          ;YES
3319  022072  004737  022122                 JSR     PC,STATS        ;TYPE STATISTICS
3320
3321  022076  013700  000042         $GET42: MOV     @#42,R0         ;GET MONITOR ADDRESS
3322  022102  001405                         BEQ     $DOAGN          ;NO MONITOR
3323  022104  000005                         RESET                   ;CLEAR WORLD
3324  022106  004710                 $ENDAD: JSR     PC,(R0)         ;GO TO MONITOR
3325  022110  000240                         NOP
3326  022112  000240                         NOP                     ;RESERVED FOR ACT11
3327  022114  000240                         NOP                     ;
3328
3329  022116  000137  003450         $DOAGN: JMP     @#NEWPAS        ;RETURN
```

```
3330                                            .SBTTL  STATISTICS TYPEOUT SUBROUTINE
3331
3332                                            ;*THIS ROUTINE TYPES OUT A NICELY FORMATTED REPORT
3333                                            ;*CONTAINING STATISTICS ON THE NUMBER OF OPERANDS
3334                                            ;*USED IN DIFFERENT SELECT CASES FOR THE $ADD, $SUB,
3335                                            ;*$MUL, AND $DIV ROUTINES.  THE DATA VALUES ARE TAKEN
3336                                            ;*FROM THE COUNTERS ADDC', MULC', AND DIVC'.
3337                                            ;*
3338                                            ;*CALLED BY:    JSR     PC,STATS
3339                                            ;*
3340  022122  010046                STATS:    MOV     R0,-(SP)        ;SAVE REGISTERS
3341
3342  022124  012700  022230                  MOV     #SVEC1,R0       ;FIRST DATA LINE ADDR VECTOR
3343  022130  001404                          BEQ     1$              ;NONE IF ZERO
3344  022132  104401  022317                  TYPE    ,SHDR1          ;HEADER
3345  022136  004737  022202                  JSR     PC,10$          ;DATA LINE
3346  022142  012700  022254          1$:     MOV     #SVEC2,R0       ;SECOND DATA LINE ADDR VECTOR
3347  022146  001404                          BEQ     2$              ;NONE IF ZERO
3348  022150  104401  022664                  TYPE    ,SHDR2          ;HEADER
3349  022154  004737  022202                  JSR     PC,10$          ;DATA LINE
3350  022160  012700  022272          2$:     MOV     #SVEC3,R0       ;THIRD DATA LINE ADDR VECTOR
3351  022164  001404                          BEQ     3$              ;NONE IF ZERO
3352  022166  104401  023055                  TYPE    ,SHDR3          ;HEADER
3353  022172  004737  022202                  JSR     PC,10$          ;DATA LINE
3354
3355  022176  012600                3$:     MOV     (SP)+,R0        ;RESTORE REGISTERS
3356  022200  000207                          RTS     PC              ;EXIT
3357
3358                                            ;*INTERNAL SUBR FOR DATA LINE TYPEOUT
3359  022202  013046                10$:     MOV     @(R0)+,-(SP)    ;MOVE NUMBER ON STACK, BUMP TO NEXT
3360  022204  104403                          TYPOS                   ;TYPE OCTAL
3361  022206     006                          .BYTE   6               ;MAX 6 DIGITS
3362  022207     000                          .BYTE   0               ;SUPPRESS LEADING ZEROS
3363  022210  005710                          TST     (R0)            ;BUMPED TO LAST VECTOR ?
3364  022212  001403                          BEQ     11$             ;YES, ONTO NEXT LINE
3365  022214  104401  022312                  TYPE    ,SHT            ;TYPE A <HT>
3366  022220  000770                          BR      10$             ;CONTINUE WITH THIS LINE
3367  022222  104401  022314          11$:    TYPE    ,SCRLF          ;TYPE A <CR><LF>
3368  022226  000207                          RTS     PC              ;DONE
3369
3370
3371                                            ;*DATA VECTORS:
3372  022230  002526  002540  002542  SVEC1:  .WORD   ADDC0,ADDC5,ADDC6,ADDC7,ADDC8,ADDC1,ADDC2,ADDC3,ADDC4,0
3373  022246  002544  002546  002530
3374  022254  002532  002534  002536
3375  022262  000000
3376  022264  002550  002554  002556  SVEC2:  .WORD   MULC0,MULC2,MULC3,MULC4,MULC5,MULC1,0
3377  022272  002560  002562  002552
3378  022300  000000
3379  022306  002564  002572  002574  SVEC3:  .WORD   DIVC0,DIVC3,DIVC4,DIVC5,DIVC6,DIVC1,DIVC2,0
3380  022314  002576  002600  002566
3381  022320  002570  000000
3382
3383                                            ;*HEADERS, ETC:
3384  022326  000011                SHT:    .ASCIZ  <11>            ;<HT>
3385  022330  005015     000        SCRLF:  .ASCIZ  <15><12>        ;<CR><LF>
```

```
3386  022317  000015  005012
3387  022322  005052  020052  052123
3388  022330  052101  051511  044524
3389  022336  051503  025040  025052
3390  022344  005015  000012
3391  022347  000050  047516  042524          .ASCII  "(NOTE - ALL NUMBERS ARE UNSIGNED OCTAL INTEGERS)"<15><12><12>
3392  022354  026440  040440  046114
3393  022362  047040  046525  042502
3394  022370  051522  040440  042522
3395  022376  052440  051516  043511
3396  022404  042516  020104  041517
3397  022412  040524  020114  047111
3398  022420  042524  042507  051522
3399  022426  006451  000012
3400  022432  042101  027504  052523          .ASCII  "ADD/SUB INSTRUCTIONS:"<15><12>
3401  022440  020102  047111  052123
3402  022446  052522  052103  047511
3403  022454  051516  006472  000012
3404  022461  000124  052117  046101          .ASCII  "TOTAL  ---OVERFLOW---  --UNDERFLOW---  OP A=0  OP A#0  OP A=0     NO"<1
                                                                                                  5><12>
3405  022466  026411  026455  053117
3406  022474  051105  046106  053517
3407  022502  026455  004455  026455
3408  022510  047125  042504  043122
3409  022516  047514  026527  026455
3410  022524  047411  020120  036501
3411  022532  004460  050117  040440
3412  022540  030043  047411  020120
3413  022546  036501  004460  020040
3414  022554  047040  006517  000012
3415  022561  000116  046525  042502          .ASCIZ  "NUMBER TOTAL W/ENABLE  TOTAL W/ENABLE  OP B#0  OP B=C  OP B=0  SHIFT"<
                                                                                                  15><12>
3416  022566  004522  047524  040524
3417  022574  020114  027527  047105
3418  022602  041101  042514  052011
3419  022610  052117  046101  053440
3420  022616  042457  040516  046102
3421  022624  004505  050117  041040
3422  022632  030043  047411  020120
3423  022640  036502  004460  050117
3424  022646  041040  030075  020011
3425  022654  044123  043111  006524
3426  022662  000012
3427  022664  005015  052515  052114  SHOR2:  .ASCII  <15><12>"MULTIPLY INSTRUCTIONS:"<15><12>
3428  022672  050111  054514  044440
3429  022700  051516  051124  041525
3430  022706  044524  047117  035123
3431  022714  005015
3432  022716  047524  040524  004514          .ASCII  "TOTAL  ---OVERFLOW---  --UNDERFLOW---  A=0 AND/OR"<15><12>
3433  022724  026455  047455  042526
3434  022732  043122  047514  026527
3435  022740  026455  026411  052455
3436  022746  042116  051105  046106
3437  022754  053517  026455  004455
3438  022762  036501  020060  047101
3439  022770  027504  051117  005015
```

```
3440  022776  052516  041115  051105          .ASCIZ  "NUMBER TOTAL W/ENABLE  TOTAL W/ENABLE      B=0"<15><12>
3441  023004  052011  052117  046101
3442  023012  053440  042457  040516
3443  023020  046132  004505  047524
3444  023026  040524  020114  027527
3445  023034  047105  041101  042514
3446  023042  020011  020040  041040
3447  023050  030075  005015      000
3448  023055     015  042012  053111  SHOR3:  .ASCII  <15><12>"DIVIDE INSTRUCTIONS:"<15><12>
3449  023062  042111  020105  047111
3450  023070  052123  052522  052103
3451  023076  047511  051516  006472
3452  023104     012
3453  023105     124  052117  046101          .ASCII  "TOTAL  ---OVERFLOW---  --UNDERFLOW---   NUMER   DENOM"<15><12>
3454  023112  026411  026455  053117
3455  023120  051105  046106  053517
3456  023126  026455  004455  026455
3457  023134  047125  042504  043122
3458  023142  047514  026527  026455
3459  023150  020011  052516  042515
3460  023156  004522  042040  047105
3461  023164  046517  005015
3462  023170  052516  041115  051105          .ASCIZ  "NUMBER TOTAL W/ENABLE  TOTAL W/ENABLE      A=0     B=0"<15><12>
3463  023176  052011  052117  046101
3464  023204  053440  042457  040516
3465  023212  046102  004505  047524
3466  023220  040524  020114  027527
3467  023226  047105  041101  042514
3468  023234  020011  020040  036501
3469  023242  004460  020040  041040
3470  023250  030075  005015      000
3471          023256                  EVEN            ;BACK TO AN EVEN BOUNDARY
```

```
3472                                        .SBTTL  FPP TRAP CATCHER
3473
3474  023256  012637  002370        FPPILT: MOV     (SP)+,FPPOPC    ;POP OLD PC FOR DISPLAY
3475  023262  012637  002372                MOV     (SP)+,FPPOPS    ;POP OLD PS FOR DISPLAY
3476  023266  170237  002362                STFPS   FPS             ;GET FPS
3477  023272  170337  002364                STST    FEC             ;GET FEC/FEA
3478  023276  005737  002362                TST     FPS             ;TEST ERROR BIT
3479  023302  100005                        BPL     1$              ;OFF - NO ERROR BIT SET, BUT TRAPPED
3480                                                                ;ON  - IT SHOULD BE ON A TRAP
3481  023304  032737  040000  002362        BIT     #040000,FPS     ;TEST INTERRUPT ENABLE BIT
3482  023312  001001                        BNE     1$              ;ON  - INTR DISABLED, BUT TRAPPED
3483                                                                ;OFF - ABLE TO INTR, SO IGNORE IT,
3484  023314  000401                        BR      2$              ;       AND SKIP THE ERROR
3485  023316  104015                1$:     ERROR   15              ;SIGNAL UNEXPECTED FPP TRAP
3486  023320  013746  002372        2$:     MOV     FPPOPS,-(SP)    ;PUSH PSW
3487  023324  013746  002370                MOV     FPPOPC,-(SP)    ;PUSH PC
3488  023330  000002                        RTI                     ;CONTINUE,  RECOVER AT LAST TRAP ONLY
3489
```

```
                                        .SBTTL  RANDOM NUMBER GENERATOR

                                        ;*CALLED BY     JSR  PC,RANDL4  -  FOR DOUBLE FLOAT NUMBERS
                                        ;*              .WORD   N1,N2   -   IN LOCATIONS N1 AND N2
                                        ;*
                                        ;*              JSR  PC,RANDL2  -  FOR SINGLE FLOAT NUMBERS
                                        ;*              .WORD   N1,N2   -   IN LOCATIONS N1 AND N2
                                        ;*
023332  010546          RANDL4: MOV     R5,-(SP)        ;SAVE R5
023334  012705  000004          MOV     #4,R5           ;4 WORDS AT EACH
023340  000403                  BR      RAND            ;
023342  010546          RANDL2: MOV     R5,-(SP)        ;SAVE R5
023344  012705  000002          MOV     #2,R5           ;2 WORDS AT EACH
023350  010446          RAND:   MOV     R4,-(SP)        ;SAVE REGISTERS
023352  010346                  MOV     R3,-(SP)        ;
023354  010246                  MOV     R2,-(SP)        ;
023356  010146                  MOV     R1,-(SP)        ;
023360  010046                  MOV     R0,-(SP)        ;
023362  005046                  CLR     -(SP)           ;EXTRA REGISTER
023364  016600  000016          MOV     16(SP),R0       ;GET PC FOR RETURN
023370  012003                  MOV     (R0)+,R3        ;FIRST NUMBER DEST PTR
023372  012004                  MOV     (R0)+,R4        ;SECOND NUMBER DEST PTR
023374  010066  000016          MOV     R0,16(SP)       ;STORE NEW RETURN ADDRESS
023400  011300                  MOV     (R3),R0         ;R0 INITIAL NUMBER
023402  011401                  MOV     (R4),R1         ;R1 INITIAL NUMBER
023404  012702  000007  1$:     MOV     #7,R2           ;SHIFT COUNT
023410  005016                  CLR     (SP)            ;CLEAR LOB
023412  006300          2$:     ASL     R0              ;SHIFT R0 LEFT
023414  006101                  ROL     R1              ;  AND ROTATE CARRY INTO R1
023416  006116                  ROL     (SP)            ;  AND ROTATE CARRY INTO EXT
023420  077204                  SOB     R2,2$           ;7 SHIFTS
023422  061316                  ADD     (R3),(SP)       ;ADD # TO MAKE # 129
023424  005501                  ADC     R1              ;PROPOGATE CARRY
023426  061401                  ADD     (R4),R1         ;ADD # TO MAKE # 129
023430  005516                  ADC     (SP)            ;PROPOGATE CARRY
023432  062700  001057          ADD     #001057,R0      ;ADD LOW CONSTANT
023436  005501                  ADC     R1              ;PROPOGATE CARRY
023440  005516                  ADC     (SP)            ;PROPOGATE CARRY
023442  062701  047401          ADD     #047401,R1      ;ADD HIGH CONSTANT
023446  005516                  ADC     (SP)            ;PROPOGATE CARRY
023450  062716  000006          ADD     #000006,(SP)    ;ADD HIGHEST CONSTANT
023454  061600                  ADD     (SP),R0         ;REPRIME R0 WITH HIGHEST DIGIT
023456  005501                  ADC     R1              ;PROPOGATE CARRY
023460  010023                  MOV     R0,(R3)+        ;SAVE R0
023462  010124                  MOV     R1,(R4)+        ;SAVE R1
023464  077531                  SOB     R5,1$           ;LOOP FOR REQ'D NUMBER OF WORDS
023466  005726                  TST     (SP)+           ;POP TEMP REG
023470  012600                  MOV     (SP)+,R0        ;
023472  012601                  MOV     (SP)+,R1        ;RESTORE REGISTERS
023474  012602                  MOV     (SP)+,R2        ;
023476  012603                  MOV     (SP)+,R3        ;
023500  012604                  MOV     (SP)+,R4        ;
023502  012605                  MOV     (SP)+,R5        ;
023504  000207                  RTS     PC              ;RETURN
```

```
                                .SBTTL  POLISH EXPRESSION ROUTINES

                                ;*"POLISH EXPRESSION" ALGEBRA IS A STACK ORIENTED PROCEDURE FOR
                                ;*THE EVALUATION OF ALGEBRAIC EXPRESSIONS.  BY THIS, WE MEAN
                                ;*THAT THE STACK (IN OUR CASE, WE WILL BE USING THE STANDARD
                                ;*SYSTEM STACK USING R6) IS USED FOR THE STORAGE, ON A LAST IN-
                                ;*FIRST OUT BASIS, OF ALL OPERANDS, AND RESULTS.  ALL THE
                                ;*ARITHMETIC ROUTINES (SPECIFICALLY, OUR $ADD, $SUB, $MUL, AND
                                ;*$DIV ROUTINES) EXPECT THEIR TWO OPERANDS TO BE THE TOP TWO
                                ;*ELEMENTS ON THE STACK, AND THEY LEAVE THEIR RESULT AS THE
                                ;*TOP ELEMENT ON THE STACK, REMOVING (POPPING) THE INITIAL
                                ;*OPERANDS IN THE PROCESS.  OTHER ROUTINES ARE PRESENT FOR
                                ;*ADDING/REMOVING ELEMENTS TO/FROM THE STACK - $POPX, TO TAKE
                                ;*THE TOP ELEMENT OFF, AND $PUSH, TO PUT A NEW ELEMENT ON THE
                                ;*TOP.  IT IS IMPORTANT TO NOTE THAT OPERATORS WILL AT MOST
                                ;*REFERENCE THE TOP TWO ELEMENTS ON THE STACK; THE OTHERS ARE
                                ;*INACCESSIBLE UNTIL OUTER ELEMENTS ARE OPERATED UPON.  FOR
                                ;*EXAMPLE, THE EXPRESSION:
                                ;*
                                ;*      E = (A + B) * (C - D)
                                ;*
                                ;*COULD BE EVALUATED BY THE POLISH EXPRESSION:
                                ;*
                                ;*      $PUSH   A       ;OPERAND A ONTO STACK
                                ;*      $PUSH   B       ;OPERAND B ONTO STACK
                                ;*      $ADD            ;FORM A+B, SAVE FOR LATER
                                ;*      $PUSH   C       ;OPERAND C ONTO STACK
                                ;*      $PUSH   D       ;OPERAND D ONTO STACK
                                ;*      $SUB            ;FORM C-D ON TOP
                                ;*                      ;NOTE - THE TOP TWO OPERANDS ARE NOW:
                                ;*                      ;    (A+B) AND (C-D)
                                ;*      $MUL            ;FORM (A+B) * (C-D) ON TOP
                                ;*      $POPX   E       ;POP RESULT FROM STACK INTO E
                                ;*
                                ;*NOTE THAT OTHER POLISH EXPRESSIONS ARE POSSIBLE FOR COMPUTING
                                ;*THIS EXAMPLE, IN GENERAL THERE IS MORE THAN ONE WAY TO
                                ;*CALCULATE A GIVEN EXPRESSION.
                                ;*

                                ;*THIS ROUTINE ENTERS US INTO POLISH MODE
023506  000134                  $POLSH: JMP     @(R4)+          ;ENTER POLISH MODE

                                ;*PUSH OPERAND ON STACK FROM LOCATION SPECIFIED
                                ;*IN CONTENTS OF NEXT WORD AFTER $PUSH CALL
                                ;*2/4 WORDS DEPENDING UPON F/D MODE
023510  012400                  $PUSH:  MOV     (R4)+,R0        ;GET PTR TO SOURCE
023512  105737  002400                  TSTB    $FPS            ;
023516  100004                  BPL     1$              ;
023520  016046  000006          MOV     6(R0),-(SP)     ;PUSH DOUBLE ON STACK
023524  016046  000004          MOV     4(R0),-(SP)     ;
023530  016046  000002          1$:     MOV     2(R0),-(SP)     ;PUSH FLOAT ON STACK
023534  011046                  MOV     (R0),-(SP)      ;
023536  000134                  JMP     @(R4)+          ;

                                ;*POP OPERAND FROM STACK INTO LOCATION SPECIFIED
                                ;*IN CONTENTS OF NEXT WORD AFTER $POPX CALL
```

```
3601                                    ;*2/4 WORDS DEPENDING UPON F/D MODE
3602  023540  012400                    $POPX:  MOV     (R4)+,R0        ;GET PTR TO DESTINATION
3603  023542  012620                            MOV     (SP)+,(R0)+     ;POP FLOAT FROM STACK
3604  023544  012620                            MOV     (SP)+,(R0)+     ;
3605  023546  105737  002400                    TSTB    $FPS            ;
3606  023552  100002                            BPL     1$              ;
3607  023554  012620                            MOV     (SP)+,(R0)+     ;POP DOUBLE FROM STACK
3608  023556  012620                            MOV     (SP)+,(R0)+     ;
3609  023560  000204                    1$:     RTS     R4              ;EXIT POLISH MODE
```

```
                        .SBTTL  FLOATING POINT SOFTWARE ROUTINES

                        ;*FLOATING POINT SOFTWARE ADD/SUBTRACT ROUTINES
                        ;*
                        ;*  THIS ROUTINE TAKES THE TOP TWO ELEMENTS ON THE STACK
                        ;*    (LENGTH OF 2 OR 4 WORDS DEPENDING UPON WHETHER THE
                        ;*    F/D MODE BIT7 IN $FPS IS 0 OR 1 RESPECTIVELY) AND
                        ;*    REPLACES THEM WITH THEIR SUM/DIFFERENCE.
                        ;*
                        ;*  EXAMPLE:    $PUSH                   $PUSH
                        ;*              ADDR(OPERAND A)         ADDR(OPERAND A)
                        ;*              $PUSH                   $PUSH
                        ;*              ADDR(OPERAND B)         ADDR(OPERAND B)
                        ;*              $ADD                    $SUB
                        ;*              $POPX                   $POPX
                        ;*              ADDR(RESULT)            ADDR(RESULT)
                        ;*                RESULT=A+B              RESULT=A-B
                        ;*
                        ;*  NOTE ROUTINE IS CALLED THROUGH POLISH MODE OPERATORS.
                        ;*
                        ;*  ALL OPERATIONS ARE CARRIED OUT IN DOUBLE (LENGTH=4)
                        ;*    PRECISION MODE.  SINGLE PRECISION OPERANDS ARE
                        ;*    EXTENDED (VIA $CONV SUBROUTINE) WITH LOW-ORDER
                        ;*    ZEROS, AND LATER TRUNCATED BACK TO SINGLE PRECISION
                        ;*    FROM THE DOUBLE PRECISION RESULT.
                        ;*
                        ;*  STATUS BITS:
                        ;*    THE N, Z, V, AND C BITS OF $FPS ARE SET AS FOLLOWS:
                        ;*    N = 1  IF RESULT NEGATIVE (IE, BIT15 = 1),
                        ;*           ELSE  N = 0
                        ;*    Z = 1  IF RESULT ZERO (IE, EXPONENT = 000(8)),
                        ;*           ELSE  Z = 0
                        ;*    V = 1  IF ARITHMETIC OVERFLOW OCCURRED,
                        ;*           ELSE  V = 0
                        ;*    C = 0  ALWAYS
                        ;*
                        ;*  ERROR CONDITIONS:
                        ;*    IF AN ARITHMETIC OVERFLOW CONDITION OCCURS, THE RESULT
                        ;*    WILL BE SET TO ZERO IF THE OVERFLOW ENABLE BIT OF $FPS
                        ;*    (BIT09) IS ZERO.  IF THIS BIT IS SET, THEN THE RESULT
                        ;*    WILL BE CORRECT, EXCEPT THE EXPONENT WILL BE UNDERBIASED
                        ;*    BY 400(8).  ALSO, THE $FPS ERROR BIT (BIT15) WILL BE SET,
                        ;*    $FEC WILL BE SET TO 10(8), AND $FEA WILL BE LOADED WITH
                        ;*    THE VALUE IN LOCATION "EXPFEA".  IN EITHER INSTANCE,
                        ;*    THE V-BIT (BIT01) WILL BE SET.
                        ;*    IF AN ARITHMETIC UNDERFLOW CONDITION OCCURS, THE RESULT
                        ;*    WILL BE SET TO ZERO IF THE UNDERFLOW ENABLE BIT OF $FPS
                        ;*    (BIT10) IS ZERO.  IF THIS BIT IS SET, THEN THE RESULT
                        ;*    WILL BE CORRECT, EXCEPT THE EXPONENT WILL BE OVERBIASED
                        ;*    BY 400(8).  ALSO, THE $FPS ERROR BIT (BIT15) WILL BE SET,
                        ;*    $FEC WILL BE SET TO 12(8), AND $FEA WILL BE LOADED WITH
                        ;*    THE VALUE IN LOCATION "EXPFEA".
                        ;*
                        ;*  ALL REGISTERS ARE PRESERVED UPON ENTRY, AND RESTORED UPON
                        ;*    EXIT.  THE ROUTINES ARE RE-ENTRANT.
                        ;*
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                                        ;*  ADAPTED FROM PDP-11 FORTRAN SOFTWARE
                                        ;*    BY DONALD NORTH, SEPTEMBER, 1975.
                                        ;*
                                        ;
023562  062716  100000          $SUB:   ADD     #100000,(SP)    ;CHANGE SIGN OF TOP ITEM
023566  005237  002526          $ADD:   INC     ADDC0           ;CTR:  TOTAL NUMBER OF ADD/SUB
023572  042737  000017  002400          BIC     #17,$FPS        ;CLEAR STATUS BITS N Z V C
023600  105737  002400                  TSTB    $FPS            ;TEST MODE
023604  100402                          BMI     27$             ;D-MODE
023606  004737  027622                  JSR     PC,$CONV        ;D-MODE: CONVERT 2 F OPDS TO D
023612  010046                  27$:    MOV     R0,-(SP)        ;
023614  010146                          MOV     R1,-(SP)        ;
023616  010246                          MOV     R2,-(SP)        ;SAVE ALL REGISTERS
023620  010346                          MOV     R3,-(SP)        ;
023622  010446                          MOV     R4,-(SP)        ;
023624  010546                          MOV     R5,-(SP)        ;
023626  005046                          CLR     -(SP)           ;CLEAR SIGNS
023630  005004                          CLR     R4              ;CLEAR EXPONENTS
023632  005005                          CLR     R5              ;
023634  006366  000024                  ASL     24(SP)          ;SHIFT OUT SIGN OF TOP ITEM
023640  006166  000022                  ROL     22(SP)          ;
023644  006166  000020                  ROL     20(SP)          ;
023650  006166  000016                  ROL     16(SP)          ;SHIFT A1
023654  156604  000017                  BISB    17(SP),R4       ;GET E1
023660  001011                          BNE     31$             ;JUMP IF NON ZERO
023662  005726                          TST     (SP)+           ;FLUSH SIGNS
023664  032766  077600  000024          BIT     #077600,24(SP)  ;B=0, A=0 TOO ?
023672  001456                          BEQ     32$             ;YES, BOTH ZERO
023674  005237  002532                  INC     ADDC2           ;NO, CTR:  B=0,A#0
023700  000137  024712                  JMP     3$              ;DONE
023704  106116                  31$:    ROLB    (SP)            ;GET S1
023706  006366  000034                  ASL     34(SP)          ;SHIFT OUT SIGN OF 2ND ITEM
023712  006166  000032                  ROL     32(SP)          ;
023716  006166  000030                  ROL     30(SP)          ;
023722  006166  000026                  ROL     26(SP)          ;SHIFT A2
023726  156605  000027                  BISB    27(SP),R5       ;GET E2
023732  001042                          BNE     2$              ;JUMP IF NON ZERO
023734  106016                          RORB    (SP)            ;RECONSTRUCT A1
023736  006066  000016                  ROR     16(SP)          ;
023742  006066  000020                  ROR     20(SP)          ;
023746  006066  000022                  ROR     22(SP)          ;
023752  006066  000024                  ROR     24(SP)          ;
023756  016666  000016  000026          MOV     16(SP),26(SP)   ;FIRST ARG TO TOP OF STACK
023764  016666  000020  000030          MOV     20(SP),30(SP)   ;
023772  016666  000022  000032          MOV     22(SP),32(SP)   ;
024000  016666  000024  000034          MOV     24(SP),34(SP)   ;
024006  005726                          TST     (SP)+           ;FLUSH SIGNS
024010  032766  077600  000024          BIT     #077600,24(SP)  ;A=0, B=0 TOO ?
024016  001404                          BEQ     32$             ;YES, BOTH ZERO
024020  005237  002530                  INC     ADDC1           ;NO, CTR:  A=0, B#0
024024  000137  024712                  JMP     3$              ;DONE
024030  005237  002534          32$:    INC     ADDC3           ;CTR:  A=0, B=0
024034  000137  024672                  JMP     29$             ;DONE, TRUE ZERO RESULT
024040  106166  000001          2$:     ROLB    1(SP)           ;GET S2
024044  112766  000001  000027          MOVB    #1,27(SP)       ;INSERT NORMAL BIT
024052  112766  000001  000017          MOVB    #1,17(SP)       ;   "     "    "
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3722  024060  160405                        SUB     R4,R5           ;R5=E2-E1, R4=E1
3723  024062  003011                        BGT     4$              ;JUMP IF E2>E1
3724  024064  016500  000026                MOV     26(SP),R0       ;R0=A2
3725  024070  016501  000030                MOV     30(SP),R1       ;R1=B2
3726  024074  016502  000032                MOV     32(SP),R2       ;R2=C2
3727  024100  016503  000034                MOV     34(SP),R3       ;R3=D2
3728  024104  000427                        BR      5$              ;GO CHECK SIGNS
3729  024106  060504                4$:     ADD     R5,R4           ;R5=E2-E1, R4=E2,E2>E1
3730  024110  016600  000016                MOV     16(SP),R0       ;R0=A1
3731  024114  016601  000020                MOV     20(SP),R1       ;R1=B1
3732  024120  016602  000022                MOV     22(SP),R2       ;R2=C1
3733  024124  016603  000024                MOV     24(SP),R3       ;R3=D1
3734  024130  016666  000016  000026        MOV     26(SP),16(SP)
3735  024136  016666  000030  000020        MOV     30(SP),20(SP)
3736  024144  016666  000032  000022        MOV     32(SP),22(SP)
3737  024152  016666  000034  000024        MOV     34(SP),24(SP)
3738  024160  000316                        SWAB    (SP)            ;EXCHANGE SIGNS
3739  024162  005405                        NEG     R5              ;E1-E2
3740  024164  126616  000001        5$:     CMPB    1(SP),(SP)      ;COMPARE SIGNS
3741  024170  001412                        BEQ     6$              ;SAME, GO CHECK EXPONENT
3742  024172  005403                        NEG     R3              ;NEGATE OPERAND
3743  024174  005502                        ADC     R2              ;
3744  024176  005501                        ADC     R1              ;
3745  024200  005500                        ADC     R0              ;
3746  024202  005402                        NEG     R2              ;
3747  024204  005501                        ADC     R1              ;
3748  024206  005500                        ADC     R0              ;
3749  024210  005401                        NEG     R1              ;
3750  024212  005500                        ADC     R0              ;
3751  024214  005400                        NEG     R0              ;
3752  024216  005705                6$:     TST     R5              ;CHECK EXPONENTS
3753  024220  001466                        BEQ     7$              ;JUMP IF E1=E2
3754  024222  022705  177707                CMP     #-57.,R5        ;ANY POINT IN SHIFTING?
3755  024226  003413                        BLE     8$              ;YES
3756  024230  016500  000016                MOV     16(SP),R0       ;NO, ANSWER IS OPERAND
3757  024234  016601  000020                MOV     20(SP),R1       ;WITH LARGER EXPONENT
3758  024240  016602  000022                MOV     22(SP),R2       ;
3759  024244  016603  000024                MOV     24(SP),R3       ;
3760  024250  005237  002536                INC     ADDC4           ;CTR:  NO SHIFT
3761  024254  000501                        BR      9$              ;
3762  024256  022705  177770        8$:     CMP     #-8.,R5         ;CHECK # OF BITS TO SHIFT
3763  024262  003437                        BLE     10$             ;JUMP IF LESS THAN 1/2 WORD
3764  024264  005700                        TST     R0              ;
3765  024266  006746                        SXT     -(SP)           ;EXTEND SIGN
3766  024270  022705  177760        12$:    CMP     #-16.,R5        ;
3767  024274  002411                        BLT     11$             ;JUMP IF LESS THAN 1 WORD
3768  024276  010203                        MOV     R2,R3           ;SHIFT A WORD AT A TIME
3769  024300  010102                        MOV     R1,R2           ;
3770  024302  010001                        MOV     R0,R1           ;
3771  024304  011600                        MOV     (SP),R0         ;USE EXTENSION
3772  024306  062705  000020                ADD     #16.,R5         ;ADJUST EXPONENT
3773  024312  001366                        BNE     12$             ;TRY AGAIN
3774  024314  005726                        TST     (SP)+           ;POP EXTENSION
3775  024316  000427                        BR      7$              ;SHIFT DONE
3776  024320  022705  177775        11$:    CMP     #-3,R5          ;JUMP IF LESS THAN 4 TO SHIFT
3777  024324  003415                        BLE     13$             ;
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 3778  024326  010416                        MOV     R4,(SP)         ;SAVE EXP & SHIFT COUNT
 3779  024330  010546                        MOV     R5,-(SP)        ;
 3780  024332  010104                        MOV     R1,R4           ;SAVE R1
 3781  024334  073005                        ASHC    R5,R0           ;SHIFT HIGH ORDER
 3782  024336  010205                        MOV     R2,R5           ;SAVE R2
 3783  024340  073416                        ASHC    (SP),R4         ;SHIFT IT
 3784  024342  010204                        MOV     R2,R4           ;
 3785  024344  010502                        MOV     R5,R2           ;R2 DONE
 3786  024346  010305                        MOV     R3,R5           ;SET UP LOW ORDER
 3787  024350  073426                        ASHC    (SP)+,R4        ;DO LOW ORDER
 3788  024352  010503                        MOV     R5,R3           ;
 3789  024354  012604                        MOV     (SP)+,R4        ;RESTORE EXP TO R4
 3790  024356  000407                        BR      7$              ;
 3791  024360  005726                13$:    TST     (SP)+           ;POP EXTENSION
 3792  024362  006200                10$:    ASR     R0              ;SHIFT RIGHT
 3793  024364  006001                        ROR     R1              ;
 3794  024366  006002                        ROR     R2              ;
 3795  024370  006003                        ROR     R3              ;
 3796  024372  005205                        INC     R5              ;COUNT LOOP
 3797  024374  002772                        BLT     10$             ;
 3798  024376  066603  000024        7$:     ADD     24(SP),R3       ;FORM SUM
 3799  024402  005502                        ADC     R2              ;
 3800  024404  005501                        ADC     R1              ;
 3801  024406  005500                        ADC     R0              ;
 3802  024410  066602  000022                ADD     22(SP),R2       ;
 3803  024414  005501                        ADC     R1              ;
 3804  024416  005500                        ADC     R0              ;
 3805  024420  066601  000020                ADD     20(SP),R1       ;
 3806  024424  005500                        ADC     R0              ;
 3807  024426  066600  000016                ADD     16(SP),R0       ;
 3808  024432  126616  000001                CMPB    1(SP),(SP)      ;CHECK FOR UNEQUAL SIGNS
 3809  024436  001162                        BNE     14$             ;CLEAN UP SUBTRACT
 3810  024440  030027  001000                BIT     R0,#1000        ;
 3811  024444  001405                        BEQ     9$              ;JUMP IF NO NORMAL BIT OVERFLOW
 3812  024446  006200                        ASR     R0              ;
 3813  024450  006001                        ROR     R1              ;
 3814  024452  006002                        ROR     R2              ;
 3815  024454  006003                        ROR     R3              ;
 3816  024456  005204                        INC     R4              ;INCREASE EXP
 3817  024460  000304                9$:     SWAB    R4              ;MOVE EXP LEFT
 3818  024462  001425                        BEQ     16$             ;JUMP IF NO OVERFLOW
 3819  024464  105004                        CLRB    R4              ;CLEAR OVERFLOWED BITS
 3820  024466  052737  000002  002400        BIS     #02,$FPS        ;SET V BIT ON OVERFLOW
 3821  024474  005237  002540                INC     ADOCS           ;CTR:  OVERFLOW
 3822  024500  032737  001000  002400        BIT     #001000,$FPS    ;OVERFLOW ENABLED ?
 3823  024506  001464                        BEQ     34$             ;NO, ZERO RESULT
 3824  024510  005237  002542                INC     ADOC6           ;CTR:  OVERFLOW, ENABLED
 3825  024514  052737  100000  002400        BIS     #100000,$FPS    ;YES, SET ERROR BIT
 3826  024522  012737  000010  002402        MOV     #10,$FEC        ;SET $FEC
 3827  024530  013737  002376  002404        MOV     EXPFEA,$FEA     ;SET $FEA
 3828  024536  150004                16$:    BISB    R0,R4           ;INSERT HIGH ORDER FRACTION
 3829  024540  006026                        ROR     (SP)+           ;INSERT SIGN
 3830  024542  006004                        ROR     R4              ;
 3831  024544  006001                        ROR     R1              ;
 3832  024546  006002                        ROR     R2              ;
 3833  024550  006003                        ROR     R3              ;
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3834  024552  005503                        ADC     R3
3835  024554  005502                        ADC     R2
3836  024556  005501                        ADC     R1
3837  024560  005504                        ADC     R4
3838  024562  103401                        BCS     20$             ;OVERFLOW ON ROUND ?
3839  024564  102024                        BVC     30$             ;
3840  024566  052737  000002  002400  20$:  BIS     #02,$FPS        ;YES - SET V BIT
3841  024574  005237  002540                INC     ADDC5           ;CTR:  OVERFLOW
3842  024600  032737  001000  002400        BIT     #001000,$FPS    ;OVERFLOW ENABLED ?
3843  024606  001431                        BEQ     29$             ;NO, ZERO RESULT
3844  024610  005237  002542                INC     ADDC6           ;CTR:  OVERFLOW, ENABLED
3845  024614  052737  100000  002400        BIS     #100000,$FPS    ;SET ERROR BIT
3846  024622  012737  000010  002402        MOV     #10,$FEC        ;SET $FEC
3847  024630  013737  002376  002404        MOV     EXPFEA,$FEA     ;SET $FEA
3848  024636  010466  000024          30$:  MOV     R4,24(SP)       ;STORE EXP AND SIGN
3849  024642  010166  000026                MOV     R1,26(SP)       ;INSERT LOW ORDER FRACTION
3850  024646  010266  000030                MOV     R2,30(SP)       ;
3851  024652  010366  000032                MOV     R3,32(SP)       ;
3852  024656  000415                        BR      3$              ;
3853  024660  005726                  34$:  TST     (SP)+           ;FLUSH SIGN
3854  024662  000403                        BR      29$             ;AND ZERO RESULT
3855  024664  005237  002544          33$:  INC     ADDC7           ;CTR:  UNDERFLOW
3856  024670  005726                        TST     (SP)+           ;FLUSH SIGN
3857  024672  005066  000024          29$:  CLR     24(SP)          ;ZERO RESULT
3858  024676  005066  000026                CLR     26(SP)          ;
3859  024702  005066  000030                CLR     30(SP)          ;
3860  024706  005066  000032                CLR     32(SP)          ;
3861  024712  032766  077600  000024  3$:   BIT     #077600,24(SP)  ;SET Z BIT IF EXPONENT ZERO
3862  024720  001003                        BNE     17$             ;
3863  024722  052737  000004  002400        BIS     #04,$FPS        ;
3864  024730  005766  000024          17$:  TST     24(SP)          ;SET N BIT IF RESULT NEGATIVE
3865  024734  100003                        BPL     18$             ;
3866  024736  052737  000010  002400        BIS     #10,$FPS        ;
3867  024744  012605                  18$:  MOV     (SP)+,R5        ;
3868  024746  012604                        MOV     (SP)+,R4        ;
3869  024750  012603                        MOV     (SP)+,R3        ;RESTORE REGISTERS
3870  024752  012602                        MOV     (SP)+,R2        ;
3871  024754  012601                        MOV     (SP)+,R1        ;
3872  024756  012600                        MOV     (SP)+,R0        ;
3873  024760  062706  000010                ADD     #8.,SP          ;POP SECOND ARGUMENT
3874  024764  105737  002400                TSTB    $FPS            ;FOR D MODE?
3875  024770  100404                        BMI     26$             ;D MODE
3876  024772  012666  000002                MOV     (SP)+,2(SP)     ;F MODE - CONVERT
3877  024776  012666  000002                MOV     (SP)+,2(SP)     ;
3878  025002  000134          26$:  JMP     @(R4)+          ;DONE
3879
3880
3881  025004  005700          14$:  TST     R0              ;CHECK HIGH ORDER FRACTION RESULT
3882  025006  003014                BGT     22$             ;IF + SIGN OK
3883  025010  001453                BEQ     23$             ;CHECK FOR ZERO RESULT
3884  025012  005403                NEG     R3              ;ABS VALUE
3885  025014  005502                ADC     R2              ;
3886  025016  005501                ADC     R1              ;
3887  025020  005500                ADC     R0              ;
3888  025022  005402                NEG     R2              ;
3889  025024  005501                ADC     R1              ;
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                                                ADC     R0              ;
                                                NEG     R1              ;
                                                ADC     R0              ;
                                                NEG     R0              ;
                                                SWAB    (SP)            ;EXCHANGE SIGNS
025040  030027  000400          22$:            BIT     R0,#400         ;CHECK NORMAL BIT
025044  001427                                  BEQ     19$             ;JUMP IF NONE
025046  005704                                  TST     R4              ;CHECK FOR UNDERFLOW
025050  003203                                  BGT     9$              ;
025052  032737  002000  002400                  BIT     #002000,$FPS    ;UNDERFLOW - IS IT ENABLED ?
025060  001701                                  BEQ     33$             ;NO, MAKE ZERO RESULT
025062  005237  002544                          INC     ADDC7           ;CTR:  UNDERFLOW
025066  005237  002546                          INC     ADDC8           ;CTR:  UNDERFLOW, ENABLED
025072  052737  100000  002400                  BIS     #100000,$FPS    ;SET ERROR BIT
025100  012737  000012  002432                  MOV     #12,$FEC        ;SET $FEC
025106  013737  002376  002404                  MOV     EXPFEA,$FEA     ;SET $FEA
025114  000304                                  SWAB    R4              ;MOVE EXP LEFT
025116  105004                                  CLRB    R4              ;CLEAR WHERE FRACTION WILL GO \
025120  000137  024536                          JMP     16$             ;ASSEMBLE NUMBER
025124  005304                          19$:    DEC     R4              ;DECREASE EXP
025126  006303                                  ASL     R3              ;DOUBLE FRACTION
025130  006102                                  ROL     R2              ;
025132  006101                                  ROL     R1              ;
025134  006100                                  ROL     R0              ;
025136  000740                                  BR      22$             ;
025140  162704  000010          23$:            SUB     #8.,R4          ;REDUCE EXP
025144  005701                                  TST     R1              ;
025146  001020                                  BNE     24$             ;JUMP IF ONLY R0=0
025150  162704  000020                          SUB     #16.,R4         ;
025154  010201                                  MOV     R2,R1           ;
025156  001012                                  BNE     25$             ;JUMP IF R2 NON ZERO
025160  162704  000020                          SUB     #16.,R4         ;
025164  005703                                  TST     R3              ;
025166  001422                                  BEQ     21$             ;ANSWER IS ZERO
025170  150301                                  BISB    R3,R1           ;MOVE BYTES TO R0,R1
025172  000301                                  SWAB    R1              ;
025174  000303                                  SWAB    R3              ;
025176  150300                                  BISB    R3,R0           ;
025200  005003                                  CLR     R3              ;MAKE ALL OTHERS ZERO
025202  000716                                  BR      22$             ;GO NORMALIZE
025204  010302                          25$:    MOV     R3,R2           ;
025206  005003                                  CLR     R3              ;
025210  000301                          24$:    SWAB    R1              ;MOVE LEFT
025212  150100                                  BISB    R1,R0           ;
025214  105001                                  CLRB    R1              ;
025216  000302                                  SWAB    R2              ;
025220  150201                                  BISB    R2,R1           ;
025222  105002                                  CLRB    R2              ;
025224  000303                                  SWAB    R3              ;
025226  150302                                  BISB    R3,R2           ;
025230  105003                                  CLRB    R3              ;
025232  000702                                  BR      22$             ;
025234  005016                          21$:    CLR     (SP)            ;SET POSITIVE
025236  005004                                  CLR     R4              ;
025240  000137  024536                          JMP     16$             ;
                                                ;*END OF ADD/SUB
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;#FLOATING POINT SOFTWARE MULTIPLY ROUTINE
;#
;#  THIS ROUTINE TAKES THE TOP TWO ELEMENTS ON THE STACK
;#    (LENGTH OF 2 OR 4 WORDS DEPENDING UPON WHETHER THE
;#    F/D MODE BIT7 IN SFPS IS 0 OR 1 RESPECTIVELY) AND
;#    REPLACES THEM WITH THEIR PRODUCT.
;#
;#  EXAMPLE:     SPUSH
;#               ADDR(OPERAND A)
;#               SPUSH
;#               ADDR(OPERAND B)
;#               SMUL
;#               SPOPX
;#               ADDR(RESULT)
;#                 RESULT=A*B
;#
;#  NOTE ROUTINE IS CALLED THROUGH POLISH MODE OPERATORS.
;#
;#  ALL OPERATIONS ARE CARRIED OUT IN DOUBLE (LENGTH=4)
;#    PRECISION MODE.  SINGLE PRECISION OPERANDS ARE
;#    EXTENDED (VIA SCONV SUBROUTINE) WITH LOW-ORDER
;#    ZEROS, AND LATER TRUNCATED BACK TO SINGLE PRECISION
;#    FROM THE DOUBLE PRECISION RESULT.
;#
;#  STATUS BITS:
;#    THE N, Z, V, AND C BITS OF SFPS ARE SET AS FOLLOWS:
;#    N = 1  IF RESULT NEGATIVE (IE, BIT15 = 1),
;#           ELSE  N = 0
;#    Z = 1  IF RESULT ZERO (IE, EXPONENT = 000(8)),
;#           ELSE  Z = 0
;#    V = 1  IF ARITHMETIC OVERFLOW OCCURRED,
;#           ELSE  V = 0
;#    C = 0  ALWAYS
;#
;#  ERROR CONDITIONS:
;#    IF AN ARITHMETIC OVERFLOW CONDITION OCCURS, THE RESULT
;#    WILL BE SET TO ZERO IF THE OVERFLOW ENABLE BIT OF SFPS
;#    (BIT09) IS ZERO.  IF THIS BIT IS SET, THEN THE RESULT
;#    WILL BE CORRECT, EXCEPT THE EXPONENT WILL BE UNDERBIASED
;#    BY 400(8).  ALSO, THE SFPS ERROR BIT (BIT15) WILL BE SET,
;#    SFEC WILL BE SET TO 10(8), AND SFEA WILL BE LOADED WITH
;#    THE VALUE IN LOCATION "EXPFEA".  IN EITHER INSTANCE,
;#    THE V-BIT (BIT01) WILL BE SET.
;#    IF AN ARITHMETIC UNDERFLOW CONDITION OCCURS, THE RESULT
;#    WILL BE SET TO ZERO IF THE UNDERFLOW ENABLE BIT OF SFPS
;#    (BIT10) IS ZERO.  IF THIS BIT IS SET, THEN THE RESULT
;#    WILL BE CORRECT, EXCEPT THE EXPONENT WILL BE OVERBIASED
;#    BY 400(8).  ALSO, THE SFPS ERROR BIT (BIT15) WILL BE SET,
;#    SFEC WILL BE SET TO 12(8), AND SFEA WILL BE LOADED WITH
;#    THE VALUE IN LOCATION "EXPFEA".
;#
;#  ALL REGISTERS ARE PRESERVED UPON ENTRY, AND RESTORED UPON
;#    EXIT.  THE ROUTINES ARE RE-ENTRANT.
;#
;#  ADAPTED FROM PDP-11 FORTRAN SOFTWARE
;#    BY DONALD NORTH, SEPTEMBER, 1975.
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4002                                            ;*
4003
4004  025244  005237  002550          $MUL:   INC     MULCO           ;CTR:  TOTAL NUMBER MUL
4005  025250  042737  000017  002400          BIC     #17,$FPS        ;CLEAR STATUS BITS N Z V C
4006  025256  105737  002400                  TSTB    $FPS            ;TEST MODE
4007  025262  100402                          BMI     1$$             ;D-MODE
4008  025264  004737  027622                  JSR     PC,$CONV        ;F-MODE:  CONVERT 2 F OPDS TO D
4009  025270  010046                  1$$:    MOV     R0,-(SP)
4010  025272  010146                          MOV     R1,-(SP)
4011  025274  010246                          MOV     R2,-(SP)        ;SAVE ALL REGISTERS
4012  025276  010346                          MOV     R3,-(SP)
4013  025300  010446                          MOV     R4,-(SP)
4014  025302  010546                          MOV     R5,-(SP)
4015  025304  006366  000014                  ASL     14(SP)          ;SHIFT MULTIPLICAND
4016  025310  006146                          ROL     -(SP)           ;KEEP SIGN
4017  025312  005046                          CLR     -(SP)           ;CLEAR EXPONENT
4018  025314  116616  000021                  MOVB    21(SP),(SP)     ;KEEP MULTIPLICAND EXP
4019  025320  001436                          BEQ     1$              ;ANSWER ZERO
4020  025322  116666  000020  000021          MOVB    20(SP),21(SP)   ;SHIFT FRACTION LEFT
4021  025330  000261                          SEC                     ;INSERT NORMAL BIT
4022  025332  006066  000020                  ROR     20(SP)
4023  025336  116666  000023  000020          MOVB    23.(SP),20(SP)
4024  025344  000366  000022                  SWAB    22(SP)
4025  025350  116666  000025  000022          MOVB    25(SP),22.SP.
4026  025356  000366  000024                  SWAB    24(SP)
4027  025362  116666  000027  000024          MOVB    27(SP),24.SP.
4028  025370  000366  000026                  SWAB    26(SP)
4029  025374  105066  000026                  CLRB    26 SP.          ;EXTRA BITS
4030  025400  006366  000030                  ASL     30 SP)          ;SHIFT HIGH MULTIPLIER
4031  025404  006266  000002                  ROC     2(SP.           ;PRODUCT SIGN
4032  025410  105766  000031                  TSTB    31 SP)
4033  025414  001005                          BNE     2$              ;JUMP IF NON ZERO
4034  025416  026666                  :$:     CMP     SP),+,(SP.+     ;FLUSH SIGN AND EXPONENT
4035  025420  005237  002552                  INC     MULC1           ;CTR:  A=0 AND/OR B=0
4036  025424  000137  026100                  JMP     3$
4037  025430  005000                  2$:     CLR     R0              ;CLEAR PRODUCT
4038  025432  005001                          CLR     R1
4039  025434  005002                          CLR     R2
4040  025436  005003                          CLR     R3
4041  025440  005005                          CLR     R5              ;CLEAR C BIT OVERFLOW CATCHER
4042  025442  006066  000030                  ROR     30(SP)          ;SIGN IS +
4043  025446  012746  000020                  MOV     #16.,-(SP)      ;ITERATION COUNT
4044  025452  016604  000040                  MOV     40(SP),R4       ;GET LOWEST ORDER MULTIPLIER
4045  025456  001404                          BEQ     4$              ;JUMP IF NO BITS HERE
4046  025460  004737  026320                  JSR     PC,30$
4047  025464  012716  000020                  MOV     #16.,(SP)       ;RESTORE COUNT
4048  025470  016604  000036          4$:     MOV     36(SP),R4       ;GET NEXT LOWEST FRACTION
4049  025474  001003                          BNE     5$              ;WORK TO DO
4050  025476  005766  000040                  TST     40.SP)
4051  025502  001406                          BEQ     6$              ;NO PRODUCT YET
4052  025504  004737  026314          5$:     JSR     PC,31$
4053  025510  004737  026222                  JSR     PC,32$          ;ONE BIT FULL PRECISION
4054  025514  012716  000020                  MOV     #16.,(SP)
4055  025520  016604  000034          6$:     MOV     34(SP),R4       ;NEXT TO HIGHEST ORDER FRACTION
4056  025524  001006                          BNE     7$
4057  025526  005766  000036                  TST     36(SP)
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                                                        BNE     7$
                                                        TST     40(SP)
                                                        BEQ     8$
                                                7$:     JSR     PC,32$
                                                8$:     MOV     32(SP),R4       ;GET HIGH ORDER BITS
                                                        MOV     #7.,(SP)        ;SEVEN OF THEM
                                                        JSR     PC,32$
                                                        JSR     PC,33$          ;NORMAL BIT
                                                        TST     (SP)+           ;FLUSH ITERATION COUNT
                                                        ADD     (SP)+,R4        ;ADD EXP
                                                        ASL     R3              ;SHIFT OUT NORMAL BIT
                                                        ROL     R2
                                                        ROL     R1
                                                        ROL     R0
                                                        BCS     9$              ;NORMAL BIT FOUND
                                                        ASL     R3
                                                        ROL     R2
                                                        ROL     R1
                                                        ROL     R0              ;HAVE IT
                                                        DEC     R4              ;ADJUST EXP
                                                9$:     SUB     #200,R4         ;REMOVE BIAS FROM EXP
                                                        BGT     10$             ;BR IF NO UNDERFLOW
                                                        INC     MULC4           ;CTR:  UNDERFLOW
                                                        BIT     #002000,$FPS    ;UNDERFLOW - IS IT ENABLED ?
                                                        BEQ     12$             ;NO, MAKE ZERO RESULT
                                                        INC     MULC5           ;CTR:  UNDERFLOW, ENABLED
                                                        BIS     #100000,$FPS    ;SET ERROR BIT
                                                        MOV     #12,$FEC        ;SET $FEC
                                                        MOV     EXPFEA,$FEA     ;SET $FEA
                                                        BR      11$             ;CONTINUE
                                                10$:    CMP     #377,R4         ;CHECK FOR OVERFLOW
                                                        BGE     11$             ;BR IF NO OVERFLOW
                                                        BIS     #02,$FPS        ;SET V BIT ON OVERFLOW
                                                        INC     MULC2           ;CTR:  OVERFLOW
                                                        BIT     #001000,$FPS    ;OVERFLOW ENABLED ?
                                                        BEQ     12$             ;NO, ZERO RESULT
                                                        INC     MULC3           ;CTR:  OVERFLOW, ENABLED
                                                        BIS     #100000,$FPS    ;SET ERROR BIT
                                                        MOV     #10,$FEC        ;SET $FEC
                                                        MOV     EXPFEA,$FEA     ;SET $FEA
                                                11$:    CLRB    R3
                                                        BISB    R2,R3           ;SHIFT FRACTION RIGHT
                                                        SWAB    R3
                                                        CLRB    R2
                                                        BISB    R1,R2
                                                        SWAB    R2
                                                        CLRB    R1
                                                        BISB    R0,R1
                                                        SWAB    R1
                                                        CLRB    R0
                                                        BISB    R4,R0
                                                        SWAB    R0
                                                        ROR     (SP)+           ;GET PRODUCT SIGN
                                                        ROR     R0              ;PUT IN RESULT
                                                        ROR     R1
                                                        ROR     R2
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4114  026006  006003                        ROR     R3
4115  026010  005503                        ROC     R3              ;ROUND RESULT
4116  026012  005502                        ROC     R2
4117  026014  005501                        ROC     R1
4118  026016  005500                        ROC     R0
4119  026020  103401                        BCS     16$             ;OVERFLOW ON ROUND ?
4120  026022  102032                        BVC     13$
4121  026024  052737  000002  002400  16$:  BIS     #02,$FPS        ;YES - SET V BIT
4122  026032  005237  002554                INC     MULC2           ;CTR:  OVERFLOW
4123  026036  032737  001000  002400        BIT     #001000,$FPS    ;OVERFLOW ENABLED ?
4124  026044  001415                        BEQ     3$              ;NO, ZERO RESULT
4125  026046  005237  002556                INC     MULC3           ;CTR:  OVERFLOW, ENABLED
4126  026052  052737  100000  002400        BIS     #100000,$FPS    ;SET ERROR BIT
4127  026060  012737  000010  002402        MOV     #10,$FEC        ;SET $FEC
4128  026066  013737  002376  002404        MOV     EXPFEA,$FEA     ;SET $FEA
4129  026074  000405                        BR      13$             ;CONTINUE
4130  026076  005726                 12$:   TST     (SP)+           ;FLUSH SIGN
4131  026100  005000                 3$:    CLR     R0              ;CLEAR RESULT
4132  026102  005001                        CLR     R1
4133  026104  005002                        CLR     R2
4134  026106  005003                        CLR     R3
4135  026110  010066  000024        13$:   MOV     R0,24(SP)
4136  026114  010166  000026                MOV     R1,26(SP)       ;STUFF RESULT
4137  026120  010266  000030                MOV     R2,30(SP)
4138  026124  010366  000032                MOV     R3,32(SP)
4139  026130  032766  077600  000024        BIT     #077600,24(SP)  ;SET Z BIT IF EXPONENT ZERO
4140  026136  001003                        BNE     17$
4141  026140  052737  000004  002400        BIS     #04,$FPS
4142  026146  005766  000024         17$:   TST     24(SP)          ;SET N BIT IF RESULT NEGATIVE
4143  026152  100003                        BPL     18$
4144  026154  052737  000010  002400        BIS     #10,$FPS
4145  026162  012605                 18$:   MOV     (SP)+,R5
4146  026164  012604                        MOV     (SP)+,R4
4147  026166  012603                        MOV     (SP)+,R3        ;RESTORE REGISTERS
4148  026170  012602                        MOV     (SP)+,R2
4149  026172  012601                        MOV     (SP)+,R1
4150  026174  012600                        MOV     (SP)+,R0
4151  026176  062706  000010                ADD     #8.,SP          ;CLEAR SECOND OPERAND OFF STACK
4152  026202  105737  002400                TSTB    $FPS            ;F OR D MODE
4153  026206  100404                        BMI     14$             ;D-MODE
4154  026210  012666  000002                MOV     (SP)+,2(SP)     ;F MODE - CONVERT
4155  026214  012666  000002                MOV     (SP)+,2(SP)
4156  026220  000134                 14$:   JMP     @(R4)+          ;RETURN
4157
4158  026222  006204                 32$:   ASR     R4              ;TEST NEXT MULTIPLIER BIT
4159  026224  103022                        BCC     34$             ;JUMP IF ZERO
4160  026226  066603  000032        33$:   ADD     32(SP),R3       ;ADD IN MULTIPLICAND
4161  026232  005502                        ADC     R2
4162  026234  005501                        ADC     R1
4163  026236  005500                        ADC     R0
4164  026240  005505                        ADC     R5              ;SAVE OVERFLOW
4165  026242  066602  000030                ADD     30(SP),R2
4166  026246  005501                        ADC     R1
4167  026250  005500                        ADC     R0
4168  026252  005505                        ADC     R5
4169  026254  066601  000026                ADD     26(SP),R1
```

```
 4170  026260  005500                        ADC     R0              ;
 4171  026262  005505                        ADC     R5              ;
 4172  026264  066600  000024                ADD     24(SP),R0       ;
 4173  026270  005505                        ADC     R5              ;
 4174  026272  006205              34$:      ASR     R5              ;RECOVER OVERFLOW IF ANY
 4175  026274  006000                        ROR     R0              ;SHIFT PRODUCT
 4176  026276  006001                        ROR     R1              ;
 4177  026300  006002                        ROR     R2              ;
 4178  026302  006003                        ROR     R3              ;
 4179  026304  005366  000002                DEC     2(SP)           ;COUNT LOOP
 4180  026310  003344                        BGT     32$             ;AGAIN
 4181  026312  000207                        RTS     PC              ;RETURN
 4182  026314  005366  000002      31$:      DEC     2(SP)           ;ONLY 15 BITS THIS PASS
 4183  026320  006204              30$:      ASR     R4              ;TEST NEXT MULTIPLIER BIT
 4184  026322  103007                        BCC     35$             ;JUMP IF ZERO
 4185  026324  066501  000026                ADD     26(SP),R1       ;USE ONLY HIGH ORDER MULTIPLICAND
 4186  026330  005500                        ADC     R0              ;
 4187  026332  005505                        ADC     R5              ;
 4188  026334  066600  000024                ADD     24(SP),R0       ;
 4189  026340  005505                        ADC     R5              ;
 4190  026342  006205              35$:      ASR     R5              ;RECOVER ANY OVERFLOW
 4191  026344  006000                        ROR     R0              ;
 4192  026346  006001                        ROR     R1              ;
 4193  026350  006002                        ROR     R2              ;
 4194  026352  006003                        ROR     R3              ;
 4195  026354  005366  000002                DEC     2(SP)           ;COUNT LOOP
 4196  026360  003357                        BGT     30$             ;
 4197  026362  000207                        RTS     PC              ;RETURN
 4198                                        ;*END OF MUL
```

```
4199                    ;#FLOATING POINT SOFTWARE DIVIDE ROUTINE
4200                    ;*
4201                    ;*  THIS ROUTINE TAKES THE TOP TWO ELEMENTS ON THE STACK
4202                    ;*    (LENGTH OF 2 OR 4 WORDS DEPENDING UPON WHETHER THE
4203                    ;*    F/D MODE BIT7 IN $FPS IS 0 OR 1 RESPECTIVELY) AND
4204                    ;*    REPLACES THEM WITH THEIR QUOTIENT.
4205                    ;*
4206                    ;*  EXAMPLE:    $PUSH
4207                    ;*              ADDR(OPERAND A)
4208                    ;*              $PUSH
4209                    ;*              ADDR(OPERAND B)
4210                    ;*              $DIV
4211                    ;*              $POPX
4212                    ;*              ADDR(RESULT)
4213                    ;*                RESULT=A/B
4214                    ;*
4215                    ;*  NOTE ROUTINE IS CALLED THROUGH POLISH MODE OPERATORS.
4216                    ;*
4217                    ;*  ALL OPERATIONS ARE CARRIED OUT IN DOUBLE (LENGTH=4)
4218                    ;*    PRECISION MODE.  SINGLE PRECISION OPERANDS ARE
4219                    ;*    EXTENDED (VIA $CONV SUBROUTINE) WITH LOW-ORDER
4220                    ;*    ZEROS, AND LATER TRUNCATED BACK TO SINGLE PRECISION
4221                    ;*    FROM THE DOUBLE PRECISION RESULT.
4222                    ;*
4223                    ;*  STATUS BITS:
4224                    ;*    THE N, Z, V, AND C BITS OF $FPS ARE SET AS FOLLOWS:
4225                    ;*    N = 1  IF RESULT NEGATIVE (IE, BIT15 = 1),
4226                    ;*           ELSE  N = 0
4227                    ;*    Z = 1  IF RESULT ZERO (IE, EXPONENT = 000(8)),
4228                    ;*           ELSE  Z = 0
4229                    ;*    V = 1  IF ARITHMETIC OVERFLOW OCCURRED,
4230                    ;*           ELSE  V = 0
4231                    ;*    C = 0  ALWAYS
4232                    ;*
4233                    ;*  ERROR CONDITIONS:
4234                    ;*    IF AN ARITHMETIC OVERFLOW CONDITION OCCURS, THE RESULT
4235                    ;*    WILL BE SET TO ZERO IF THE OVERFLOW ENABLE BIT OF $FPS
4236                    ;*    (BIT09) IS ZERO.  IF THIS BIT IS SET, THEN THE RESULT
4237                    ;*    WILL BE CORRECT, EXCEPT THE EXPONENT WILL BE UNDERBIASED
4238                    ;*    BY 400(8).  ALSO, THE $FPS ERROR BIT (BIT15) WILL BE SET,
4239                    ;*    $FEC WILL BE SET TO 10(8), AND $FEA WILL BE LOADED WITH
4240                    ;*    THE VALUE IN LOCATION "EXPFEA".  IN EITHER INSTANCE,
4241                    ;*    THE V-BIT (BIT01) WILL BE SET.
4242                    ;*    IF AN ARITHMETIC UNDERFLOW CONDITION OCCURS, THE RESULT
4243                    ;*    WILL BE SET TO ZERO IF THE UNDERFLOW ENABLE BIT OF $FPS
4244                    ;*    (BIT10) IS ZERO.  IF THIS BIT IS SET, THEN THE RESULT
4245                    ;*    WILL BE CORRECT, EXCEPT THE EXPONENT WILL BE OVERBIASED
4246                    ;*    BY 400(8).  ALSO, THE $FPS ERROR BIT (BIT15) WILL BE SET,
4247                    ;*    $FEC WILL BE SET TO 12(8), AND $FEA WILL BE LOADED WITH
4248                    ;*    THE VALUE IN LOCATION "EXPFEA".
4249                    ;*    IF DIVISION BY ZERO IS ATTEMPTED (EG, EXPONENT OF
4250                    ;*    DENOMINATOR OPERAND IS ZERO), THE RESULT LEFT ON THE
4251                    ;*    STACK WILL BE THE NUMERATOR, WITH THE CONDITION CODES SET
4252                    ;*    ACCORDINGLY.  THE $FPS ERROR BIT WILL BE SET, $FEC WILL BE
4253                    ;*    SET TO 4(8), AND $FEA WILL BE SET TO THE VALUE CONTAINED
4254                    ;*    IN THE LOCATION "EXPFEA".
```

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                                        ;*
                                        ;*  ALL REGISTERS ARE PRESERVED UPON ENTRY, AND RESTORED UPON
                                        ;*    EXIT.  THE ROUTINES ARE RE-ENTRANT.
                                        ;*
                                        ;*  ADAPTED FROM PDP-11 FORTRAN SOFTWARE
                                        ;*    BY DONALD NORTH, SEPTEMBER, 1975.
                                        ;*
026364  005237  002564          $DIV:   INC     DIVC0           ;CTR:  TOTAL NUMBER OF DIV
026370  042737  000017  002400          BIC     #17,$FPS        ;CLEAR STATUS BITS N Z V C
026376  105737  002400                  TSTB    $FPS            ;TEST MODE
026402  100402                          BMI     14$             ;D-MODE
026404  004737  027622                  JSR     PC,$CONV        ;F-MODE:  CONVERT 2 F OPDS TO D
026410  010046                  14$:    MOV     R0,-(SP)        ;
026412  010146                          MOV     R1,-(SP)        ;
026414  010246                          MOV     R2,-(SP)        ;
026416  010346                          MOV     R3,-(SP)        ;SAVE REGISTERS
026420  010446                          MOV     R4,-(SP)        ;
026422  010546                          MOV     R5,-(SP)        ;
026424  032766  077600  000014          BIT     #077600,14(SP)  ;DIVIDE BY ZERO ?
026432  001015                          BNE     2$              ;NO
026434  005237  002570                  INC     DIVC2           ;CTR:  DENOM=0
026440  052737  100000  002400          BIS     #100000,$FPS    ;YES, SET ERROR BIT
026446  012737  000004  002402          MOV     #4,$FEC         ;SET $FEC
026454  013737  002376  002404          MOV     EXPFEA,$FEA     ;SET $FEA
026462  000137  027372                  JMP     9$              ;DONE
026466  005000                  2$:     CLR     R0              ;
026470  005001                          CLR     R1              ;
026472  005002                          CLR     R2              ;
026474  005003                          CLR     R3              ;
026476  005046                          CLR     -(SP)           ;
026500  006366  000026                  ASL     26(SP)          ;SHIFT NUMERATOR
026504  006116                          ROL     (SP)            ;NUMERATOR SIGN
026506  005046                          CLR     -(SP)           ;
026510  156616  000031                  BISB    31(SP),(SP)     ;NUMERATOR EXP
026514  001004                          BNE     6$              ;NUMERATOR IS ZERO?
026516  005237  002566                  INC     DIVC1           ;CTR:  NUMER=0
026522  000137  027346                  JMP     1$              ;YES, DONE
026526  156600  000030          6$:     BISB    30(SP),R0       ;
026532  000300                          SWAB    R0              ;LEFT JUSTIFY NUMERATOR FRACTION
026534  000261                          SEC                     ;INSERT NORMAL BIT
026536  006000                          ROR     R0              ;
026540  156600  000033                  BISB    33(SP),R0       ;
026544  156601  000032                  BISB    32(SP),R1       ;
026550  000301                          SWAB    R1              ;
026552  156601  000035                  BISB    35(SP),R1       ;
026556  156602  000034                  BISB    34(SP),R2       ;
026562  000302                          SWAB    R2              ;
026564  156602  000037                  BISB    37(SP),R2       ;
026570  156603  000036                  BISB    36(SP),R3       ;
026574  000303                          SWAB    R3              ;
026576  006366  000020                  ASL     20(SP)          ;SHIFT DENOMINATOR
026602  005566  000002                  ADC     2(SP)           ;RESULT SIGN
026606  005004                          CLR     R4              ;
026610  156604  000021                  BISB    21(SP),R4       ;DIVISOR EXPONENT
026614  160416                          SUB     R4,(SP)         ;SUBTRACT EXPONENTS
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4311  026616  000366  000020                  SWAB    20(SP)          ;LEFT JUSTIFY DENOM
4312  026622  000261                          SEC                     ;INSERT NORMAL BIT
4313  026624  006066  000020                  ROR     20(SP)          ;
4314  026630  116666  000023  000020          MOVB    23(SP),20(SP)   ;
4315  026636  116666  000022  000023          MOVB    22(SP),23(SP)   ;
4316  026644  116666  000025  000022          MOVB    25(SP),22(SP)   ;
4317  026652  116666  000024  000025          MOVB    24(SP),25(SP)   ;
4318  026660  116666  000027  000024          MOVB    27(SP),24(SP)   ;
4319  026666  116666  000026  000027          MOVB    26(SP),27(SP)   ;
4320  026674  105066  000026                  CLRB    26(SP)          ;
4321  026700  005066  000030                  CLR     30(SP)          ;CLEAR QUOTIENT
4322  026704  005066  000032                  CLR     32(SP)          ;
4323  026710  005066  000034                  CLR     34(SP)          ;
4324  026714  020066  000020                  CMP     R0,20(SP)       ;COMPARE HIGH NUM + DENOM
4325  026720  101020                          BHI     3$              ;JUMP IF DENOM LOW
4326  026722  103424                          BLO     4$              ;JUMP IF DENOM HI
4327  026724  020166  000022                  CMP     R1,22(SP)       ;COMPARE LOW ORDER PARTS
4328  026730  101014                          BHI     3$              ;
4329  026732  103420                          BLO     4$              ;
4330  026734  020266  000024                  CMP     R2,24(SP)       ;
4331  026740  101010                          BHI     3$              ;
4332  026742  103414                          BLO     4$              ;
4333  026744  020366  000026                  CMP     R3,26(SP)       ;
4334  026750  101004                          BHI     3$              ;
4335  026752  001010                          BNE     4$              ;
4336  026754  005216                          INC     (SP)            ;BUMP EXP
4337  026756  005004                          CLR     R4              ;
4338  026760  000443                          BR      5$              ;
4339
4340  026762  006000          3$:             ROR     R0              ;HALVE DENOM (C=0)
4341  026764  006001                          ROR     R1              ;TO INSURE N<D
4342  026766  006002                          ROR     R2              ;
4343  026770  006003                          ROR     R3              ;
4344  026772  005216                          INC     (SP)            ;COMPENSATE EXP
4345  026774  012705  000011          4$:     MOV     #9.,R5          ;FIRST NINE QUOTIENT BITS
4346  027000  004737  027464                  JSR     PC,30$          ;
4347  027004  110466  000030                  MOVB    R4,30(SP)       ;SAVE ALL HIGH ORDER Q FRACTION
4348  027010  005705                          TST     R5              ;DONE?
4349  027012  001025                          BNE     10$             ;YES - REST OF NUMBER IS 0
4350  027014  012705  000020                  MOV     #16.,R5         ;16 MORE BITS
4351  027020  004737  027464                  JSR     PC,30$          ;
4352  027024  010466  000032                  MOV     R4,32(SP)       ;
4353  027030  005705                          TST     R5              ;
4354  027032  001015                          BNE     10$             ;
4355  027034  012705  000020                  MOV     #16.,R5         ;
4356  027040  004737  027464                  JSR     PC,30$          ;
4357  027044  010466  000034                  MOV     R4,34(SP)       ;
4358  027050  005705                          TST     R5              ;
4359  027052  001005                          BNE     10$             ;
4360  027054  012705  000020                  MOV     #16.,R5         ;
4361  027060  004737  027464                  JSR     PC,30$          ;
4362  027064  000401                          BR      5$              ;
4363  027066  005004          10$:            CLR     R4              ;CLEAR LOWEST ORDER QUOTIENT
4364  027070  012605          5$:             MOV     (SP)+,R5        ;PUSH UP EXPONENT
4365  027072  062705  000200                  ADD     #200,R5         ;INSERT BIAS
4366  027076  003022                          BGT     7$              ;BR IF NO UNDERFLOW
```

```
4367  027100  005237  002576                      INC     DIVC5           ;CTR:  UNDERFLOW
4368  027104  032737  002000  002400              BIT     #002000,$FPS    ;UNDERFLOW - IS IT ENABLED ?
4369  027112  001516                              BEQ     15$             ;NO, MAKE ZERO RESULT
4370  027114  005237  002600                      INC     DIVC6           ;CTR:  UNDERFLOW, ENABLED
4371  027120  052737  100000  002400              BIS     #100000,$FPS    ;SET ERROR BIT
4372  027126  012737  000012  002402              MOV     #12,$FEC        ;SET $FEC
4373  027134  013737  002376  002404              MOV     EXPFEA,$FEA     ;SET $FEA
4374  027142  000427                              BR      11$             ;CONTINUE
4375  027144  022705  000377              7$:     CMP     #377,R5         ;CHECK FOR OVERFLOW
4376  027150  002024                              BGE     11$             ;BR IF NO OVERFLOW
4377  027152  052737  000002  002400              BIS     #02,$FPS        ;SET V BIT ON OVERFLOW
4378  027160  005237  002572                      INC     DIVC3           ;CTR:  OVERFLOW
4379  027164  032737  001000  002400              BIT     #001000,$FPS    ;OVERFLOW ENABLED ?
4380  027172  001466                              BEQ     15$             ;NO, ZERO RESULT
4381  027174  005237  002574                      INC     DIVC4           ;CTR:  OVERFLOW, ENABLED
4382  027200  052737  100000  002400              BIS     #100000,$FPS    ;SET ERROR BIT
4383  027206  012737  000010  002402              MOV     #10,$FEC        ;SET $FEC
4384  027214  013737  002376  002404              MOV     EXPFEA,$FEA     ;SET $FEA
4385  027222  110566  000027              11$:    MOVB    R5,27(SP)       ;PUT EXPIN RESULT
4386  027226  006026                              ROR     (SP)+           ;INSERT SIGN
4387  027230  006066  000024                      ROR     24(SP)          ;
4388  027234  006066  000026                      ROR     26(SP)          ;
4389  027240  006066  000030                      ROR     30(SP)          ;
4390  027244  006004                              ROR     R4              ;
4391  027246  005504                              ADC     R4              ;ROUND
4392  027250  005566  000030                      ADC     30(SP)          ;
4393  027254  005566  000026                      ADC     26(SP)          ;
4394  027260  005566  000024                      ADC     24(SP)          ;
4395  027264  010466  000032                      MOV     R4,32(SP)       ;INSERT LOW ORDER FRACTION
4396  027270  103401                              BCS     16$             ;OVERFLOW ON ROUND ?
4397  027272  102037                              BVC     9$              ;
4398  027274  052737  000002  002400  16$:        BIS     #02,$FPS        ;YES - SET V BIT
4399  027302  005237  002572                      INC     DIVC3           ;CTR:  OVERFLOW
4400  027306  032737  001000  002400              BIT     #001000,$FPS    ;OVERFLOW ENABLED ?
4401  027314  001416                              BEQ     19$             ;NO, ZERO RESULT
4402  027316  005237  002574                      INC     DIVC4           ;CTR:  OVERFLOW, ENABLED
4403  027322  052737  100000  002400              BIS     #100000,$FPS    ;SET ERROR BIT
4404  027330  012737  000010  002402              MOV     #10,$FEC        ;SET $FEC
4405  027336  013737  002376  002404              MOV     EXPFEA,$FEA     ;SET $FEA
4406  027344  000412                              BR      9$              ;CONTINUE
4407  027346  005726                      1$:     TST     (SP)+           ;FLUSH EXP
4408  027350  005726                      15$:    TST     (SP)+           ;FLUSH SIGN
4409  027352  005066  000024              19$:    CLR     24(SP)          ;CLEAR RESULT
4410  027356  005066  000026                      CLR     26(SP)          ;
4411  027362  005066  000030                      CLR     30(SP)          ;
4412  027366  005066  000032                      CLR     32(SP)          ;
4413  027372  032766  077600  000024  9$:        BIT     #077600,24(SP)  ;SET Z BIT IF EXPONENT ZERO
4414  027400  001003                              BNE     17$             ;
4415  027402  052737  000004  002400              BIS     #04,$FPS        ;
4416  027410  005766  000024              17$:    TST     24(SP)          ;SET N BIT IF RESULT NEGATIVE
4417  027414  100003                              BPL     18$             ;
4418  027416  052737  000010  002400              BIS     #10,$FPS        ;
4419  027424  012605                      18$:    MOV     (SP)+,R5        ;
4420  027426  012604                              MOV     (SP)+,R4        ;
4421  027430  012603                              MOV     (SP)+,R3        ;RESTORE REGISTERS
4422  027432  012602                              MOV     (SP)+,R2        ;
```

```
4423  027434  012601                      MOV     (SP)+,R1        ;
4424  027436  012600                      MOV     (SP)+,R0        ;
4425  027440  062706  000010              ADD     #8.,SP          ;FLUSH FIRST ARG
4426  027444  105737  002400              TSTB    $FPS            ;F OR D MODE
4427  027450  100404                      BMI     13$             ;D MODE
4428  027452  012666  000002              MOV     (SP)+,2(SP)     ;F MODE - CONVERT
4429  027456  012666  000002              MOV     (SP)+,2(SP)     ;
4430  027462  000134              13$:    JMP     @(R4)+          ;RETURN
4431
4432  027464  006304              30$:    ASL     R4              ;SHIFT QUOTIENT
4433  027466  006303                      ASL     R3              ;
4434  027470  006102                      ROL     R2              ;
4435  027472  006101                      ROL     R1              ;
4436  027474  006100                      ROL     R0              ;
4437  027476  103420                      BCS     31$             ;GUARANTEED TO GO
4438  027500  026600  000022              CMP     22(SP),R0       ;COMPARE HIGH DIVISOR AND DIVIDEND
4439  027504  101034                      BHI     32$             ;DIVISOR BIGGER
4440  027506  103414                      BLO     31$             ;
4441  027510  026601  000024              CMP     24(SP),R1       ;CHECK LOW ORDERS
4442  027514  101030                      BHI     32$             ;
4443  027516  103410                      BLO     31$             ;
4444  027520  026602  000026              CMP     26(SP),R2       ;
4445  027524  101024                      BHI     32$             ;
4446  027526  103404                      BLO     31$             ;
4447  027530  026603  000030              CMP     30(SP),R3       ;
4448  027534  101020                      BHI     32$             ;
4449  027536  001422                      BEQ     33$             ;NUMER=DENOM
4450  027540  166603  000030      31$:    SUB     30(SP),R3       ;N=N-D
4451  027544  005602                      SBC     R2              ;
4452  027546  005601                      SBC     R1              ;
4453  027550  005600                      SBC     R0              ;
4454  027552  166602  000026              SUB     26(SP),R2       ;
4455  027556  005601                      SBC     R1              ;
4456  027560  005600                      SBC     R0              ;
4457  027562  166601  000024              SUB     24(SP),R1       ;
4458  027566  005600                      SBC     R0              ;
4459  027570  166600  000022              SUB     22(SP),R0       ;
4460  027574  005204                      INC     R4              ;INSERT QUOTIENT BIT
4461  027576  005305              32$:    DEC     R5              ;COUNT LOOP
4462  027600  003331                      BGT     30$             ;
4463  027602  000207                      RTS     PC              ;RETURN
4464  027604  005204              33$:    INC     R4              ;INSERT LAST 1 BIT IN QUOTIENT
4465  027606  000401                      BR      34$             ;
4466  027610  006304              35$:    ASL     R4              ;FINISH OUT QUOTIENT WITH ZEROS
4467  027612  005305              34$:    DEC     R5              ;
4468  027614  003375                      BGT     35$             ;
4469  027616  005205                      INC     R5              ;FLAG NO MORE NUMER
4470  027620  000207                      RTS     PC              ;RETURN
4471                                      ;*END OF DIV
```

```
                                                ;#CONVERT TOP 2 OPERANDS ON STACK FROM F MODE
                                                ;#    TO D MODE
                                                ;#
                                                ;#  THIS ROUTINE TAKES THE TOP TWO 2-WORD (SINGLE
                                                ;#    PRECISION) FLOATING POINT NUMBERS ON THE
                                                ;#    STACK AND CONVERTS THEM BOTH TO 4-WORD
                                                ;#    (DOUBLE PRECISION) FORMAT BY APPENDING
                                                ;#    TWO WORDS OF ZEROS AS THE LOW ORDER BIT
                                                ;#    EXTENSION.
                                                ;#

027622  005046                        $CONV:  CLR     -(SP)           ;CLEAR WORD 3 OF A
027624  016646  000006                        MOV     6(SP),-(SP)     ;MOVE WORD 2 OF A
027630  016646  000006                        MOV     6(SP),-(SP)     ;MOVE WORD 1 OF A
027634  016646  000006                        MOV     6(SP),-(SP)     ;MOVE RETURN ADDR TO TOP
027640  016666  000020  000014                MOV     20(SP),14(SP)   ;MOVE WORD 2 OF B
027646  016666  000016  000012                MOV     16(SP),12(SP)   ;MOVE WORD 1 OF B
027654  005066  000020                        CLR     20(SP)          ;CLEAR WORD 4 OF B
027660  005066  000016                        CLR     16(SP)          ;CLEAR WORD 3 OF B
027664  005066  000010                        CLR     10(SP)          ;CLEAR WORD 4 OF A
027670  000207                              RTS     PC              ;
```

```
                                .SBTTL  SCOPE HANDLER ROUTINE

                                ;;*****************************************************************
                                ;*THIS ROUTINE CONTROLS THE LOOPING OF SUBTESTS. IT WILL INCREMENT
                                ;*AND LOAD THE TEST NUMBER(STSTNM) INTO THE DISPLAY REG.(DISPLAY<15:0>)
                                ;*THE SWITCH OPTIONS PROVIDED BY THIS ROUTINE ARE:
                                ;*SW14=1         LOOP ON TEST
                                ;*SW11=1         INHIBIT ITERATIONS
                                ;*SW09=1         LOOP ON ERROR
                                ;*SW08=1         LOOP ON TEST IN "SLPTST"
                                ;*CALL
                                ;*      SCOPE           ;;SCOPE=IOT

027672                          $SCOPE:
027672                          64$:
027672  032777  040000  151244  1$:     BIT     #BIT14,@SWR     ;;LOOP ON PRESENT TEST?
027700  001114                          BNE     $OVER           ;;YES IF SW14=1
                                ;*****START OF CODE FOR THE XOR TESTER*****
027702  000416                  $XTSTR: BR      6$              ;;IF RUNNING ON THE "XOR" TESTER CHANGE
                                                                ;;THIS INSTRUCTION TO A "NOP" (NOP=240)
027704  013746  000004                  MOV     @#ERRVEC,-(SP)  ;;SAVE THE CONTENTS OF THE ERROR VECTOR
027710  012737  027730  000004          MOV     #5$,@#ERRVEC    ;;SET FOR TIMEOUT
027716  005737  177060                  TST     @#177060        ;;TIME OUT ON XOR?
027722  012637  000004                  MOV     (SP)+,@#ERRVEC  ;;RESTORE THE ERROR VECTOR
027726  000463                          BR      $SVLAD          ;;GO TO THE NEXT TEST
027730  022626                  5$:     CMP     (SP)+,(SP)+     ;;CLEAR THE STACK AFTER A TIME OUT
027732  012637  000004                  MOV     (SP)+,@#ERRVEC  ;;RESTORE THE ERROR VECTOR
027736  000423                          BR      7$              ;;LOOP ON THE PRESENT TEST
027740                          6$:;*****END OF CODE FOR THE XOR TESTER*****
027740  032777  000400  151176          BIT     #BIT08,@SWR     ;;LOOP ON SPEC. TEST?
027746  001404                          BEQ     2$              ;;BR IF NO
027750  023737  001150  001102          CMP     $LPTST,$TSTNM   ;;ON THE RIGHT TEST?
027756  001465                          BEQ     $OVER           ;;BR IF YES
027760  005737  001104          2$:     TST     $ERFLG          ;;HAS AN ERROR OCCURRED?
027764  001421                          BEQ     3$              ;;BR IF NO
027766  023737  001120  001104          CMP     $ERMAX,$ERFLG   ;;MAX. ERRORS FOR THIS TEST OCCURRED?
027774  101015                          BHI     3$              ;;BR IF NO
027776  032777  001000  151140          BIT     #BIT09,@SWR     ;;LOOP ON ERROR?
030004  001404                          BEQ     4$              ;;BR IF NO
030006  013737  001112  001110  7$:     MOV     $LPERR,$LPADR   ;;SET LOOP ADDRESS TO LAST SCOPE
030014  000446                          BR      $OVER
030016  005037  001104          4$:     CLR     $ERFLG          ;;ZERO THE ERROR FLAG
030022  005037  001166                  CLR     $TIMES          ;;CLEAR THE NUMBER OF ITERATIONS TO MAKE
030026  000415                          BR      1$              ;;ESCAPE TO THE NEXT TEST
030030  032777  004000  151106  3$:     BIT     #BIT11,@SWR     ;;INHIBIT ITERATIONS?
030036  001011                          BNE     1$              ;;BR IF YES
030040  005737  001210                  TST     $PASS           ;;IF FIRST PASS OF PROGRAM
030044  001406                          BEQ     1$              ;;      INHIBIT ITERATIONS
030046  005237  001106                  INC     $ICNT           ;;INCREMENT ITERATION COUNT
030052  023737  001166  001106          CMP     $TIMES,$ICNT    ;;CHECK THE NUMBER OF ITERATIONS MADE
030060  002024                          BGE     $OVER           ;;BR IF MORE ITERATION REQUIRED
030062  012737  000001  001106  1$:     MOV     #1,$ICNT        ;;REINITIALIZE THE ITERATION COUNTER
030070  013737  030146  001166          MOV     $MXCNT,$TIMES   ;;SET NUMBER OF ITERATIONS TO DO
030076  005237  001102          $SVLAD: INC     $TSTNM          ;;COUNT TEST NUMBERS
030102  013737  001102  001206          MOV     $TSTNM,$TESTN   ;;SET TEST NUMBER IN APT MAILBOX
030110  011637  001110                  MOV     (SP),$LPADR     ;;SAVE SCOPE LOOP ADDRESS
```

```
 4549  030114  011637  001112                 MOV     (SP),$LPERR     ;;SAVE ERROR LOOP ADDRESS
 4550  030120  005037  001170                 CLR     $ESCAPE         ;;CLEAR THE ESCAPE FROM ERROR ADDRESS
 4551  030124  012737  000001  001120         MOV     #1,$ERMAX       ;;ONLY ALLOW ONE(1) ERROR ON NEXT TEST
 4552  030132  013777  001102  151006 $OVER:  MOV     $TSTNM,@DISPLAY ;;DISPLAY TEST NUMBER
 4553  030140  013716  001110                 MOV     $LPADR,(SP)     ;;FUDGE RETURN ADDRESS
 4554  030144  000002                         RTI                     ;;FIXES PS
 4555  030146  000400         $MXCNT: 400                             ;;MAX. NUMBER OF ITERATIONS
```

```
                                .SBTTL  ERROR HANDLER ROUTINE

                                ;;**********************************************************************
                                ;*THIS ROUTINE WILL INCREMENT THE ERROR FLAG AND THE ERROR COUNT,
                                ;*SAVE THE ERROR ITEM NO. IN R0 AND THE ADDRESS OF THE ERROR CALL
                                ;*AND GO TO $TYPERR ON ERROR
                                ;*THE SWITCH OPTIONS PROVIDED BY THIS ROUTINE ARE:
                                ;*SW15=1         HALT ON ERROR
                                ;*SW13=1         INHIBIT ERROR TYPEOUTS
                                ;*SW10=1         BELL ON ERROR
                                ;*SW09=1         LOOP ON ERROR
                                ;*CALL
                                ;*      ERROR   N       ;;ERROR=EMT AND N=ERROR ITEM NUMBER

030150                          $ERROR:
030150  010037  002602                  MOV     R0,EREG0        ; DISPLAY R0
030154  010137  002604                  MOV     R1,EREG1        ;         R1
030160  010237  002606                  MOV     R2,EREG2        ;         R2
030164  010337  002610                  MOV     R3,EREG3        ;         R3
030170  010437  002612                  MOV     R4,EREG4        ;         R4
030174  010537  002614                  MOV     R5,EREG5        ;         R5
030200  010637  002616                  MOV     R6,EREG6        ; GET R6(SP) BEFORE TRAP
030204  062737  000004  002616          ADD     #4,EREG6        ;
030212  011637  002620                  MOV     (SP),EREG7      ; PC -> ERROR CALL INSTR
030216  005237  001104          7$:     INC     $ERFLG          ;;SET THE ERROR FLAG
030222  001775                  1$:     BEQ     7$              ;;DON'T LET THE FLAG GO TO ZERO
030224  013777  001102  150714          MOV     $TSTNM,@DISPLAY ;;DISPLAY TEST NUMBER
030232  032777  002000  150704          BIT     #BIT10,@#SWR    ;;BELL ON ERROR?
030240  001402                  1$:     BEQ     1$              ;;NO - SKIP
030242  104401  001172                  TYPE    ,$BELL          ;;RING BELL
030246  005237  001114          1$:     INC     $ERTTL          ;;COUNT THE NUMBER OF ERRORS
030252  011637  001122                  MOV     (SP),$ERRPC     ;;GET ADDRESS OF ERROR INSTRUCTION
030256  162737  000002  001122          SUB     #2,$ERRPC       ;
030264  117737  150632  001116          MOVB    @$ERRPC,$ITEMB  ;;STRIP AND SAVE THE ERROR ITEM CODE
030272  032777  020000  150644          BIT     #BIT13,@#SWR    ;;SKIP TYPEOUT IF SET
030300  001004                  BNE     20$             ;;SKIP TYPEOUTS
030302  004737  030412                  JSR     PC,$TYPERR      ;;GO TO USER ERROR ROUTINE
030306  104401  001177                  TYPE    ,$CRLF          ;
030312                          20$:
030312  122737  000001  001222          CMPB    #APTENV,$ENV    ;;RUNNING IN APT MODE
030320  001007                  BNE     2$              ;;NO,SKIP APT ERROR REPORT
030322  113737  001116  030334          MOVB    $ITEMB,21$      ;;SET ITEM NUMBER AS ERROR NUMBER
030330  004737  031152                  JSR     PC,$ATY4        ;;REPORT FATAL ERROR TO APT
030334  000             21$:    .BYTE   0
030335  000                     .BYTE   0
030336  000777          22$:    BR      22$             ;;APT ERROR LOOP
030340  005777  150600          2$:     TST     @#SWR           ;;HALT ON ERROR
030344  100001                  BPL     3$              ;;SKIP IF CONTINUE
030346  000000                  HALT                    ;;HALT ON ERROR!
030350  032777  001000  150566  3$:     BIT     #BIT09,@#SWR    ;;LOOP ON ERROR SWITCH SET?
030356  001402                  BEQ     4$              ;;BR IF NO
030360  013716  001112                  MOV     $LPERR,(SP)     ;;FUDGE RETURN FOR LOOPING
030364  005737  001170          4$:     TST     $ESCAPE         ;;CHECK FOR AN ESCAPE ADDRESS
030370  001402                  BEQ     5$              ;;BR IF NONE
030372  013716  001170                  MOV     $ESCAPE,(SP)    ;;FUDGE RETURN ADDRESS FOR ESCAPE
030376                          5$:
```

```
 #612  030376  022737  022106  000042          CMP     @#ERRPAD,#42    ;;ACT-11 AUTO-ACCEPT?
 #613  030404  001001                          BNE     6$              ;;BRANCH IF NO
 #614  030406  000000                          HALT                    ;;YES
 #615  030410                          6$:
 #616  030410  000002                  64$:    RTI                     ;RETURN
```

```
                                ;;*****************************************************************

                                .SBTTL  ERROR MESSAGE TYPEOUT ROUTINE (MODIFIED SYSMAC)

                                ;*THIS ROUTINE USES THE "ITEM CONTROL BYTE" ($ITEMB) TO DETERMINE WHICH
                                ;*ERROR IS TO BE REPORTED.  IT THEN OBTAINS, FROM THE "ERROR TABLE",
                                ;*($ERRTB) THE ERROR MESSAGE, DATA HEADER, AND DATA VALUES TO PRINT.
                                ;*      FORMAT:         W1:     PTR TO ASCIZ ERROR MESSAGE, 0 IF NONE
                                ;*                      W2:     PTR TO ASCIZ DATA HEADER, 0 IF NONE
                                ;*                      W3:     PTR TO DATA VALUES ADDR LIST, 0 IF NONE
                                ;*                      W4-W9:  PTR TO OPERAND VALUES ADDR LIST, 0 IF NONE
                                ;*                      W10:    ALWAYS 0
                                ;*
                                ;*                      DATA VALUES LIST FORMAT:
                                ;*                              A VARIABLE LENGTH LIST OF POINTERS TO
                                ;*                              WORDS TO PRINT AS 6 OCTAL DIGITS.  LIST
                                ;*                              MUST BE TERMINATED BY A ZERO WORD.
                                ;*
                                ;*                      OPERAND VALUES LIST FORMAT:
                                ;*                              FIRST WORD IS ADDRESS OF ASCIZ MESSAGE TO
                                ;*                              PRINT AT START OF LINE; REST OF LIST IS
                                ;*                              IN SAME FORMAT AS DATA VALUES LAST

030412                          $TYPERR:
                                        TYPE                    ;START WITH MESSAGE PREFIX, HOT OR WARM
030412  104401                 HOTWRM: .WORD   $CRLF            ;PTR TO "HOT" OR "WARM"
030414  001177                 
030416  010046                         MOV     R0,-(SP)        ;SAVE R0
030420  010146                         MOV     R1,-(SP)        ;SAVE R1
030422  005000                         CLR     R0              ;PICKUP ITEM INDEX
030424  153700  001116                 BISB    @#$ITEMB,R0     ;
030430  001004                         BNE     1$              ;IF ITEM NUMBER FROM ERROR 0,
                                                                ;  JUST TYPE PC OF ERROR
030432  013746  001122                 MOV     $ERRPC,-(SP)    ;GET ERROR PC FOR TYPEOUT
030436  104402                         TYPOC                   ;TYPE OCTAL, ALL DIGITS
030440  000454                         BR      7$              ;EXIT
030442  005300                 1$:     DEC     R0              ;ADJUST ERROR # FOR TABLE INDEX
030444  006300                         ASL     R0              ;  OF 20. BYTES/ENTRY
030446  006300                         ASL     R0              ;
030450  010001                         MOV     R0,R1           ;
030452  006300                         ASL     R0              ;
030454  006300                         ASL     R0              ;
030456  060100                         ADD     R1,R0           ;
030460  062700  001232                 ADD     #$ERRTB,R0      ;FORM TABLE PTR
030464  012037  030474                 MOV     (R0)+,2$        ;PICKUP "ERROR MESSAGE" PTR
030470  001404                         BEQ     3$              ;SKIP TYPEOUT IF NULL
030472  104401                         TYPE                    ;TYPE "ERROR MESSAGE"
030474  000000                 2$:     .WORD   0               ;"ERROR MESSAGE" PTR HERE
030476  104401  001177                 TYPE    ,$CRLF          ;CR & LF
030502  104401  030632         3$:     TYPE    ,11$            ;"TEST #    ERR PC" HEADER
030506  012037  030516                 MOV     (R0)+,4$        ;PICKUP "DATA HEADER" PTR
030512  001402                         BEQ     5$              ;SKIP TYPEOUT IF NULL
030514  104401                         TYPE                    ;TYPE "DATA HEADER"
030516  000000                 4$:     .WORD   0               ;"DATA HEADER" PTR HERE
030520  104401  001177         5$:     TYPE    ,$CRLF          ;CR & LF
030524  017746  000074                 MOV     @8$,-(SP)       ;($TESTN)
```

```
4673  030530  104402                        TYPOC                   ;OCTAL W/ LEADING ZEROS
4674  030532  104401  030630                TYPE    10$             ;<HT>
4675  030536  017746  000064                MOV     @9$,-(SP)       ;($ERRPC)
4676  030542  104402                        TYPOC                   ;OCTAL W/ LEADING ZEROS
4677  030544  104401  030630                TYPE    10$             ;<HT>
4678  030550  012001                        MOV     (R0)+,R1        ;PICKUP "DATA TABLE" PTR
4679  030552  001407                        BEQ     7$              ;EXIT IF NULL
4680  030554  013146              6$:       MOV     @(R1)+,-(SP)    ;SAVE ... FOR TYPEOUT
4681  030556  104402                        TYPOC                   ;TYPE OCTAL, ALL DIGITS
4682  030560  005711              14$:      TST     (R1)            ;ANOTHER NUMBER ?
4683  030562  001403                        BEQ     7$              ;NO - EXIT
4684  030564  104401  030630                TYPE    10$             ;TAB BETWEEN ELEMENTS
4685  030570  000771                        BR      6$              ;LOOP ON DATA TABLE VECTOR
4686  030572  104401  001177        7$:     TYPE    $CRLF           ;END THE LINE
4687  030576  012001                        MOV     (R0)+,R1        ;GET OPERAND LIST PTR
4688  030600  001406                        BEQ     15$             ;ALL DONE
4689  030602  012137  030612                MOV     (R1)+,12$       ;OPERAND TITLE
4690  030606  001402                        BEQ     13$             ;SKIP IF ZERO
4691  030610  104401                        TYPE                    ;TYPE IT
4692  030612  000000              12$:      .WORD   0               ;FROM HERE
4693  030614  000761              13$:      BR      14$             ;GO FINISH DATA LIST
4694  030616  012601              15$:      MOV     (SP)+,R1        ;RESTORE R1
4695  030620  012600                        MOV     (SP)+,R0        ;RESTORE R0
4696  030622  000207                        RTS     PC              ;RETURN
4697  030624  001206              8$:       .WORD   $TESTN          ;
4698  030626  001122              9$:       .WORD   $ERRPC          ;
4699  030630  000011              10$:      .ASCIZ  <11>            ;<HT>
4700  030632  042524  052123  021440  11$:      .ASCIZ  "TEST # ERR PC  "
4701  030640  042411  051122  050040
4702  030646  004503     000
4703          030652                        .EVEN
```

```
                                .SBTTL  TYPE ROUTINE

                                ;;*****************************************************************
                                ;*ROUTINE TO TYPE ASCIZ MESSAGE. MESSAGE MUST TERMINATE WITH A 0 BYTE.
                                ;*THE ROUTINE WILL INSERT A NUMBER OF NULL CHARACTERS AFTER A LINE FEED.
                                ;*NOTE1:         $NULL CONTAINS THE CHARACTER TO BE USED AS THE FILLER CHARACTER.
                                ;*NOTE2:         $FILLS CONTAINS THE NUMBER OF FILLER CHARACTERS REQUIRED.
                                ;*NOTE3:         $FILLC CONTAINS THE CHARACTER TO FILL AFTER.
                                ;*
                                ;*CALL:
                                ;*1) USING A TRAP INSTRUCTION
                                ;*      TYPE    ,MESADR         ;;MESADR IS FIRST ADDRESS OF AN ASCIZ STRING
                                ;*OR
                                ;*      TYPE
                                ;*      MESADR
                                ;*

030652  105737  001165          $TYPE:  TSTB    $TPFLG          ;;IS THERE A TERMINAL?
030656  100002                          BPL     1$              ;;BR IF YES
030660  000000                          HALT                    ;;HALT HERE IF NO TERMINAL
030662  000430                          BR      3$              ;;LEAVE
030664  010046                  1$:     MOV     R0,-(SP)        ;;SAVE R0
030666  017600  000002                  MOV     2(SP),R0        ;;GET ADDRESS OF ASCIZ STRING
030672  122737  000001  001222          CMPB    #APTENV,$ENV    ;;RUNNING IN APT MODE
030700  001011                          BNE     6$              ;;NO,GO CHECK FOR APT CONSOLE
030702  132737  000100  001223          BITB    #APTSPOOL,$ENVM ;;SPOOL MESSAGE TO APT
030710  001405                          BEQ     6$              ;;NO,GO CHECK FOR CONSOLE
030712  010037  030722                  MOV     R0,61$          ;;SETUP MESSAGE ADDRESS FOR APT
030716  004737  031142                  JSR     PC,$ATY3        ;;SPOOL MESSAGE TO APT
030722  000000                  61$:    .WORD   0               ;;MESSAGE ADDRESS
030724  132737  000040  001223  6$:     BITB    #APTCSUP,$ENVM  ;;APT CONSOLE SUPPRESSED
030732  001003                          BNE     60$             ;;YES,SKIP TYPE OUT
030734  112046                  2$:     MOVB    (R0)+,-(SP)     ;;PUSH CHARACTER TO BE TYPED ONTO STACK
030736  001005                          BNE     4$              ;;BR IF IT ISN'T THE TERMINATOR
030740  005726                          TST     (SP)+           ;;IF TERMINATOR POP IT OFF THE STACK
030742  012600                  60$:    MOV     (SP)+,R0        ;;RESTORE R0
030744  062716  000002          3$:     ADD     #2,(SP)         ;;ADJUST RETURN PC
030750  000002                          RTI                     ;;RETURN
030752  122716  000011          4$:     CMPB    #HT,(SP)        ;;BRANCH IF <HT>
030756  001430                          BEQ     8$
030760  122716  000200                  CMPB    #CRLF,(SP)      ;;BRANCH IF NOT <CRLF>
030764  001006                          BNE     5$
030766  005726                          TST     (SP)+           ;;POP  <CR><LF> EQUIV
030770  104401                          TYPE                    ;;TYPE A CR AND LF
030772  001177                          $CRLF
030774  105037  031130                  CLRB    $CHARCNT        ;;CLEAR CHARACTER COUNT
031000  000755                          BR      2$              ;;GET NEXT CHARACTER
031002  004737  031064          5$:     JSR     PC,$TYPEC       ;;GO TYPE THIS CHARACTER
031006  123726  001164          6$:     CMPB    $FILLC,(SP)+    ;;IS IT TIME FOR FILLER CHARS.?
031012  001350                          BNE     2$              ;;IF NO GO GET NEXT CHAR.
031014  013746  001162                  MOV     $NULL,-(SP)     ;;GET # OF FILLER CHARS. NEEDED
                                                                ;;AND THE NULL CHAR.
031020  105366  000001          7$:     DECB    1(SP)           ;;DOES A NULL NEED TO BE TYPED?
031024  002770                          BLT     6$              ;;BR IF NO--GO POP THE NULL OFF OF STACK
031026  004737  031064                  JSR     PC,$TYPEC       ;;GO TYPE A NULL
031032  105337  031130                  DECB    $CHARCNT        ;;DO NOT COUNT AS A COUNT
```

```
 4760  031036  000770                          BR      7$              ;;LOOP
 4761
 4762                                          ;HORIZONTAL TAB PROCESSOR
 4763
 4764  031040  112716  000040                  8$:     MOVB    #' ,(SP)        ;;REPLACE TAB WITH SPACE
 4765  031044  004737  031064                  9$:     JSR     PC,$TYPEC       ;;TYPE A SPACE
 4766  031050  132737  000007  031130                  BITB    #7,$CHARCNT     ;;BRANCH IF NOT AT
 4767  031056  001372                                  BNE     9$              ;;TAB STOP
 4768  031060  005726                                  TST     (SP)+           ;;POP SPACE OFF STACK
 4769  031062  000724                                  BR      2$              ;;GET NEXT CHARACTER
 4770  031064  105777  150066                  $TYPEC: TSTB    @$TPS           ;;WAIT UNTIL PRINTER IS READY
 4771  031070  100375                                  BPL     $TYPEC
 4772  031072  116677  000002  150060                  MOVB    2(SP),@$TPB     ;;LOAD CHAR TO BE TYPED INTO DATA REG.
 4773  031100  122766  000015  000002                  CMPB    #CR,2(SP)       ;;IS CHARACTER A CARRIAGE RETURN?
 4774  031106  001003                                  BNE     1$              ;;BRANCH IF NO
 4775  031110  105037  031130                          CLRB    $CHARCNT        ;;YES--CLEAR CHARACTER COUNT
 4776  031114  000406                                  BR      $TYPEX          ;;EXIT
 4777  031116  122766  000012  000002  1$:     CMPB    #LF,2(SP)       ;;IS CHARACTER A LINE FEED?
 4778  031124  001402                                  BEQ     $TYPEX          ;;BRANCH IF YES
 4779  031126  105227                                  INCB    (PC)+           ;;COUNT THE CHARACTER
 4780  031130  000000                  $CHARCNT:.WORD  0               ;;CHARACTER COUNT STORAGE
 4781  031132  000207                  $TYPEX: RTS     PC
 4782
```

```
                                        .SBTTL  APT COMMUNICATIONS ROUTINE
                                        ;;*****************************************************************
031134  112737  000001  031400  $ATY1:  MOVB    #1,$FFLG        ;;TO REPORT FATAL ERROR
031142  112737  000001  031376  $ATY3:  MOVB    #1,$MFLG        ;;TO TYPE A MESSAGE
031150  000403                  BR      $ATYC
031152  112737  000001  031400  $ATY4:  MOVB    #1,$FFLG        ;;TO ONLY REPORT FATAL ERROR
031160                          $ATYC:
031160  010046                  MOV     R0,-(SP)        ;;PUSH R0 ON STACK
031162  010146                  MOV     R1,-(SP)        ;;PUSH R1 ON STACK
031164  105737  031376          TSTB    $MFLG           ;;SHOULD TYPE A MESSAGE?
031170  001450                  BEQ     5$              ;;IF NOT:  BR
031172  122737  000001  001222  CMPB    #APTENV,$ENV    ;;OPERATING UNDER APT?
031200  001031                  BNE     3$              ;;IF NOT:  BR
031202  132737  000100  001223  BITB    #APTSPOOL,$ENVM ;;SHOULD SPOOL MESSAGES?
031210  001425                  BEQ     3$              ;;IF NOT:  BR
031212  017600  000004          MOV     @4(SP),R0       ;;GET MESSAGE ADDR.
031216  062766  000002  000004  ADD     #2,4(SP)                ;;BUMP RETURN ADDR.
031224  005737  001202          1$:     TST     $MSGTYPE        ;;SEE IF DONE W/ LAST XMISSION?
031230  001375                  BNE     1$              ;;IF NOT:  WAIT
031232  010037  001216          MOV     R0,$MSGAD       ;;PUT ADDR IN MAILBOX
031236  105720                  2$:     TSTB    (R0)+           ;;FIND END OF MESSAGE
031240  001376                  BNE     2$
031242  163700  001216          SUB     $MSGAD,R0       ;;SUB START OF MESSAGE
031246  006200                  ASR     R0              ;;GET MESSAGE LNGTH IN WORDS
031250  010037  001220          MOV     R0,$MSGLGT      ;;PUT LENGTH IN MAILBOX
031254  012737  000004  001202  MOV     #4,$MSGTYPE     ;;TELL APT TO TAKE MSG.
031262  000413                  BR      5$
031264  017637  000004  031310  3$:     MOV     @4(SP),4$       ;;PUT MSG ADDR IN JSR LINKAGE
031272  062766  000002  000004  ADD     #2,4(SP)                ;;BUMP RETURN ADDRESS
031300  013746  177776          MOV     177776,-(SP)    ;;PUSH 177776 ON STACK
031304  004737  030652          JSR     PC,$TYPE        ;;CALL TYPE MACRO
031310  000000                  4$:     .WORD   0
031312                          5$:
031312  105737  031400          10$:    TSTB    $FFLG           ;;SHOULD REPORT FATAL ERROR?
031316  001416                  BEQ     12$             ;;IF NOT:  BR
031320  005737  001222          TST     $ENV            ;;RUNNING UNDER APT?
031324  001413                  BEQ     12$             ;;IF NOT:  BR
031326  005737  001202          11$:    TST     $MSGTYPE        ;;FINISHED LAST MESSAGE?
031332  001375                  BNE     11$             ;;IF NOT:  WAIT
031334  017637  000004  001204  MOV     @4(SP),$FATAL   ;;GET ERROR #
031342  062766  000002  000004  ADD     #2,4(SP)                ;;BUMP RETURN ADDR.
031350  005237  001202          INC     $MSGTYPE        ;;TELL APT TO TAKE ERROR
031354  105037  031400          12$:    CLRB    $FFLG           ;;CLEAR FATAL FLAG
031360  105037  031377          CLRB    $LFLG           ;;CLEAR LOG FLAG
031364  105037  031376          CLRB    $MFLG           ;;CLEAR MESSAGE FLAG
031370  012601                  MOV     (SP)+,R1        ;;POP STACK INTO R1
031372  012600                  MOV     (SP)+,R0        ;;POP STACK INTO R0
031374  000207                  RTS     PC              ;;RETURN
031376     000          $MFLG:  .BYTE   0               ;;MESSG. FLAG
031377     000          $LFLG:  .BYTE   0               ;;LOG FLAG
031400     000          $FFLG:  .BYTE   0               ;;FATAL FLAG
031402                          .EVEN
000200                  APTSIZE=200
000001                  APTENV=001
000100                  APTSPOOL=100
```

```
 4839          000040                  APTCSUP=040
```

```
                                .SBTTL  BINARY TO OCTAL (ASCII) AND TYPE

                                ;;*****************************************************************
                                ;*THIS ROUTINE IS USED TO CHANGE A 16-BIT BINARY NUMBER TO A 6-DIGIT
                                ;*OCTAL (ASCII) NUMBER AND TYPE IT.
                                ;*$TYPOS---ENTER HERE TO SETUP SUPPRESS ZEROS AND NUMBER OF DIGITS TO TYPE
                                ;*CALL:
                                ;*      MOV     NUM,-(SP)       ;;NUMBER TO BE TYPED
                                ;*      TYPOS                   ;;CALL FOR TYPEOUT
                                ;*      .BYTE   N               ;;N=1 TO 6 FOR NUMBER OF DIGITS TO TYPE
                                ;*      .BYTE   M               ;;M=1 OR 0
                                ;*                                      ;;1=TYPE LEADING ZEROS
                                ;*                                      ;;0=SUPPRESS LEADING ZEROS
                                ;*
                                ;*$TYPON----ENTER HERE TO TYPE OUT WITH THE SAME PARAMETERS AS THE LAST
                                ;*$TYPOS OR $TYPOC
                                ;*CALL:
                                ;*      MOV     NUM,-(SP)       ;;NUMBER TO BE TYPED
                                ;*      TYPON                   ;;CALL FOR TYPEOUT
                                ;*
                                ;*$TYPOC---ENTER HERE FOR TYPEOUT OF A 16 BIT NUMBER
                                ;*CALL:
                                ;*      MOV     NUM,-(SP)       ;;NUMBER TO BE TYPED
                                ;*      TYPOC                   ;;CALL FOR TYPEOUT

031402  017646  000000        $TYPOS: MOV     @(SP),-(SP)     ;;PICKUP THE MODE
031406  116637  000001  031625        MOVB    1(SP),$OFILL    ;;LOAD ZERO FILL SWITCH
031414  112637  031627                MOVB    (SP)+,$OMODE+1  ;;NUMBER OF DIGITS TO TYPE
031420  062716  000002                ADD     #2,(SP)         ;;ADJUST RETURN ADDRESS
031424  000406                        BR      $TYPON
031426  112737  000001  031625 $TYPOC: MOVB    #1,$OFILL       ;;SET THE ZERO FILL SWITCH
031434  112737  000006  031627        MOVB    #6,$OMODE+1     ;;SET FOR SIX(6) DIGITS
031442  112737  000005  031624 $TYPON: MOVB    #5,$OCNT        ;;SET THE ITERATION COUNT
031450  010346                        MOV     R3,-(SP)        ;;SAVE R3
031452  010446                        MOV     R4,-(SP)        ;;SAVE R4
031454  010546                        MOV     R5,-(SP)        ;;SAVE R5
031456  113704  031627                MOVB    $OMODE+1,R4     ;;GET THE NUMBER OF DIGITS TO TYPE
031462  005404                        NEG     R4
031464  062704  000006                ADD     #6,R4           ;;SUBTRACT IT FOR MAX. ALLOWED
031470  110437  031626                MOVB    R4,$OMODE       ;;SAVE IT FOR USE
031474  113704  031625                MOVB    $OFILL,R4       ;;GET THE ZERO FILL SWITCH
031500  016605  000012                MOV     12(SP),R5       ;;PICKUP THE INPUT NUMBER
031504  005003                        CLR     R3              ;;CLEAR THE OUTPUT WORD
031506  006105                1$:     ROL     R5              ;;ROTATE MSB INTO "C"
031510  000404                        BR      3$              ;;GO DO MSB
031512  006105                2$:     ROL     R5              ;;FORM THIS DIGIT
031514  006105                        ROL     R5
031516  006105                        ROL     R5
031520  010503                        MOV     R5,R3
031522  006103                3$:     ROL     R3              ;;GET LSB OF THIS DIGIT
031524  105337  031626                DECB    $OMODE          ;;TYPE THIS DIGIT?
031530  100016                        BPL     7$              ;;BR IF NO
031532  042703  177770                BIC     #177770,R3      ;;GET RID OF JUNK
031536  001002                        BNE     4$              ;;TEST FOR 0
031540  005704                        TST     R4              ;;SUPPRESS THIS 0?
031542  001403                        BEQ     5$              ;;BR IF YES
```

```
4896  031544  005204                 4$:     INC     R4              ;;DON'T SUPPRESS ANYMORE 0'S
4897  031546  052703  000060                 BIS     #'0,R3          ;;MAKE THIS DIGIT ASCII
4898  031552  052703  000040         5$:     BIS     #' ,R3          ;;MAKE ASCII IF NOT ALREADY
4899  031556  110337  031622                 MOVB    R3,8$           ;;SAVE FOR TYPING
4900  031562  104401  031622                 TYPE    ,8$             ;;GO TYPE THIS DIGIT
4901  031566  105337  031624         7$:     DECB    $OCNT           ;;COUNT BY 1
4902  031572  003347                 BGT     2$              ;;BR IF MORE TO DO
4903  031574  002402                 BLT     6$              ;;BR IF DONE
4904  031576  005204                 INC     R4              ;;INSURE LAST DIGIT ISN'T A BLANK
4905  031600  000744                 BR      2$              ;;GO DO THE LAST DIGIT
4906  031602  012605         6$:     MOV     (SP)+,R5        ;;RESTORE R5
4907  031604  012604                 MOV     (SP)+,R4        ;;RESTORE R4
4908  031606  012603                 MOV     (SP)+,R3        ;;RESTORE R3
4909  031610  016666  000002  000004        MOV     2(SP),4(SP)     ;;SET THE STACK FOR RETURNING
4910  031616  012616                 MOV     (SP)+,(SP)
4911  031620  000002                 RTI                     ;;RETURN
4912  031622     000          8$:     .BYTE   0               ;;STORAGE FOR ASCII DIGIT
4913  031623     000                  .BYTE   0               ;;TERMINATOR FOR TYPE ROUTINE
4914  031624     000          $OCNT:  .BYTE   0               ;;OCTAL DIGIT COUNTER
4915  031625     000          $OFILL: .BYTE   0               ;;ZERO FILL SWITCH
4916  031626  000000          $OMODE: .WORD   0               ;;NUMBER OF DIGITS TO TYPE
```

```
                                .SBTTL  TRAP DECODER

                                ;;*****************************************************************
                                ;*THIS ROUTINE WILL PICKUP THE LOWER BYTE OF THE "TRAP" INSTRUCTION
                                ;*AND USE IT TO INDEX THROUGH THE TRAP TABLE FOR THE STARTING ADDRESS
                                ;*OF THE DESIRED ROUTINE. THEN USING THE ADDRESS OBTAINED IT WILL
                                ;*GO TO THAT ROUTINE.

031630  010046                  $TRAP:  MOV     R0,-(SP)        ;;SAVE R0
031632  016600  000002                  MOV     2(SP),R0        ;;GET TRAP ADDRESS
031636  005740                          TST     -(R0)           ;;BACKUP BY 2
031640  111000                          MOVB    (R0),R0         ;;GET RIGHT BYTE OF TRAP
031642  006300                          ASL     R0              ;;POSITION FOR INDEXING
031644  016000  031664                  MOV     $TRPAD(R0),R0   ;;INDEX TO TABLE
031650  000200                          RTS     R0              ;;GO TO ROUTINE


                                ;;THIS IS USE TO HANDLE THE "GETPRI" MACRO

031652  011646                  $TRAP2: MOV     (SP),-(SP)      ;;MOVE THE PC DOWN
031654  016666  000004  000002          MOV     4(SP),2(SP)     ;;MOVE THE PSW DOWN
031662  000002                          RTI                     ;;RESTORE THE PSW

                                .SBTTL  TRAP TABLE

                                ;*THIS TABLE CONTAINS THE STARTING ADDRESSES OF THE ROUTINES CALLED
                                ;*BY THE "TRAP" INSTRUCTION.

                                ;       ROUTINE
                                ;       -------
031664  031652                  $TRPAD: .WORD   $TRAP2
031666  030652                          $TYPE   ;;CALL=TYPE     TRAP+1(104401)  TTY TYPEOUT ROUTINE
031670  031426                          $TYPOC  ;;CALL=TYPOC    TRAP+2(104402)  TYPE OCTAL NUMBER (WITH LEADING ZEROS)
031672  031402                          $TYPOS  ;;CALL=TYPOS    TRAP+3(104403)  TYPE OCTAL NUMBER (NO LEADING ZEROS)
031674  031442                          $TYPON  ;;CALL=TYPON    TRAP+4(104404)  TYPE OCTAL NUMBER (AS PER LAST CALL)
```

```
                                        .SBTTL  POWER DOWN AND UP ROUTINES
                                        ;;*****************************************************************
                                        ;POWER DOWN ROUTINE
031676  012737  032050  000024  $PWRDN: MOV     #$ILLUP,@#PWRVEC ;;SET FOR FAST UP
031704  012737  000340  000026          MOV     #340,@#PWRVEC+2  ;;PRIO:7
031712  010046                        MOV     R0,-(SP)         ;;PUSH R0 ON STACK
031714  010146                        MOV     R1,-(SP)         ;;PUSH R1 ON STACK
031716  010246                        MOV     R2,-(SP)         ;;PUSH R2 ON STACK
031720  010346                        MOV     R3,-(SP)         ;;PUSH R3 ON STACK
031722  010446                        MOV     R4,-(SP)         ;;PUSH R4 ON STACK
031724  010546                        MOV     R5,-(SP)         ;;PUSH R5 ON STACK
031726  017746  147212                MOV     @SWR,-(SP)       ;;PUSH @SWR ON STACK
031732  010637  032054                MOV     SP,$SAVR6        ;;SAVE SP
031736  012737  031750  000024        MOV     #$PWRUP,@#PWRVEC ;;SET UP VECTOR
031744  000000                        HALT
031746  000776                        BR      .-2              ;;HANG UP
                                        ;;*****************************************************************
                                        ;POWER UP ROUTINE
031750  012737  032050  000024  $PWRUP: MOV     #$ILLUP,@#PWRVEC ;;SET FOR FAST DOWN
031756  013706  032054                MOV     $SAVR6,SP        ;;GET SP
031762  005037  032054                CLR     $SAVR6           ;;WAIT LOOP FOR THE TTY
031766  005237  032054          1$:   INC     $SAVR6           ;;WAIT FOR THE INC
031772  001375                        BNE     1$               ;;OF  WORD
031774  011600                        MOV     (SP),R0          ;GET SAVED SWR OFF STACK
031776  076600  000226                MFD     226              ;RESTORE SWR CONTENTS
032002  012677  147136                MOV     (SP)+,@SWR       ;;POP STACK INTO @SWR
032006  012605                        MOV     (SP)+,R5         ;;POP STACK INTO R5
032010  012604                        MOV     (SP)+,R4         ;;POP STACK INTO R4
032012  012603                        MOV     (SP)+,R3         ;;POP STACK INTO R3
032014  012602                        MOV     (SP)+,R2         ;;POP STACK INTO R2
032016  012601                        MOV     (SP)+,R1         ;;POP STACK INTO R1
032020  012600                        MOV     (SP)+,R0         ;;POP STACK INTO R0
032022  012737  031676  000024        MOV     #$PWRDN,@#PWRVEC ;;SET UP THE POWER DOWN VECTOR
032030  012737  000340  000026        MOV     #340,@#PWRVEC+2  ;;PRIO:7
032036  104401                        TYPE                     ;REPORT THE POWER FAILURE
032040  032056                $PWRMG: .WORD   $POWER           ;;POWER FAIL MESSAGE POINTER
032042  012716                        MOV     (PC)+,(SP)       ;;RESTART AT START
032044  003000                $PWRAD: .WORD   START            ;;RESTART ADDRESS
032046  000002                        RTI
032050  000000                $ILLUP: HALT                     ;;THE POWER UP SEQUENCE WAS STARTED
032052  000776                        BR      .-2              ;;  BEFORE THE POWER DOWN WAS COMPLETE
032054  000000                $SAVR6: 0                        ;;PUT THE SP HERE
032056  005015  047520  042527  $POWER: .ASCIZ  <15><12>"POWER"
032064  000122
                                        .EVEN
```

```
                                        .SBTTL  ERROR MESSAGES, DATA HEADERS, DATA VECTORS, OPERAND VECTORS, ETC

                                        ;MESSAGE PREFIX
032066  047510  035124  000040  ASCHOT: .ASCIZ  "HOT: "
032074  040527  046522  020072  ASCWRM: .ASCIZ  "WARM: "
032102     000

                                        ;ERROR MESSAGES HERE
032103     106  046455  042117  EMA:    .ASCIZ  "F-MODE EXERCISER - FPS ERROR"
032110  020105  054105  051105
032116  044503  042523  020122
032124  020055  050106  020123
032132  051105  047522  000122
032140  026504  047515  042504  EMB:    .ASCIZ  "D-MODE EXERCISER - FPS ERROR"
032146  042440  042530  041522
032154  051511  051105  026440
032162  043040  051520  042440
032170  051122  051117     000
032175     106  046455  042117  EMC:    .ASCIZ  "F-MODE EXERCISER - RESULT ERROR"
032202  020105  054105  051105
032210  044503  042523  020122
032216  020055  042522  052523
032224  052114  042440  051122
032232  051117     000
032235     104  046455  042117  EMD:    .ASCIZ  "D-MODE EXERCISER - RESULT ERROR"
032242  020105  054105  051105
032250  044503  042523  020122
032256  020055  042522  052523
032264  052114  042440  051122
032272  051117     000
032275     101  042104  043050  EME:    .ASCIZ  "ADD(F/D) - RESULT ERROR"
032302  042057  020051  020055
032310  042522  052523  052114
032316  042440  051122  051117
032324     000
032325     123  041125  043050  EMF:    .ASCIZ  "SUB(F/D) - RESULT ERROR"
032332  042057  020051  020055
032340  042522  052523  052114
032346  042440  051122  051117
032354     000
032355     115  046125  043050  EMG:    .ASCIZ  "MUL(F/D) - RESULT ERROR"
032362  042057  020051  020055
032370  042522  052523  052114
032376  042440  051122  051117
032404     000
032405     104  053111  043050  EMH:    .ASCIZ  "DIV(F/D) - RESULT ERROR"
032412  042057  020051  020055
032420  042522  052523  052114
032426  042440  051122  051117
032434     000
032435     125  042516  050130  EMI:    .ASCIZ  "UNEXPECTED FLOATING POINT TRAP, IGNORED AND CONTINUING"
032442  041505  042524  020104
032450  046106  040517  044524
032456  043516  050040  044517
032464  052116  052040  040522
032472  026120  044440  047107
```

```
5057  032500  051117  042105  040440
5058  032506  042116  041440  047117
5059  032514  044524  052516  047111
5060  032522  000107
5061  032524  042101  043104  026440  EMJ:    .ASCIZ  "ADDF - FPS ERROR"
5062  032532  043040  051520  042440
5063  032540  051122  051117     000
5064  032546     123  041125  020106  EMK:    .ASCIZ  "SUBF - FPS ERROR"
5065  032554  020055  050106  020123
5066  032562  051105  047522  000122
5067  032566  052515  043114  026440  EML:    .ASCIZ  "MULF - FPS ERROR"
5068  032574  043040  051520  042440
5069  032602  051122  051117     000
5070  032607     104  053111  020106  EMM:    .ASCIZ  "DIVF - FPS ERROR"
5071  032614  020055  050106  020123
5072  032622  051105  047522  000122
5073  032630  042101  042104  026440  EMN:    .ASCIZ  "ADDD - FPS ERROR"
5074  032636  043040  051520  042440
5075  032644  051122  051117     000
5076  032651     123  041125  020104  EMO:    .ASCIZ  "SUBD - FPS ERROR"
5077  032656  020055  050106  020123
5078  032664  051105  047522  000122
5079  032672  052515  042114  026440  EMP:    .ASCIZ  "MULD - FPS ERROR"
5080  032700  043040  051520  042440
5081  032706  051122  051117     000
5082  032713     104  053111  020104  EMQ:    .ASCIZ  "DIVD - FPS ERROR"
5083  032720  020055  050106  020123
5084  032726  051105  047522  000122
5085  032734  042101  043104  026440  EMR:    .ASCIZ  "ADDF - FEC/FEA ERROR"
5086  032742  043040  041505  043057
5087  032750  040505  042440  051122
5088  032756  051117     000
5089  032761     123  041125  020106  EMS:    .ASCIZ  "SUBF - FEC/FEA ERROR"
5090  032766  020055  042506  027503
5091  032774  042506  020101  051105
5092  033002  047522  000122
5093  033006  052515  043114  026440  EMT:    .ASCIZ  "MULF - FEC/FEA ERROR"
5094  033014  043040  041505  043057
5095  033022  040505  042440  051122
5096  033030  051117     000
5097  033033     104  053111  020106  EMU:    .ASCIZ  "DIVF - FEC/FEA ERROR"
5098  033040  020055  042506  027503
5099  033046  042506  020101  051105
5100  033054  047522  000122
5101  033060  042101  042104  026440  EMV:    .ASCIZ  "ADDD - FEC/FEA ERROR"
5102  033066  043040  041505  043057
5103  033074  040505  042440  051122
5104  033102  051117     000
5105  033105     123  041125  020104  EMW:    .ASCIZ  "SUBD - FEC/FEA ERROR"
5106  033112  020055  042506  027503
5107  033120  042506  020101  051105
5108  033126  047522  000122
5109  033132  052515  042114  026440  EMX:    .ASCIZ  "MULD - FEC/FEA ERROR"
5110  033140  043040  041505  043057
5111  033146  040505  042440  051122
5112  033154  051117     000
```

```
5113  033157  000104  053111  020104  EMY:    .ASCIZ  "DIVD - FEC/FEA ERROR"
5114  033164  020055  042506  027503
5115  033172  042506  020101  051105
5116  033200  047522  000122
5117
5118
5119                                  ;DATA HEADERS HERE
5120  033204  054105  023520  004504  DMA:    .ASCIZ  "EXP'D  RCV'D"
5121  033212  041522  023524  000104
5122  033220  026455  042455  050130  DMB:    .ASCIZ  "---EXPECTED--- ---RECEIVED---"
5123  033226  041505  042524  026504
5124  033234  026455  026411  026455
5125  033242  042520  042503  053111
5126  033250  042105  026455  000055
5127  033256  026455  026455  026455  DMC:    .ASCIZ  "----------EXPECTED---------- ----------RECEIVED----------"
5128  033264  026455  026455  042455
5129  033272  050130  041505  042524
5130  033300  026504  026455  026455
5131  033306  026455  026455  026455
5132  033314  026411  026455  026455
5133  033322  026455  026455  026455
5134  033330  042522  042503  053111
5135  033336  042105  026455  026455
5136  033344  026455  026455  026455
5137  033352  000055
5138  033354  046117  020104  041520  DMD:    .ASCIZ  "OLD PC OLD PS   FPS     FEC     FEA     $FPS    $FEC    $FEA"
5139  033362  047411  042114  050040
5140  033370  004523  043040  051520
5141  033376  020011  042506  004503
5142  033404  043040  040505  020011
5143  033412  043044  051520  020011
5144  033420  043044  041505  020011
5145  033426  043044  040505  000040
5146  033433  000105  050130  042047  DME:    .ASCIZ  "EXP'D-FEC-RCV'D        EXP'D-FEA-RCV'D"
5147  033440  043055  041505  051055
5148  033446  053103  042047  042411
5149  033454  050130  042047  043055
5150  033462  040505  051055  053103
5151  033470  042047  000040
5152
5153
5154                                  ;DATA VECTORS HERE
5155          033474                  .EVEN
5156  033474  002400  002362  000000  DTA:    .WORD   $FPS,FPS,0
5157  033502  002402  002364  002404  DTB:    .WORD   $FEC,FEC,$FEA,FEA,0
5158  033510  002366  000000
5159  033514  002416  002420  002406  DTD:    .WORD   ANS2,ANS2+2,ANS1,ANS1+2,0
5160  033522  002410  000000
5161  033526  002416  002420  002422  DTE:    .WORD   ANS2,ANS2+2,ANS2+4,ANS2+6
5162  033534  002424
5163  033536  002406  002410  002412          .WORD   ANS1,ANS1+2,ANS1+4,ANS1+6,0
5164  033544  002414  000000
5165  033550  002370  002372  002362  DTF:    .WORD   FPPOPC,FPPOPS,FPS,FEC,FEA,$FPS,$FEC,$FEA,0
5166  033556  002364  002366  002400
5167  033564  002402  002404  000000
5168
```

```
                                                        ;OPERAND VECTORS HERE
                                                        .EVEN
033572  034032  002426  002430  LOD:    .WORD   XLO,LONUM,LONUM+2,LONUM+4,LONUM+6,0
033600  002432  002434  000000
033606  034042  002436  002440  HID:    .WORD   XHI,HINUM,HINUM+2,HINUM+4,HINUM+6,0
033614  002442  002444  000000
033622  034032  002426  002430  LOF:    .WORD   XLO,LONUM,LONUM+2,0
033630  000000
033632  034042  002436  002440  HIF:    .WORD   XHI,HINUM,HINUM+2,0
033640  000000
033642  034052  002446  002450  OP1F:   .WORD   XOP1,OP1,OP1+2,0
033650  000000
033652  034060  002456  002460  OP2F:   .WORD   XOP2,OP2,OP2+2,0
033660  000000
033662  034066  002466  002470  OP3F:   .WORD   XOP3,OP3,OP3+2,0
033670  000000
033672  034074  002476  002500  OP4F:   .WORD   XOP4,OP4,OP4+2,0
033700  000000
033702  034110  002506  002510  OP5F:   .WORD   XOP5,OP5,OP5+2,0
033710  000000
033712  034102  002516  002520  OP6F:   .WORD   XOP6,OP6,OP6+2,0
033720  000000
033722  034052  002446  002450  OP1D:   .WORD   XOP1,OP1,OP1+2,OP1+4,OP1+6,0
033730  002452  002454  000000
033736  034060  002456  002460  OP2D:   .WORD   XOP2,OP2,OP2+2,OP2+4,OP2+6,0
033744  002462  002464  000000
033752  034066  002466  002470  OP3D:   .WORD   XOP3,OP3,OP3+2,OP3+4,OP3+6,0
033760  002472  002474  000000
033766  034074  002476  002500  OP4D:   .WORD   XOP4,OP4,OP4+2,OP4+4,OP4+6,0
033774  002502  002504  000000
034002  034110  002506  002510  OP5D:   .WORD   XOP5,OP5,OP5+2,OP5+4,OP5+6,0
034010  002512  002514  000000
034016  034102  002516  002520  OP6D:   .WORD   XOP6,OP6,OP6+2,OP6+4,OP6+6,0
034024  002522  002524  000000


                                                        ;OPERAND TITLES
034032  047514  052516  035115  XLO:    .ASCIZ  "LONUM:"<11>
034040  000011
034042  044510  052516  035115  XHI:    .ASCIZ  "HINUM:"<11>
034050  000011
034052  050117  035061  000011  XOP1:   .ASCIZ  "OP1:"<11>
034060  050117  035062  000011  XOP2:   .ASCIZ  "OP2:"<11>
034066  050117  035063  000011  XOP3:   .ASCIZ  "OP3:"<11>
034074  050117  035064  000011  XOP4:   .ASCIZ  "OP4:"<11>
034102  050117  035066  000011  XOP6:   .ASCIZ  "OP6:"<11>
034110  050117  035065  000011  XOP5:   .ASCIZ  "OP5:"<11>
                                                        ;THE END
        000001                                          .END
```

```
ABASE = 000000            258
ACOM1 = 000000            258
ACOM2 = 000000            258
ACPUOP= 000000            258     273
ADDC0   002526            462#    570     3372    3671*
ADDC1   002530            463#   3372     3715*
ADDC2   002532            464#   3372     3694*
ADDC3   002534            465#   3372     3717*
ADDC4   002536            466#   3372     3760*
ADDC5   002540            467#   3372     3821*   3841*
ADDC6   002542            468#   3372     3824*   3844*
ADDC7   002544            469#   3372     3855*   3901*
ADDC8   002546            470#   3372     3902*
ADDM0 = 000000            258
ADDM1 = 000000            258
ADDM10= 000000            258
ADDM11= 000000            258
ADDM12= 000000            258
ADDM13= 000000            258
ADDM14= 000000            258
ADDM15= 000000            258
ADDM2 = 000000            258
ADDM3 = 000000            258
ADDM4 = 000000            258
ADDM5 = 000000            258
ADDM6 = 000000            258
ADDM7 = 000000            258
ADDM8 = 000000            258
ADDM9 = 000000            258
ADEVCT= 000000            258     264
ADEVM = 000000            258
AEN01   004102            706     713     717#
AEN010  006456           1151    1160    1167    1171#
AEN011  006742           1224    1231    1235#
AEN012  007236           1291    1300    1304#
AEN013  007464           1348    1355    1359#
AEN014  007722           1403    1412    1416#
AEN015  010230           1472    1479    1484    1488#
AEN016  010556           1544    1553    1560    1564#
AEN017  011026           1608    1615    1620    1624#
AEN02   004376            772     781     785#
AEN020  011316           1668    1677    1684    1688#
AEN03   004624            829     836     840#
AEN04   005062            884     893     897#
AEN05   005370            953     960     965     969#
AEN06   005716           1026    1035    1042    1046#
AEN07   006166           1091    1098    1103    1107#
AENV  = 000000            258     269
AENVM = 000000            258     270
AERR1   004002            688     692#
AERR11  006642           1206    1210#
AERR12  007126           1273    1277#
AERR15  010106           1454    1458#
AERR16  010414           1526    1530#
AERR2   004266            754     758#
AERR5   005246            935     939#
```

AERR6	005554	1008	1012*											
AFATAL=	000000	258	261											
AMADR1=	000000	258												
AMADR2=	000000	258												
AMADR3=	000000	258												
AMADR4=	000000	258												
AMAMS1=	000000	258												
AMAMS2=	000000	258												
AMAMS3=	000000	258												
AMAMS4=	000000	258												
AMSGAD=	000000	258	266											
AMSGLG=	000000	258	267											
AMSGTY=	000000	258	260											
AMTYP1=	000000	258												
AMTYP2=	000000	258												
AMTYP3=	000000	258												
AMTYP4=	000000	258												
ANS1	002406	440*	689*	708*	709*	710*	711	714*	755*	774*	775*	776*	777*	778*
		779	782*	824*	831*	832*	833*	834	837*	879*	886*	887*	888*	889*
		890*	891	894*	936*	955*	956*	957*	958	961*	962*	963	966*	1009*
		1028*	1029*	1030*	1031*	1032*	1033	1036*	1037*	1038*	1039*	1040	1043*	1086*
		1093*	1094*	1095*	1096	1099*	1100*	1101	1104*	1146*	1153*	1154*	1155*	1156*
		1157*	1158	1161*	1162*	1163*	1164*	1165	1168*	1207*	1226*	1227*	1228*	1229
		1232*	1274*	1293*	1294*	1295*	1296*	1297*	1298	1301*	1343*	1350*	1351*	1352*
		1353	1356*	1398*	1405*	1406*	1407*	1408*	1409*	1410	1413*	1455*	1474*	1475*
		1476*	1477	1480*	1481*	1482	1485*	1527*	1546*	1547*	1548*	1549*	1550*	1551
		1554*	1555*	1556*	1557*	1558	1561*	1603*	1610*	1611*	1612*	1613	1616*	1617*
		1618	1621*	1663*	1670*	1671*	1672*	1673*	1674*	1675	1678*	1679*	1680*	1681*
		1682	1685*	1724*	1743*	1744*	1745*	1746	1749*	1791*	1810*	1811*	1812*	1813*
		1814*	1815	1818*	1860*	1867*	1868*	1869*	1870	1873*	1915*	1922*	1923*	1924*
		1925*	1926*	1927	1930*	1971*	1990*	1991*	1992*	1993	1996*	1997*	1998	2001*
		2043*	2062*	2063*	2064*	2065*	2066*	2067	2070*	2071*	2072*	2073*	2074	2077*
		2119*	2126*	2127*	2128*	2129	2132*	2133*	2134	2137*	2179*	2186*	2187*	2188*
		2189*	2190*	2191	2194*	2195*	2196*	2197*	2198	2201*	2240*	2259*	2260*	2261*
		2262	2265*	2307*	2326*	2327*	2328*	2329*	2330*	2331	2334*	2376*	2395*	2396*
		2397*	2398	2401*	2443*	2462*	2463*	2464*	2465*	2466*	2467	2470*	2512*	2531*
		2532*	2533*	2534	2537*	2538*	2539	2542*	2584*	2603*	2604*	2605*	2606*	2607*
		2608	2611*	2612*	2613*	2614*	2615	2618*	2660*	2679*	2680*	2681*	2682	2685*
		2686*	2687	2690*	2732*	2751*	2752*	2753*	2754*	2755*	2756	2759*	2760*	2761*
		2762*	2763	2766*	2808*	2827*	2828*	2829*	2830	2833*	2874*	2893*	2894*	2895*
		2896*	2897*	2898	2901*	2943*	2962*	2963*	2964*	2965	2968*	2969*	2970	2973*
		3014*	3033*	3034*	3035*	3036*	3037*	3038	3041*	3042*	3043*	3044*	3045	3048*
		3107*	3115*	3117*	3118*	3119*	3121*	3122*	3123*	3124*	3126	3129	3132*	3197*
		3205*	3207*	3208*	3209*	3210*	3211*	3212*	3213*	3214*	3215*	3216*	3218*	3219*
		3220*	3221*	3222*	3223*	3224*	3225*	3227	3229	3231	3234	3237*	5159	5163
ANS2	002416	442*	672	678	738	744	807	813	862	868	919	925	992	998
		1069	1075	1129	1135	1190	1196	1257	1263	1326	1332	1381	1387	1438
		1444	1510	1516	1586	1592	1646	1652	1707	1713	1774	1780	1843	1849
		1898	1904	1954	1960	2026	2032	2102	2108	2162	2168	2223	2229	2290
		2296	2359	2365	2426	2432	2495	2501	2567	2573	2643	2649	2715	2721
		2791	2797	2857	2863	2926	2932	2997	3003	3086	3089	3117	3119	3176
		3179	3207	3211	3214	3216	5159	5161						
APASS =	000000	258	263											
APRIOR=	000000	258												
APTCSU=	000040	4734	4839*											
APTENV=	000001	4595	4727	4795	4837*									

```
APTSIZ= 000200          560  4836#
APTSPO= 000100         4729  4797  4838#
ARET1   003756          659   685#
ARET10  006326         1116  1142#
ARET11  006616         1177  1203#
ARET12  007102         1244  1270#
ARET13  007376         1313  1339#
ARET14  007624         1368  1394#
ARET15  010062         1425  1451#
ARET16  010370         1497  1523#
ARET17  010716         1573  1599#
ARET2   004242          725   751#
ARET20  011166         1633  1659#
ARET3   004536          794   820#
ARET4   004764          849   875#
ARET5   005222          906   932#
ARET6   005530          979  1005#
ARET7   006056         1056  1082#
ASCHOT  032066          651  5004#
ASCHRM  032074          653  5005#
ASMREG= 000000          258   271
ATESTN= 000000          258   262
ATST1   004040          693   701   704#
ATST10  006352         1145  1149#
ATST11  006700         1211  1219  1222#
ATST12  007164         1278  1286  1289#
ATST13  007422         1342  1346#
ATST14  007650         1397  1401#
ATST15  010144         1459  1467  1470#
ATST16  010452         1531  1539  1542#
ATST17  010742         1602  1606#
ATST2   004324          759   767   770#
ATST20  011212         1662  1666#
ATST3   004562          823   827#
ATST4   005010          878   882#
ATST5   005304          940   948   951#
ATST6   005612         1013  1021  1024#
ATST7   006102         1085  1089#
AUNIT = 000000          258   265
AUSWR = 000000          258   272
AVECT1= 000000          258
AVECT2= 000000          258
BGNMES  002622          498#  575
BIT0  = 000001          125#
BIT00 = 000001          115#  125
BIT01 = 000002          114#  124
BIT02 = 000004          113#  123
BIT03 = 000010          112#  122
BIT04 = 000020          111#  121   581   633  3260
BIT05 = 000040          110#  120
BIT06 = 000100          109#  119
BIT07 = 000200          108#  118
BIT08 = 000400          107#  117  4522
BIT09 = 001000          106#  116  4530  4605
BIT1  = 000002          124#
BIT10 = 002000          105#  4583
```

```
BIT11 = 004000            104#   4537
BIT12 = 010000            103#    613     643     645     648    3266
BIT13 = 020000            102#   4590
BIT14 = 040000            101#   4508
BIT15 = 100000            100#
BIT2  = 000004            123#
BIT3  = 000010            122#
BIT4  = 000020            121#
BIT5  = 000040            120#
BIT6  = 000100            119#
BIT7  = 000200            118#
BIT8  = 000400            117#
BIT9  = 001000            116#
BPTVEC= 000014            132#
CR    = 000015             40#    498     503     511    4773    4783
CRLF  = 000200             41#   4744    4783
DDISP = 177570             47#    238     548
DEND1   014442           2257    2264    2268#
DEND10  017206           2744    2749    2758    2765    2769#
DEND11  017472           2825    2832    2836#
DEND12  017766           2891    2900    2904#
DEND13  020274           2960    2967    2972    2976#
DEND14  020622           3031    3040    3047    3051#
DEND2   014736           2324    2333    2337#
DEND3   015222           2393    2400    2404#
DEND4   015516           2460    2469    2473#
DEND5   016024           2529    2536    2541    2545#
DEND6   016352           2601    2610    2617    2621#
DEND7   016660           2677    2684    2689    2693#
DERR1   014342           2239    2243#
DERR10  017044           2731    2735#
DERR11  017372           2807    2811#
DERR12  017656           2873    2877#
DERR13  020152           2942    2946#
DERR14  020460           3013    3017#
DERR2   014626           2306    2310#
DERR3   015122           2375    2379#
DERR4   015406           2442    2446#
DERR5   015702           2511    2515#
DERR6   016210           2583    2587#
DERR7   016536           2659    2663#
DHA     033204            298     302     306     354     358     362     366     370     408     412    5120#
DHB     033220            316     324     332     340     417    5122#
DHC     033256            320     328     336     344     421    5127#
DHD     033354            349    5138#
DHE     033433            375     379     383     387     391     395     399     403    5146#
DISPLA  001146            238#    548*    556*   4552*   4582*
DISPRE  000174            169#    556
DIVC0   002564            479#   3379    4263*
DIVC1   002566            480#   3379    4291*
DIVC2   002570            481#   3379    4276*
DIVC3   002572            482#   3379    4378*   4399*
DIVC4   002574            483#   3379    4381*   4402*
DIVC5   002576            484#   3379    4367*
DIVC6   002600            485#   3379    4370*
DRET1   014316           2210    2236#
```

```
DRET10  017020          2702    2728#
DRET11  017346          2778    2804#
DRET12  017632          2844    2870#
DRET13  020126          2913    2939#
DRET14  020434          2984    3010#
DRET2   014602          2277    2303#
DRET3   015076          2346    2372#
DRET4   015362          2413    2439#
DRET5   015656          2482    2508#
DRET6   016164          2554    2580#
DRET7   016512          2630    2656#
DSWR  = 177570            46#    237     547
DTA     033474           298     302     306     354     358     362     366     370     408     412     5156#
DTB     033502           375     379     383     387     391     395     399     403     5157#
DTD     033514           316     324     332     340     417     5159#
DTE     033526           320     328     336     344     421     5161#
DTF     033550           349     5165#
DTST1   014400          2244    2252    2255#
DTST10  017102          2736    2747#
DTST11  017430          2812    2820    2823#
DTST12  017714          2878    2886    2889#
DTST13  020210          2947    2955    2958#
DTST14  020516          3018    3026    3029#
DTST2   014664          2311    2319    2322#
DTST3   015160          2380    2388    2391#
DTST4   015444          2447    2455    2458#
DTST5   015740          2516    2524    2527#
DTST6   016246          2588    2596    2599#
DTST7   016574          2664    2672    2675#
EEND1   021200          3112    3130    3135#
EEND2   021662          3202    3235    3240#
EERR1   021172          3127    3132#
EERR2   021654          3228    3230    3232    3237#
EMA     032103           408    5009#
EMB     032140           412    5014#
EMC     032175           417    5019#
EMD     032235           421    5025#
EME     032275           316     320    5031#
EMF     032325           324     328    5036#
EMG     032355           332     336    5041#
EMH     032405           340     344    5046#
EMI     032436           348    5051#
EMJ     032524           288    5061#
EMK     032545           302    5064#
EML     032566           306    5067#
EMM     032607           354    5070#
EMN     032630           358    5073#
EMO     032651           362    5076#
EMP     032672           366    5079#
EMQ     032713           370    5082#
EMR     032734           375    5085#
EMS     032761           379    5089#
EMT     033006           383    5093#
EMTVEC= 000030           135#    531*    532*
EMU     033033           387    5097#
EMV     033060           391    5101#
```

CROSS REFERENCE TABLE -- USER SYMBOLS

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EMV001  001232            298#
EMV002  001256            302#
EMV003  001302            306#
EMV004  001326            311#
EMV005  001352            316#
EMV006  001376            320#
EMV007  001422            324#
EMV010  001446            328#
EMV011  001472            332#
EMV012  001516            336#
EMV013  001542            340#
EMV014  001566            344#
EMV015  001612            349#
EMV016  001636            354#
EMV017  001662            358#
EMV020  001706            362#
EMV021  001732            366#
EMV022  001756            370#
EMV023  002002            375#
EMV024  002026            379#
EMV025  002052            383#
EMV026  002076            387#
EMV027  002122            391#
EMV030  002146            395#
EMV031  002172            399#
EMV032  002216            403#
EMV033  002242            408#
EMV034  002266            412#
EMV035  002312            417#
EMV036  002336            421#
EMW     033105            395     5105#
EMX     033132            399     5109#
EMY     033157            403     5113#
EREG0   002602            488#    4571*
EREG1   002604            489#    4572*
EREG2   002606            490#    4573*
EREG3   002610            491#    4574*
EREG4   002612            492#    4575*
EREG5   002614            493#    4576*
EREG6   002616            494#    4577*   4578*
EREG7   002620            495#    4579*
ERRVEC= 000004            128#     545     546*    557*    4513    4514*   4516*   4519*
ETST1   021076           3106    3110#
ETST2   021464           3196    3200#
EXPFEA  002376            436#     659*    725*    794*    849*    906*    979*   1056*   1116*   1177*   1244*   1313*   1368*
                         1425*   1497*   1573*   1633*   1694*   1761*   1830*   1885*   1941*   2013*   2089*   2149*   2210*
                         2277*   2346*   2413*   2482*   2554*   2630*   2702*   2778*   2844*   2913*   2984*   3827    3847
                         3905    4086    4097    4128    4279    4373    4384    4405
FEA     002366            432#     665*    700     731*    766     800*    855*    912*    947     985*   1020    1062*   1122*
                         1183*   1218    1250*   1285    1319*   1374*   1431*   1466    1503*   1538    1579*   1639*   1700*
                         1735    1767*   1802    1836*   1891*   1947*   1982    2019*   2054    2095*   2155*   2216*   2251
                         2283*   2318    2352*   2387    2419*   2454    2488*   2523    2560*   2595    2636*   2671    2708*
                         2743    2784*   2819    2850*   2885    2919*   2954    2990*   3025    3063*   3151*   5157    5165
FEC     002364            431#     664*    694*    696     730*    760*    762     799*    854*    911*    941*    943     984*
                         1014*   1016    1061*   1121*   1182*   1212*   1214    1249*   1279*   1281    1318*   1373*   1430*
                         1460*   1462    1502*   1532*   1534    1578*   1638*   1699*   1729*   1731    1766*   1796*   1798
```

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                    1835*  1890*  1946*  1976*  1978   2018*  2048*  2050   2094*  2154*  2215*  2245*  2247
                    2   *  2312*  2314   2351*  2381*  2383   2418*  2448*  2450   2487*  2517*  2519   2559*
                    2   9*  2591   2635*  2665*  2667   2707*  2737*  2739   2783*  2813*  2815   2849*  2879*
                    2881   2918*  2948*  2950   2989*  3019*  3021   3062*  3150*  3477*  5157   5165
FPPILT  023256        566   3474*
FPPOPC  002370        433*  3474*  3487   5165
FPPOPS  002372        434*  3475*  3486   5165
FPPOSP  002374        435*
FPPVEC= 000244        150*   566*   567*
FPS     002362        430*   663*   686*   687    717*   729*   752*   753    785*   798*   821*   822    840*
                      853*   876*   877    897*   910*   933*   934    969*   983*  1006*  1007   1046*  1060*
                     1083*  1084   1107*  1120*  1143*  1144   1171*  1181*  1204*  1205   1235*  1248*  1271*
                     1272   1304*  1317*  1340*  1341   1359*  1372*  1395*  1396   1416*  1429*  1452*  1453
                     1488*  1501*  1524*  1525   1564*  1577*  1600*  1601   1624*  1637*  1660*  1661   1688*
                     1698*  1721*  1722   1752*  1765*  1788*  1789   1821*  1834*  1857*  1858   1876*  1889*
                     1912*  1913   1933*  1945*  1968*  1969   2004*  2017*  2040*  2041   2080*  2093*  2116*
                     2117   2140*  2153*  2176*  2177   2204*  2214*  2237*  2238   2268*  2281*  2304*  2305
                     2337*  2350*  2373*  2374   2404*  2417*  2440*  2441   2473*  2486*  2509*  2510   2545*
                     2558*  2581*  2582   2621*  2634*  2657*  2658   2693*  2706*  2729*  2730   2769*  2782*
                     2805*  2806   2836*  2848*  2871*  2872   2904*  2917*  2940*  2941   2976*  2988*  3011*
                     3012   3051*  3061*  3104*  3105   3135*  3149*  3194*  3195   3240*  3476*  3478   3481
                     5156   5165
GNS   = ****** U      168   4948   4949   4950   4951
HID     033606        320    328    336    344   5173*
HIF     033632        316    324    332    340   5177*
HINUM   002436        446*   667    670    677    733    736    743    802    805    812    857    860    867
                      914    917    924    987    990    997   1064   1067   1074   1124   1127   1134   1185
                     1188   1195   1252   1255   1262   1321   1324   1331   1376   1379   1386   1433   1436
                     1443   1505   1508   1515   1581   1584   1591   1641   1644   1651   1702   1705   1712
                     1769   1772   1779   1838   1841   1848   1893   1896   1903   1949   1952   1959   2021
                     2024   2031   2097   2100   2107   2157   2160   2167   2218   2221   2228   2285   2288
                     2295   2354   2357   2364   2421   2424   2431   2490   2493   2500   2562   2565   2572
                     2638   2641   2648   2710   2713   2720   2786   2789   2796   2852   2855   2862   2921
                     2924   2931   2992   2995   3002   5173   5177
HOTWRM  030414        651*   653*  4643*
HT    = 000011         38*  4742   4783
IOTVEC= 000020        133*   529*   530*
LF    = 000012         39*   498    503    511   4777   4783
LOD     033572        320    328    336    344   5171*
LOF     033622        316    324    332    340   5175*
LONUM   002426        444*   667    669    676    733    735    742    802    804    811    857    859    866
                      914    916    923    987    989    996   1064   1066   1073   1124   1126   1133   1185
                     1187   1194   1252   1254   1261   1321   1323   1330   1376   1378   1385   1433   1435
                     1442   1505   1507   1514   1581   1583   1590   1641   1643   1650   1702   1704   1711
                     1769   1771   1778   1838   1840   1847   1893   1895   1902   1949   1951   1958   2021
                     2023   2030   2097   2099   2106   2157   2159   2166   2218   2220   2227   2285   2287
                     2294   2354   2356   2363   2421   2423   2430   2490   2492   2499   2562   2564   2571
                     2638   2640   2647   2710   2712   2719   2786   2788   2795   2852   2854   2861   2921
                     2923   2930   2992   2994   3001   5171   5175
MED   = 076600        142*   580    632    636    646   3259   3267   3273   4980
MEND1   011602       1741   1748   1752*
MEND10  014156       2184   2193   2200   2204*
MEND2   012076       1808   1817   1821*
MEND3   012324       1865   1872   1876*
MEND4   012562       1920   1929   1933*
MEND5   013070       1988   1995   2000   2004*
```

```
MEND6   013416            2060    2069    2076    2080#
MEND7   013666            2124    2131    2136    2140#
MERR1   011502            1723    1727#
MERR2   011766            1790    1794#
MERR5   012746            1970    1974#
MERR6   013254            2042    2046#
MRET1   011456            1694    1720#
MRET10  014026            2149    2175#
MRET2   011742            1761    1787#
MRET3   012236            1830    1856#
MRET4   012464            1885    1911#
MRET5   012722            1941    1967#
MRET6   013230            2013    2039#
MRET7   013556            2089    2115#
MTST1   011540            1728    1736    1739#
MTST10  014052            2178    2182#
MTST2   012034            1795    1803    1806#
MTST3   012262            1859    1863#
MTST4   012510            1914    1918#
MTST5   013004            1975    1983    1986#
MTST6   013312            2047    2055    2058#
MTST7   013602            2118    2122#
MULC0   002550             472#   3376    4004#
MULC1   002552             473#   3376    4035#
MULC2   002554             474#   3376    4091#   4122#
MULC3   002556             475#   3376    4094#   4125#
MULC4   002560             476#   3376    4080#
MULC5   002562             477#   3376    4083#
NEWPAS  003450             584     586     611#   3329
NWPAS1  002723             511#    618
OP1     002446             448#   3066    3075    3096    3154    3165    3186    5179    5191
OP1D    033722             421    5191#
OP1F    033642             417    5179#
OP2     002456             450#   3068    3076    3097    3156    3170    3189    5181    5193
OP2D    033736             421    5193#
OP2F    033652             417    5181#
OP3     002466             452#   3070    3078    3100    3156    3166    3187    5183    5195
OP3D    033752             421    5195#
OP3F    033662             417    5183#
OP4     002476             454#   3066    3079    3098    3154    3171    3190    5185    5197
OP4D    033766             421    5197#
OP4F    033672             417    5185#
OP5     002506             456#   3068    3084    3102    3158    3159    3168    3188    5187    5199
OP5D    034002             421    5199#
OP5F    033702             417    5187#
OP6     002516             458#   3070    3071    3080    3099    3158    3161    3173    3191    5189    5201
OP6D    034016             421    5201#
OP6F    033712             417    5189#
PIRQ    = 177772            45#
PIRQVE= 000240             139#
PR0     = 000000            62#
PR1     = 000040            63#
PR2     = 000100            64#
PR3     = 000140            65#
PR4     = 000200            66#
PR5     = 000240            67#
```

```
PR6     = 000300            68#
PR7     = 000340            69#
PS      = 177776            42#     43
PSW     = 177776            43#
PWRVEC= 000024             134#    535#    536#   4958#   4959#   4968#   4974#   4988#   4989#
RAND    023350            3500    3503#
RANDL2  023342             666     801     913    1063    1184    1320    1432    1580    1701    1837    1948    2096    2217
                          2353    2489    2637    2785    2920    3065    3067    3069    3501#
RANDL4  023332             732     856     986    1123    1251    1375    1504    1640    1768    1892    2020    2156    2284
                          2420    2561    2709    2851    2991    3153    3155    3157    3498#
RESVEC= 000010             129#
RFLAG   = 000144           146#    636    3267
RMHAMI= 000022             144#    580     632    3259
SCRLF   022314            3367    3385#
SHOR1   022317            3344    3386#
SHOR2   022664            3348    3427#
SHOR3   023055            3352    3448#
SHT     022312            3365    3384#
STACK   = 001100             33#    527     611     630
START   = 003000            172     520#   4993
STATS   022122            3319    3340#
STKLMT= 177774              44#
SUBPRS  003516             614     616     630#   3277    3299
SVEC1   022230            3342    3372#
SVEC2   022254            3346    3376#
SVEC3   022272            3350    3379#
SWR     001144             237#    525     547#    549     555#    562#    613     638     641    3263    3313    3317    4508
                          4522    4530    4537    4583    4590    4602    4605    4966    4981#
SWREG   000176             170#    555
SW0     = 000001            97#
SW00    = 000001            87#     97     641
SW01    = 000002            86#     96     638    3263
SW02    = 000004            85#     95
SW03    = 000010            84#     94
SW04    = 000020            83#     93
SW05    = 000040            82#     92
SW06    = 000100            81#     91
SW07    = 000200            80#     90
SW08    = 000400            79#     89
SW09    = 001000            78#     88
SW1     = 000002            96#
SW10    = 002000            77#   3313
SW11    = 004000            76#
SW12    = 010000            75#   3317
SW13    = 020000            74#
SW14    = 040000            73#
SW15    = 100000            72#
SW2     = 000004            95#
SW3     = 000010            94#
SW4     = 000020            93#
SW5     = 000040            92#
SW6     = 000100            91#
SW7     = 000200            90#
SW8     = 000400            89#
SW9     = 001000            88#
TBITVE= 000014             130#
```

```
TKVEC = 000060            137#
TPVEC = 000064            138#
TRAPVE= 000034            136#    533#    534#
TRTVEC= 000014            131#
TST1    003622            658#
TST10   006172           1115#
TST11   006462           1176#
TST12   006746           1243#
TST13   007242           1312#
TST14   007470           1367#
TST15   007726           1424#
TST16   010234           1496#
TST17   010562           1572#
TST2    004106            724#
TST20   011032           1632#
TST21   011322           1693#
TST22   011606           1760#
TST23   012102           1829#
TST24   012330           1884#
TST25   012566           1940#
TST26   013074           2012#
TST27   013422           2088#
TST3    004402            793#
TST30   013672           2148#
TST31   014162           2209#
TST32   014446           2276#
TST33   014742           2345#
TST34   015226           2412#
TST35   015522           2481#
TST36   016030           2553#
TST37   016356           2629#
TST4    004630            848#
TST40   016664           2701#
TST41   017212           2777#
TST42   017476           2843#
TST43   017772           2912#
TST44   020300           2983#
TST45   020626           3055#
TST46   021204           3143#
TST5    005066            905#
TST6    005374            978#
TST7    005722           1055#
TYPE  = 104401            575     583     585     618     623    3315    3344    3348    3352    3365    3367    4585    4593
                          4642    4663    4665    4666    4669    4671    4674    4677    4684    4686    4691    4747    4900
                          4948#   4990
TYPOC = 104402            4651    4673    4676    4681    4949#
TYPON = 104404            4951#
TYPOS = 104403             621    3360    4950#
WFLAG = 000344             147#    646    3273
XHI     034042            5173    5177    5208#
XLO     034032            5171    5175    5206#
XOP1    034052            5179    5191    5210#
XOP2    034060            5181    5193    5211#
XOP3    034066            5183    5195    5212#
XOP4    034074            5185    5197    5213#
XOP5    034110            5187    5199    5215#
```

```
XOPS    034102          5189    5201    5214#
$FOO    023566           671     737     806     861     918     991    1068    1128    3082    3167    3671#
$HPTHD  001000           194     200#
$ASTAT= ****** U        4817    4832
$ATYC   031160          4788    4790#
$ATY1   031134          4786#
$ATY3   031142          4732    4787#
$ATY4   031152          4598    4789#
$AUTOB  001140           233#
$BDRDR  001126           228#
$BDDAT  001132           230#
$BELL   001172           250#    3315    4585    4617
$CHARC  031130          4749#   4759#   4766    4775#   4780#
$CKSUM= ****** U        4954
$CMTAG  001100           215#     522     523     531     537     538     539
$CM3  = 000000           248#
$CONV   027622          3675    4008    4267    4483#
$CPUOP  001230           273#
$CRLF   001177           252#     623    4593    4617    4643    4665    4671    4686    4748    4783
$DEVCT  001212           264#
$DIV    026364          2222    2289    2358    2425    2494    2566    2642    2714    2790    2856    2925    2996    3081
                        3169    3174    4263#
$DDRGN  022116          3308    3322    3329#
$EMDRD  022106           180    3324#   4612
$EMDCT  022042           537     615    3310#
$EMV    001222           269#   4595    4727    4795    4819
$EMVM   001223           270#    560    4729    4734    4797
$EOP    021764          3261    3264    3276    3291#
$EOPCT  022034           537#    615    3307#   3311
$ERFLG  001104           219#   3246#   3292#   4526    4528    4534#   4556    4580#   4617
$ERMAX  001120           225#    540#   4528    4551#   4556
$ERROR  030150           531     4570#
$ERRPC  001122           226#   4587#   4588#   4589    4617    4650    4698
$ERRTB  001232           284#   4660
$ERTTL  001114           223#   4586#   4617
$ESCAP  001170           249#    539#   4550#   4608    4610    4617
$ETABL  001222           268#
$ETEND  001232           206     280#
$FATAL  001204          261#    4823#
$FEA    002404           439#    662#    700     728#    766     797#    852#    909#    947     982#   1020    1059#   1119#
                        1180#   1218    1247#   1285    1316#   1371#   1428#   1466    1500#   1538    1576#   1636#   1697#
                        1735    1764#   1802    1833#   1888#   1944#   1982    2016#   2054    2092#   2152#   2213#   2251
                        2280#   2318    2349#   2387    2416#   2454    2485#   2523    2557#   2595    2633#   2671    2705#
                        2743    2781#   2819    2847#   2885    2916#   2954    2987#   3025    3060#   3148#   3827#   3847#
                        3905#   4086#   4097#   4128#   4279#   4373#   4384#   4405#   5157    5165
$FEC    002402           438#    661#    696     727#    762     796#    851#    908#    943     981#   1016    1058#   1118#
                        1179#   1214    1246#   1281    1315#   1370#   1427#   1462    1499#   1534    1575#   1635#   1696#
                        1731    1763#   1798    1832#   1887#   1943#   1978    2015#   2050    2091#   2151#   2212#   2247
                        2279#   2314    2348#   2383    2415#   2450    2484#   2519    2556#   2591    2632#   2667    2704#
                        2739    2780#   2815    2846#   2881    2915#   2950    2986#   3021    3059#   3147#   3826#   3846#
                        3904#   4085#   4096#   4127#   4278#   4372#   4383#   4404#   5157    5165
$FFLG   031400          4786#   4789#   4817    4826#   4834#
$FILLC  001164           246#   4752    4783
$FILLS  001163           245#   4783
$FPS    002400           437#    660#    674     687     692     726#    740     753     758     795#    809     822     850#
                         864     877     907#    921     934     939     980#    994    1007    1012    1057#   1071    1084
```

```
                        1117*  1131   1144   1178*  1192   1205   1210   1245*  1259   1272   1277   1314*  1328
                        1341   1369*  1383   1396   1426*  1440   1453   1458   1498*  1512   1525   1530   1574*
                        1588   1601   1634*  1648   1661   1695*  1709   1722   1727   1762*  1776   1789   1794
                        1831*  1845   1858   1886*  1900   1913   1942*  1956   1969   1974   2014*  2028   2041
                        2046   2090*  2104   2117   2150*  2164   2177   2211*  2225   2238   2243   2278*  2292
                        2305   2310   2347*  2361   2374   2379   2414*  2428   2441   2446   2483*  2497   2510
                        2515   2555*  2569   2582   2587   2631*  2645   2658   2663   2703*  2717   2730   2735
                        2779*  2793   2806   2811   2845*  2859   2872   2877   2914*  2928   2941   2946   2985*
                        2999   3012   3017   3058*  3090   3105   3146*  3180   3195   3591   3605   3672*  3673
                        3820*  3822   3825*  3840*  3842   3845*  3863*  3866*  3874   3899   3903*  4005*  4006
                        4081   4084*  4090*  4092   4095*  4121*  4123   4126*  4141*  4144*  4152   4264*  4265
                        4277*  4368   4371*  4377*  4379   4382*  4398*  4400   4403*  4415*  4418*  4426   5156
                        5165
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$GOOAT  001130          229#
$GET42  022076          3318   3321#
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$HIBTS  001000          201#
$ICNT   001106          220#   4541*  4542   4544*  4555
$ILLUP  032050          4958   4974   4995#
$INTAG  001141          234#
$ITEMB  001116          224#   4589*  4597   4617   4647
$LF     001200          253#   4617   4783
$LFLG   031377          4827*  4833#
$LPADR  001110          221#    541*   680*   746*   815*   870*   927*  1000*  1077*  1137*  1198*  1265*  1334*
                        1389*  1446*  1518*  1594*  1654*  1715*  1782*  1851*  1906*  1962*  2034*  2110*  2170*
                        2231*  2298*  2367*  2434*  2503*  2575*  2651*  2723*  2799*  2865*  2934*  3005*  3091*
                        3181*  4532*  4548*  4553   4555
$LPERR  001112          222#    542*  4532   4549*  4555   4607
$LPTST  001150          239#   4524
$MAIL   001202          202     206    259#   559    4547   4595   4727
$MBADR  001002          202#
$MFLG   031376          4787*  4793   4828*  4832#
$MSGAD  001216          266#   4803*  4806
$MSGLG  001220          267#   4808*
$MSGTY  001202          260#   4801   4809*  4821   4825*
$MUL    025244          1706   1773   1842   1897   1953   2025   2101   2161   3083   3085   3175   4004#
$MXCNT  030146          4545   4555#
$NULL   001162          244#   4754   4783
$NWTST= 000001          655#   721#   790#   845#   902#   975#  1052#  1112#  1173#  1240#  1309#  1364#  1421#
                        1493#  1569#  1 29#  1690#  1757#  1826#  1881#  1937#  2009#  2085#  2145#  2206#  2273#
                        2342#  2409#  2478#  2550#  2626#  2698#  2774#  2840#  2909#  2980#  3052#  3140#
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$OMODE  031626          4867*  4871*  4876   4879*  4890*  4916#
$OVFR   030132          4509   4525   4533   4543   4552#
$PASS   001210          263#    559*   619   3304*  3305*  4539   4556
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                        2355   2422   2491   2563   2639   2711   2787   2853   2922   2993   3074   3164   3585#
$POPX   023540          672     738    807    862    919    992   1069   1129   1190   1257   1326   1381   1438
                        1510   1586   1646   1707   1774   1843   1898   1954   2026   2102   2162   2223   2290
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$POWER  032056          4991   4998#
$PUSH   023510          669     670    735    736    804    805    859    860    916    917    989    990   1066
```

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                        1067    1126    1127    1187    1188    1254    1255    1323    1324    1378    1379    1435    1436
                        1507    1508    1583    1584    1643    1644    1704    1705    1771    1772    1840    1841    1895
                        1896    1951    1952    2023    2024    2099    2100    2159    2160    2220    2221    2287    2288
                        2356    2357    2423    2424    2492    2493    2564    2565    2640    2641    2712    2713    2788
                        2789    2854    2855    2923    2924    2994    2995    3075    3076    3078    3079    3080    3084
                        3165    3166    3168    3170    3171    3173    3590#
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$PWRDN  031676           535    4958#   4988
$PWRMG  032040          4991#
$PWRUP  031750          4968    4974#
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$RODEC= ****** U        4954
$ROLIN= ****** U        4954
$ROOCT= ****** U        4954
$R2A  = ****** U        4954
$SAVRE= ****** U        4954
$SAVR6  032054          4967#   4975    4976#   4977#   4997#
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$SETUP= 000037           514#    528     529     531     533     535     537     538     539     541    4507    4571    4605
                        4612
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$SUB    023562          1189    1256    1325    1380    1437    1509    1585    1645    3077    3172    3670#
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$SVPC = 000204           178#    183
$SWR  = 167400             1#     12     248     249     250     538     539     541     542     659     725     794     849
                         906     979    1056    1116    1177    1244    1313    1368    1425    1497    1573    1633    1694
                        1761    1830    1885    1941    2013    2089    2149    2210    2277    2346    2413    2482    2554
                        2630    2702    2778    2844    2913    2984    3056    3144    4498    4499    4500    4501    4502
                        4508    4520    4522    4523    4526    4527    4528    4535    4536    4537    4549    4552    4555
                        4562    4563    4564    4565    4566    4583    4590    4602    4605    4617    4994
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$SWRMK= 000000          4502    4524
$TESTN  001206           262#   4547*   4697
$TIMES  001166           248#    538*   3245*   3294*   4535*   4542    4545*   4555
$TKB    001154           241#
$TKS    001152           240#
$TN   = 000047             1#     12     655     659#    721     725#    790     794#    845     849#    902     906#    975
                         979#   1052    1056#   1112    1116#   1173    1177#   1240    1244#   1309    1313#   1364    1368#
                        1421    1425#   1493    1497#   1569    1573#   1629    1633#   1690    1694#   1757    1761#   1826
                        1830#   1881    1885#   1937    1941#   2009    2013#   2085    2089#   2145    2149#   2206    2210#
                        2273    2277#   2342    2346#   2409    2413#   2478    2482#   2550    2554#   2626    2630#   2698
                        2702#   2774    2778#   2840    2844#   2909    2913#   2980    2984#   3052    3056#   3140    3144#
$TPB    001160           243#   4772*   4783
$TPFLG  001165           247#   4721    4783
$TPS    001156           242#   4770    4783
$TRAP   031630           533    4925#
$TRAP2  031652          4936#   4947
$TRP  = 000005          4940#   4949#   4950#   4951#   4952#
$TRPAD  031664          4930    4947#
$TSTM   001004           203#
$TSTNM  001102           218#   3247*   3293*   4524    4546*   4547    4552    4556    4582    4617
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$TYPDS= ****** U        4952
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$TYPEC  031064          4751    4758    4765    4770#   4771
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$TYPEX  031132            4776    4778    4781#
$TYPOC  031426            4870#   4949
$TYPON  031442            4869    4872#   4951
$TYPOS  031402            4865#   4950
$UNIT   001214             265#
$UNITM  001010             205#
$USWR   001226             272#
$XTSTR  027702            4511#
$OFILL  031625            4866*   4870*   4880    4915#
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.       = 034116           164#    168#    178     179#    181#    183#    184#    190     191#    193#    195#    214#    254
                           515#    526     541     542     680     746     815     870     927     1000    1077    1137    1198
                          1265    1334    1389    1446    1518    1594    1654    1715    1782    1851    1907    1962    2034
                          2110    2170    2231    2298    2367    2434    2503    2575    2651    2723    2799    2865    2934
                          3005    3091    3181    3471#   4555    4556    4617    4703#   4783    4835#   4970    4996    5155#
.$ASTA= ****** U          4787    4790
.$X     = 001000           190#    195
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COMMEN    140#
COMM00      1#
COMM01      1#
COMM02      1#
COMM03      1#
COMM04      1#
COMM05      1#
COMM06      1#
COMM07      1#
COMM1       1#
COMM10      1#
COMM11      1#
COMM12      1#
COMM13      1#
COMM14      1#
COMM15      1#
COMM16      1#
COMM17      1#
COMM2       1#
COMM20      1#
COMM21      1#
COMM22      1#
COMM23      1#
COMM24      1#
COMM25      1#
COMM26      1#
COMM27      1#
COMM3       1#
COMM30      1#
COMM31      1#
COMM32      1#
COMM33      1#
COMM34      1#
COMM35      1#
COMM36      1#
COMM37      1#
COMM4       1#
COMM40      1#
COMM41      1#
COMM42      1#
COMM43      1#
COMM44      1#
COMM45      1#
COMM46      1#
COMM47      1#
ENDCOM    140#
ERRCMP      1#
ERRLUR      1#  4616
ERROR     348#   690   698   702   715   756   764   768   783   825   838   880   895   937   945
              949   967  1010  1018  1022  1044  1087  1105  1147  1169  1208  1216  1220  1233  1275
             1283  1287  1302  1344  1357  1399  1414  1456  1464  1468  1486  1528  1536  1540  1562
             1604  1622  1664  1686  1725  1737  1750  1792  1800  1804  1819  1861  1874  1916
             1931  1972  1980  1984  2002  2044  2052  2056  2078  2120  2138  2180  2202  2241  2249
             2253  2266  2308  2316  2320  2335  2377  2385  2389  2402  2444  2452  2456  2471  2513
             2521  2525  2543  2585  2593  2597  2619  2661  2669  2673  2691  2733  2741  2745  2767
```

```
            2809    2817    2821    2834    2875    2883    2887    2902    2944    2952    2956    2974    3015    3023    3027
            3049    3108    3133    3198    3238    3485
ESCAPE       140#
FCOM0          1#
FCOM1          1#
FCOM2          1#
FCOM3          1#
FCOM4          1#
FPRGT0         1#
FPRGT1         1#
FPSFEC         1#
FPSTST         1#
GENCOM         1#
GENTS1         1#
GENTS2         1#
GENTS3         1#
GENTS4         1#
GETPRI       140#
GETSWR       140#
GTSTD          1#
GTSTF          1#
HTSTD          1#
HTSTF          1#
MOVDIS         1#
MULT         140#
NEWTST       140#     655     721     790     845     902     975    1052    1112    1173    1240    1309    1364    1421    1493
            1569    1629    1690    1757    1826    1881    1937    2009    2085    2145    2206    2273    2342    2409    2478
            2550    2626    2698    2774    2840    2909    2980    3052    3140
POP          140#    4829    4830    4981    4982
PUSH         140#    4790    4792    4813    4960    4966
REPORT       140#
SBTST1         1#
SBTST2         1#
SCOM0          1#
SCOM1          1#
SCOM2          1#
SCOM3          1#
SCOM4          1#
SCOM5          1#
SCOM6          1#
SCOM7          1#
SCOPE         35#     658     724     793     848     905     978    1055    1115    1176    1243    1312    1367    1424    1496
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            2553    2629    2701    2777    2843    2912    2983    3055    3143    3244
SCPLUR         1#    4507
SEADAT         1#
SETPRI       140#
SETREG         1#    4571
SETTRA      4940#    4949    4950    4951
SETUP          1#     140#    520
SKIP         140#
SLASH        140#     577     604
SPACE        140#
STARS        140#     176     187     189     196     210     254     257     516     518     607     609     626     628     655
             657     721     723     790     792     845     847     902     904     975     977    1052    1054    1112    1114
            1173    1175    1240    1242    1309    1311    1364    1366    1421    1423    1493    1495    1569    1571    1629
```

```
        1631  1690  1692  1757  1759  1826  1828  1881  1883  1937  1939  2009  2011  2085  2087
        2145  2147  2206  2208  2273  2275  2342  2344  2409  2411  2478  2480  2550  2552  2626
        2628  2698  2700  2774  2776  2840  2842  2909  2911  2980  2982  3052  3054  3093  3140
        3142  3183  3241  3280  4495  4558  4617  4706  4785  4842  4919  4956  4972
STATUS     1#
SWRSU    140#   543#
TADD01     1#
TADD02     1#
TADDF1     1#
TADDF2     1#
TADDR1     1#
TADDR2     1#
TRMTRP  4940#
TYPBIN   140#
TYPDEC   140#
TYPNAM   140#
TYPNUM   140#
TYPOCS   140#
TYPOCT   140#
TYPTXT   140#
UPCODE     1#  4979
SSCMRE   208#
SSCMTM   208#
SSESCA   140#
SSNEXT   140#   655   721   790   845   902   975  1052  1112  1173  1240  1309  1364  1421  1493
        1569  1629  1690  1757  1826  1881  1937  2009  2085  2145  2206  2273  2342  2409  2478
        2550  2626  2698  2774  2840  2909  2980  3052  3140
SSSET   4940#  4949  4950  4951
SSSETM   559#
SSSKIP   140#
.EQUAT     1#    30
.HEADE     1#     2
.SBPAS     1#  3241
.SETUP     1#   514
.STPAS     1#   577
.$ACTI     1#   174
.$APTB     1#   255#
.$APTH     1#   185
.$APTY     1#  4783
.$CATC     1#   162
.$CMTA     1#   208
.$EOP      1#
.$ERRO     1#  4556
.$POWE     1#  4954
.$SCOP     1#  4493
.$TRAP     1#  4917
.$TYER     1#
.$TYPE     1#  4704
.$TYPO     1#  4840

. ABS.  034116     000

 ERRORS DETECTED:  0
 DEFAULT GLOBALS GENERATED:  0
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RUN-TIME:  19 16 1 SECONDS
RUN-TIME RATIO:  102/37=2.7
CORE USED:  25K  (50 PAGES)

DOCUMENT PAGES:  128
WRAP-AROUND:  0%

USER SYMBOLS:  606
MACRO  NAMES:  141
UNDF SYMBOLS:  14
DISK BLOCKS  READ:  1238
DISK BLKS WRITTEN:  629
KILO CORE SECONDS:  1477
```