



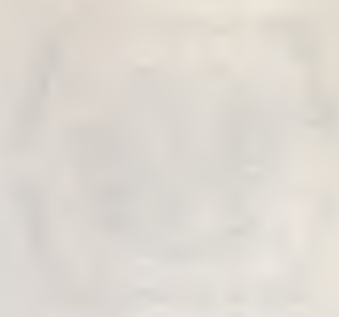
DECUS

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DECUS NO.	8-572
TITLE	COMBINATION LETTERING AND DUPLICATOR-CODER PROGRAM
AUTHOR	Ronald A. Wong
COMPANY	Edmund Wong Company San Francisco, California
DATE	August 10, 1972
SOURCE LANGUAGE	PAL III

20230

UNIVERSITY OF CALIFORNIA



COMBINATION LETTERING AND DUPLICATOR-CODER PROGRAM

Abstract

This program enables labeling and duplication of paper tapes in BIN or RIM format. The label is punched directly onto the copy tape and duplication can begin immediately. The input and output devices are selected automatically. The input can come from the teletype reader or high speed reader; output can be on the high speed punch or teletype punch.

The output format is either in BIN, RIM or AutoBIN. Several tapes may be combined onto one tape.

Combination Lettering and Duplicator-Coder program was developed by modifying DECUS programs 8-366 (written by A.T. Siy) and 8-181 (by M.A. Robinton).

Paper Tapes Available

BIN tape: locations 10 - 1432

ASCII tape: all tabs are represented by a TAB/RUBOUT, hence the tape is compressed to speed up assembly. The 211 code may be changed to the corresponding eight spaces by reading the ASCII tape into Symbolic Editor and punching a new tape with Bit 1 set to zero.

In addition, there are three PAUSE's in the tape. The program was assembled using DECUS 8-138, Pal III.5 (by J.C. Kilbane), which used a PAUSE statement to facilitate in paging.

Machine Requirements

4K PDP - 8 with Teletype. High Speed Reader/Punch optional

Operating Procedure

- 1) Load the BIN tape into the computer
- 2) Turn on the high speed reader and/or punch if it will be used.
- 3) Start the program at location 0200.
- 4) The computer will halt if the teletype reader or punch will be used. The punch should be turned on now. The reader will not be used until later and may be left off.
- 5) Type the label. All letters and numbers are legal, plus ASCII codes 241 through 257, 277 - 300 and 333 to 337. If the high speed punch



is being used, the characters will be acknowledged on the teletype printer. With low speed punching, garbage will be printed.

Note: there is no large buffer in the label program. Be patient and wait until each letter has been punched before continuing to type.

6) Hitting the RETURN key will produce blank tape followed by a HALT to enable loading of the master tape. Also for those using the low speed punch, the Halt reminds them to turn off the punch, because a command will have to be entered in, which will otherwise be reproduced on the tape if the punch is left on (see below).

7) "To duplicate without coding (without Auto start address) type 'G' (GO). To code the first and intermediate blocks of a multiple block tape type 'C' (CONTINUE). To code the final trailer of a tape for automatic start, type the starting address (up to four digits with leading zeros not necessary) then type 'G'.

"AutoBIN will not automatically start from 0000 to 0077, therefore, do not attempt to code tapes with these addresses for they will be ignored by the coder.

"If more than four digits are typed in the address, the last four digits will be the ones code for auto starting. Also, a carriage return will reset the starting address to be coded to zero. You may now type 'G', 'C', or a starting address and 'G'. Illegal characters will be echoed back on the Teletype but will be ignored. After the first digit of an address, 'C' is illegal"

- M.A. Robinton

8) After the trailer has been punched out, the program will jump back to the label section and continues to use the same I-O devices. Another tape may be duplicated. To change I-O devices, follow the Operating Procedures from step two.

Optional Modifications

1) The step six HALT may be NOPed at location $\emptyset 243$. Or it can be re-programmed as to halt only for low speed I-O by depositing a $4\emptyset 71$ (JMS CHECK) at $\emptyset 243$.

2) A HALT may be added before the program jumps from the duplicator section to the label section (step eight) at location 1357. Or the re-program-

ming can be done by depositing the 4071 at 1357.

Program Description

The program begins by determining I-O devices (Jms Z Initil at 0206). Then a character is inputted and a test made for the RETURN key (loc 0217). Letters are punched onto tape after finding the corresponding matrix pattern (loc 223)

In the duplication section, commands are first initialized (loc 1240), followed by the input of the command, which is decoded (loc 1204) and acted out. With duplication of the tape goes a checksum count (loc 110, similar to the BIN loader). Any reader error will be noted and a message will alert the operator (loc 1326).

With the ability to duplicate as well as label copied tapes, a convenience has been made available which may help to keep tapes organized if large numbers of programs are being copied and will be labeled with a sticker later. Other programs can be combined with labeling routines, such as the Binary tape consolidator programs.

Storage Utilization

Page Zero	locations 10 - 177
Subroutines	
Punching Code 200	
Issue CR/LF	
Determine I-O device	
Checksum Counter	
High and Low speed I-O routines	
Page One	locations 200 - 317
Lettering Program	
Punching of Letters	
Generation of Blank Tape	
I-O routines and pointers	
Pages Two, Three and Four	locations 400 - 1177
Matrix Patterns Table	

Pages Five and Six locations 1200 - 1432

Duplication Program

Initialization
Command Decoder
Checksum Calculation
Checksum Error Message Text

Acknowledgements and References

DECUS Program

Number

8-138 PAL III.5 by James C. Kilbane
8-181 Automatic Binary Loader and Duplicator-Coder for
 AutoBIN by Michael A. Robinton
8-366 Modified Readable Punch by Andres T. Siy

Program Listing

```
001
002      /COMBINATION LETTERING PROGRAM AND
003      /DUPLICATION-CODER FOR AUTO BIN.
004      /MODIFICATIONS HAVE BEEN MADE TO DECUS
005      /PROGRAMS 8-366 (WRITTEN BY A.T. SIY) AND
006      /8-181 (BY M.A. ROBINTON)
007      /
008      /PROGRAM WILL AUTOMATICALLY SELECT
009      /THE APPROPRIATE OUTPUT DEVICE.
010      /IF LOW SPEED OUTPUT IS BEING USED,
011      /REMEMBER TO TURN OFF THE PUNCH AFTER
012      /TYPING THE LABEL OR ELSE THE DUPLICATION
013      /COMMAND WILL BE PUNCHED ONTO TAPE.
014      /THERE IS A HALT TO ALLOW FOR THIS.
015      /
016      /A CARRIAGE RETURN IN THE LABEL SECTION
017      /WILL RESULT IN A JUMP TO THE DUPLICATION.
018      /
019      /AT THE END OF DUPLICATION, THE PROGRAM WILL
020      /JUMP BACK TO THE LABEL SECTION AND ASSUMES
021      /THE SAME I-O DEVICES WILL BE USED.
022      /
023      /PROGRAMMER: RONALD A. WONG
024      /DATE: AUGUST 10, 1972
025      /SOURCE LANGUAGE: PAL III OR PAL III.5
026      /      (DECUS 8-138 BY J.C. KILBANE)
027
028      /
029
030      *10
031 0010 0215 CR,      215
032 0011 0212 LF,      212
033 0012 7770 P7770,  7770
034 0013 7471 MG,      -307
035 0014 7475 MC,      -303
036 0015 7563 MCR,     -215
037 0016 7710 MLDR,    -70
038 0017 0077 P77,     77
039 0020 0200 P200,    200
040 0021 0007 P7,      7
041 0022 7520 M260,    -260
042 0023 7775 M3,      -3
043 0024 0300 P300,    300
044 0025 0000 LDTR,    0      /PUNCH LEADER TRAILER
045 0026 1016          TAD MLDR      /CODE 200
046 0027 3170          DCA HOLDA
047 0030 1020          TAD P200
048 0031 3167          DCA COLLECT
049 0032 4124          JMS PUNCH
050 0033 2170          ISZ HOLDA
051 0034 5032          JMP .-2
052 0035 5425          JMP I LDTR
053 0036 0000 CRLF,    0      /ISSUE CARRIAGE RETURN
```

054	0037	1010		TAD CR	/LINE FEED
055	0040	6046		TLS	
056	0041	7200		CLA	
057	0042	1011		TAD LF	
058	0043	4153		JMS PORD	
059	0044	7200		CLA	
060	0045	5436		JMP I CRLF	
061	0046	0000	INITIL,	Ø	/INITILIZE READERS AND PUNCHES
062	0047	6014		RFC	
063	0050	6032		KCC	
064	0051	1020		TAD P200	
065	0052	6046		TLS	
066	0053	6026		PLS	
067	0054	6041		TSF	
068	0055	5054		JMP .- 1	
069	0056	7200		CLA	
070	0057	6011		RSF	/CHECK FOR HIGH SPEED READER
071	0060	1160		TAD LORD	
072	0061	1161		TAD HIRD	
073	0062	3174		DCA READ	
074	0063	6021		PSF	/CHECK FOR HIGH SPEED PUNCH
075	0064	1162		TAD PLO	
076	0065	1163		TAD PHI	
077	0066	3177		DCA WRITE	
078	0067	4071		JMS CHECK	/CHECK I-O DEVICES
079	0070	5446		JMP I INITIL	
080	0071	0000	CHECK,	Ø	/HALT IF LO SPEED
081	0072	1174		TAD READ	/I-O DEVICES
082	0073	7041		CIA	
083	0074	1161		TAD HIRD	
084	0075	7640		SZA CLA	
085	0076	5103		JMP STOP	
086	0077	1177		TAD WRITE	
087	0100	7041		CIA	
088	0101	1163		TAD PHI	
089	0102	7640		SZA CLA	
090	0103	7402	STOP,	HLT	/STOP IF LO SPEED
091	0104	6032		KCC	
092	0105	5471		JMP I CHECK	
093	0106	0000	GET,	Ø	/GET A CHARACTER FROM
094	0107	4574		JMS I READ	/TAPE READ
095	0110	3170		DCA HOLDA	/SAVE CHARACTER
096	0111	1166		TAD TEMP	/DO CHECKSUMMING
097	0112	1167		TAD COLLCT	
098	0113	3166		DCA TEMP	
099	0114	1171		TAD HOLDB	
100	0115	3173		DCA HOLDC	/SAVE LAST TWO CHARACTER
101	0116	1167		TAD COLLCT	
102	0117	3171		DCA HOLDB	
103	0120	1170		TAD HOLDA	
104	0121	3167		DCA COLLCT	
105	0122	1167		TAD COLLCT	
106	0123	5506		JMP I GET	
107	0124	0000	PUNCH,	Ø	/OUTPUT CHARACTER TO TAPE

108	0125	7200		CLA	
109	0126	1167		TAD COLLECT	
110	0127	4577		JMS I WRITE	
111	0130	7200		CLA	
112	0131	5524		JMP I PUNCH	
113	0132	0000	RHI,	0	/READ HIGH SPEED
114	0133	7200		CLA	
115	0134	6011		RSF	
116	0135	5134		JMP --1	
117	0136	6016		RRB RFC	
118	0137	5532		JMP I RHI	
119	0140	0000	RLO,	0	/READ LO SPEED
120	0141	7200		CLA	
121	0142	6031		KSF	
122	0143	5142		JMP --1	
123	0144	6036		KRB	
124	0145	5540		JMP I RLO	
125	0146	0000	PIRD,	0	/PUNCH HIGH SPEED
126	0147	6021		PSF	
127	0150	5147		JMP --1	
128	0151	6026		PLS	
129	0152	5546		JMP I PIRD	
130	0153	0000	PORD,	0	/PUNCH LO SPEED
131	0154	6041		TSF	
132	0155	5154		JMP --1	
133	0156	6046		TLS	
134	0157	5553		JMP I PORD	
135	0160	0006	LORD,	RLO-RHI	
136	0161	0132	HIRD,	RHI	
137	0162	0005	PLO,	PORD-PIRD	
138	0163	0146	PHI,	PIRD	
139	0164	0000	LINK,	0	
140	0165	0000	CKL,	0	
141	0166	0000	TEMP,	0	
142	0167	0000	COLLECT,	0	
143	0170	0000	HOLDA,	0	
144	0171	0000	HOLDB,	0	
145	0172	0000	CODE,	0	
146	0173	0000	HOLDC,	0	
147	0174	0000	READ,	0	
148	0175	0000	STORE,	0	
149	0176	1374	MSG,	TAG	
150	0177	0000	WRITE,	0	
151					
152			PAUSE		

```

001
001
002
003
004
005          *0200
006          /START ROUTINE
007 0200 6032 MSTART, KCC          /CLEAR AC & KB FLAG
008 0201 6046      TLS
009 0202 7200      CLA
010 0203 1301      TAD LOC          /ADDR OF CHAR TAG
011 0204 3274      DCA TEMA        /DEPOSIT IN TEMA
012
013          /LOOP ROUTINE
014 0205 7200 LOOP,      CLA
015 0206 4046      JMS Z INITIL    /FIND OUTPUT DEVICE
016 0207 4304      JMS ACCEPT
017 0210 1303      TAD NK146        /IS IT HIGH SPEED
018 0211 1177      TAD Z WRITE     /OUTPUT?
019 0212 7650      SNA CLA
020 0213 4312      JMS TYPE        /YES: THEN ECHO INPUT
021 0214 1320      TAD INPUT        /NO: GET INPUT
022 0215 3277      DCA CHAR        /STORE CHARACTER
023 0216 1277      TAD CHAR        /BRING OUT CHAR & TEST
024 0217 1271      TAD NK215       /FOR CR
025 0220 7650      SNA CLA        /NOT CR, THEN SKIP
026 0221 5236      JMP TRAIL       /YES, GO TO TRAIL ROUTINE
027 0222 1277      TAD CHAR        /BRING OUT CHAR
028 0223 1272      TAD D240        /SUBTRACT 240
029 0224 3300      DCA DIFF        /STORE DIFFERENCE
030 0225 1300      TAD DIFF
031 0226 7106      CLL RTL         /TO LOCATE LOC OF CHAR
032 0227 1300      TAD DIFF
033 0230 1300      TAD DIFF
034 0231 1301      TAD LOC          /ADDRESS OF CHAR FOUND
035 0232 3274      DCA TEMA        /KEEP IN TEMA
036 0233 4245      JMS COUNT
037 0234 7200      CLA
038 0235 5207      JMP LOOP+2
039
040          /TRAILER ROUTINE (BLANK SPACES)
041 0236 1270 TRAIL,    TAD M144
042 0237 3275      DCA CNT
043
044          /REPEAT ROUTINE
045 0240 4261 MREPEAT,  JMS PNCH
046 0241 2275      ISZ CNT
047 0242 5240      JMP MREPEAT
048 0243 7402      HLT            /GIVE TIME TO TURN OFF
049              /PUNCH. THEN HIT 'CONTINUE'
050 0244 5702      JMP I PDUP      /DONE: GOTO DUPLICATION
051
052          /COUNTER ROUTINE

```

053	0245	7200	COUNT,	CLA	
054	0246	1273		TAD M6	
055	0247	3276		DCA WC	
056	0250	1674	CONT,	TAD I TEMA	
057	0251	0267		AND A377	
058	0252	4261		JMS PNCH	
059	0253	2274		ISZ TEMA	
060	0254	2276		ISZ WC	
061	0255	5250		JMP CONT	
062	0256	4261		JMS PNCH	
063	0257	4261		JMS PNCH	
064	0260	5645		JMP I COUNT	
065					
066				/PUNCH ROUTINE	
067	0261	0000	PNCH,	0	
068	0262	1266		TAD OUT	
069	0263	3167		DCA Z COLLECT	/BUFFER FOR OUTPUT
070	0264	4124		JMS Z PUNCH	
071	0265	5661		JMP I PNCH	
072					
073				/PARAMETERS	
074	0266	0000	OUT,	0	
075	0267	0377	A377,	377	
076	0270	7634	M144,	-144	
077	0271	7563	NK 215,	-215	
078	0272	7540	D240,	-240	
079	0273	7772	M6,	-6	
080	0274	0000	TEMA,	0	
081	0275	0000	CNT,	0	
082	0276	0000	WC,	0	
083	0277	0000	CHAR,	0	
084	0300	0000	DIFF,	0	
085	0301	0400	LOC,	MTAG	
086	0302	1237	PDUP,	DUP	/ADDRESS OF DUPLICATION
087	0303	7632	NK 146,	-146	
088					
089				/ACCEPT CHARACTER ROUTINE	
090	0304	7402	ACCEPT,	HLT	
091	0305	6031		KSF	
092	0306	5305		JMP -- 1	
093	0307	6036		KRB	
094	0310	3320		DCA INPUT	
095	0311	5704		JMP I ACCEPT	
096					
097				/TYPE ROUTINE (TELETYPE)	
098	0312	7402	TYPE,	HLT	
099	0313	1320		TAD INPUT	
100	0314	6041		TSF	
101	0315	5314		JMP -- 1	
102	0316	6046		TLS	
103	0317	5712		JMP I TYPE	
104	0320	0000	INPUT,	0	
105					
106			PAUSE		

001				
002				
003				
004				
001				
002		*0400		
003				
004		MTAG,	/CHARACTERS TAGS TABLE	
	0400	0000		
	0401	0000		
	0402	0000		
	0403	0000		
	0404	0000		
	0405	0000		
005	0406	0000	0; 0; 0; 0; 0; 0; 0	/BLANK SPACES
	0407	0016		
	0410	0277		
	0411	0016		
006	0412	0000	16; 277; 16; 0	
007	0413	0000	0	/!
	0414	0000		
	0415	0007		
	0416	0000		
	0417	0007		
008	0420	0000	0; 7; 0; 7; 0	
009	0421	0000	0	/"
	0422	0044		
	0423	0377		
	0424	0044		
	0425	0377		
010	0426	0044	44; 377; 44; 377; 44	
011	0427	0000	0	/#
	0430	0106		
	0431	0201		
	0432	0377		
	0433	0211		
012	0434	0221	106; 201; 377; 211; 221	
013	0435	0142	142	/S
	0436	0107		
	0437	0045		
	0440	0027		
	0441	0350		
014	0442	0244	107; 45; 27; 350; 244	
015	0443	0343	343	/%
	0444	0140		
	0445	0220		
	0446	0216		
	0447	0221		
016	0450	0105	140; 220; 216; 221; 105	
017	0451	0242	242	/&
	0452	0000		
	0453	0003		
	0454	0007		

	0455	0003		
018	0456	0000	0; 3; 7; 3; 0	
019	0457	0000	0	/'
	0460	0000		
	0461	0074		
	0462	0102		
	0463	0201		
020	0464	0000	0; 74; 102; 201; 0	
021	0465	0000	0	/('
	0466	0000		
	0467	0201		
	0470	0102		
	0471	0074		
022	0472	0000	0; 201; 102; 74; 0	
023	0473	0000	0	/)
	0474	0020		
	0475	0070		
	0476	0376		
	0477	0376		
024	0500	0070	20; 70; 376; 376; 70	
025	0501	0020	20	/*
	0502	0010		
	0503	0010		
	0504	0176		
	0505	0010		
026	0506	0010	10; 10; 176; 10; 10	
027	0507	0000	0	/+
	0510	0000		
	0511	0200		
	0512	0160		
	0513	0060		
028	0514	0000	0; 200; 160; 60; 0	
029	0515	0000	0	/,
	0516	0010		
	0517	0010		
	0520	0010		
	0521	0010		
030	0522	0010	10; 10; 10; 10; 10	
031	0523	0010	10	/-
	0524	0000		
	0525	0100		
	0526	0340		
	0527	0340		
032	0530	0100	0; 100; 340; 340; 100	
033	0531	0000	0	/.
	0532	0200		
	0533	0100		
	0534	0040		
	0535	0020		
034	0536	0010	200; 100; 40; 20; 10	
035	0537	0000	0	//
	0540	0176		
	0541	0301		
	0542	0241		

	0543	0221		
036	0544	0211	176; 301; 241; 221; 211	
037	0545	0176	176	/0
	0546	0000		
	0547	0202		
	0550	0377		
	0551	0200		
038	0552	0000	0; 202; 377; 200; 0	
039	0553	0000	0	/1
	0554	0302		
	0555	0241		
	0556	0221		
	0557	0201		
040	0560	0211	302; 241; 221; 201; 211	
041	0561	0206	206	/2
	0562	0102		
	0563	0201		
	0564	0201		
	0565	0211		
042	0566	0211	102; 201; 201; 211; 211	
043	0567	0166	166	/3
	0570	0060		
	0571	0050		
	0572	0044		
	0573	0042		
044	0574	0377	60; 50; 44; 42; 377	
045	0575	0040	40	/4
	0576	0117		
	0577	0201		
	0600	0205		
	0601	0205		
046	0602	0205	117; 201; 205; 205; 205	
047	0603	0171	171	/5
	0604	0176		
	0605	0211		
	0606	0211		
	0607	0211		
048	0610	0211	176; 211; 211; 211; 211	
049	0611	0160	160	/6
	0612	0001		
	0613	0001		
	0614	0361		
	0615	0011		
050	0616	0005	1; 1; 361; 11; 5	
051	0617	0003	3	/7
	0620	0166		
	0621	0211		
	0622	0211		
	0623	0211		
052	0624	0211	166; 211; 211; 211; 211	
053	0625	0166	166	/8
	0626	0016		
	0627	0221		
	0630	0221		

	0631	0221		
054	0632	0221	16; 221; 221; 221; 221	
055	0633	0176	176	/9
	0634	0000		
	0635	0000		
	0636	0066		
	0637	0066		
056	0640	0000	0; 0; 66; 66; 0	
057	0641	0000	0	/;
	0642	0000		
	0643	0100		
	0644	0066		
	0645	0066		
058	0646	0000	0; 100; 66; 66; 0	
059	0647	0000	0	/;
	0650	0000		
	0651	0010		
	0652	0020		
	0653	0044		
060	0654	0102	0; 10; 20; 44; 102	
061	0655	0000	0	/<
	0656	0024		
	0657	0024		
	0660	0024		
	0661	0024		
062	0662	0024	24; 24; 24; 24; 24	
063	0663	0024	24	/=
	0664	0000		
	0665	0102		
	0666	0044		
	0667	0020		
064	0670	0010	0; 102; 44; 20; 10	
065	0671	0000	0	/>
	0672	0006		
	0673	0001		
	0674	0301		
	0675	0331		
066	0676	0301	6; 1; 301; 331; 301	
067	0677	0006	6	/?
	0700	0176		
	0701	0201		
	0702	0271		
	0703	0271		
068	0704	0241	176; 201; 271; 271; 241	
069	0705	0176	176	/e
	0706	0374		
	0707	0022		
	0710	0021		
	0711	0021		
070	0712	0022	374; 22; 21; 21; 22	
071	0713	0374	374	/A
	0714	0377		
	0715	0211		
	0716	0211		

	0717	0211		
072	0720	0211	377; 211; 211; 211; 211	
073	0721	0166	166	/B
	0722	0074		
	0723	0102		
	0724	0201		
	0725	0201		
074	0726	0201	74; 102; 201; 201; 201	
075	0727	0102	102	/C
	0730	0377		
	0731	0201		
	0732	0201		
	0733	0201		
076	0734	0102	377; 201; 201; 201; 102	
077	0735	0074	74	/D
	0736	0377		
	0737	0211		
	0740	0211		
	0741	0211		
078	0742	0201	377; 211; 211; 211; 201	
079	0743	0201	201	/E
	0744	0377		
	0745	0011		
	0746	0011		
	0747	0011		
080	0750	0001	377; 11; 11; 11; 1	
081	0751	0001	1	/F
	0752	0176		
	0753	0201		
	0754	0201		
	0755	0221		
082	0756	0221	176; 201; 201; 221; 221	
083	0757	0162	162	/G
	0760	0377		
	0761	0010		
	0762	0010		
	0763	0010		
084	0764	0010	377; 10; 10; 10; 10	
085	0765	0377	377	/H
	0766	0000		
	0767	0201		
	0770	0377		
	0771	0201		
086	0772	0000	0; 201; 377; 201; 0	
087	0773	0000	0	/I
	0774	0140		
	0775	0200		
	0776	0200		
	0777	0200		
088	1000	0200	140; 200; 200; 200; 200	
089	1001	0177	177	/J
	1002	0377		
	1003	0020		
	1004	0030		

	1005	0044		
090	1006	0102	377; 20; 30; 44; 102	
091	1007	0201	201	/K
	1010	0377		
	1011	0200		
	1012	0200		
	1013	0200		
092	1014	0200	377; 200; 200; 200; 200	
093	1015	0200	200	/L
	1016	0377		
	1017	0002		
	1020	0004		
	1021	0004		
094	1022	0002	377; 2; 4; 4; 2	
095	1023	0377	377	/M
	1024	0377		
	1025	0002		
	1026	0014		
	1027	0060		
096	1030	0100	377; 2; 14; 60; 100	
097	1031	0377	377	/N
	1032	0074		
	1033	0102		
	1034	0201		
	1035	0201		
098	1036	0102	74; 102; 201; 201; 102	
099	1037	0074	74	/O
	1040	0377		
	1041	0021		
	1042	0021		
	1043	0021		
100	1044	0021	377; 21; 21; 21; 21	
101	1045	0016	16	/P
	1046	0074		
	1047	0102		
	1050	0221		
	1051	0241		
102	1052	0102	74; 102; 221; 241; 102	
103	1053	0274	274	/Q
	1054	0377		
	1055	0021		
	1056	0031		
	1057	0051		
104	1060	0111	377; 21; 31; 51; 111	
105	1061	0206	206	/R
	1062	0106		
	1063	0201		
	1064	0211		
	1065	0211		
106	1066	0212	106; 201; 211; 211; 212	
107	1067	0160	160	/S
	1070	0001		
	1071	0001		
	1072	0377		

	1073	0001		
108	1074	0001	1; 1; 377; 1; 1	
109	1075	0000	0	/T
	1076	0177		
	1077	0200		
	1100	0200		
	1101	0200		
110	1102	0200	177; 200; 200; 200; 200	
111	1103	0177	177	/U
	1104	0077		
	1105	0100		
	1106	0200		
	1107	0200		
112	1110	0100	77; 100; 200; 200; 100	
113	1111	0077	77	/V
	1112	0177		
	1113	0200		
	1114	0100		
	1115	0100		
114	1116	0200	177; 200; 100; 100; 200	
115	1117	0177	177	/W
	1120	0201		
	1121	0102		
	1122	0074		
	1123	0102		
116	1124	0201	201; 102; 74; 102; 201	
117	1125	0000	0	/X
	1126	0003		
	1127	0004		
	1130	0370		
	1131	0004		
118	1132	0003	3; 4; 370; 4; 3	
119	1133	0000	0	/Y
	1134	0301		
	1135	0241		
	1136	0221		
	1137	0211		
120	1140	0205	301; 241; 221; 211; 205	
121	1141	0203	203	/Z
	1142	0000		
	1143	0377		
	1144	0201		
	1145	0201		
122	1146	0000	0; 377; 201; 201; 0	
123	1147	0000	0	/[
	1150	0010		
	1151	0020		
	1152	0040		
	1153	0100		
124	1154	0200	10; 20; 40; 100; 200	
125	1155	0000	0	/\, SHIFT/L
	1156	0000		
	1157	0201		
	1160	0201		

	1161	0377		
126	1162	0000	0; 201; 201; 377; 0	
127	1163	0000	0	/]
	1164	0004		
	1165	0006		
	1166	0377		
	1167	0006		
128	1170	0004	4; 6; 377; 6; 4	
129	1171	0000	0	/↑
	1172	0040		
	1173	0160		
	1174	0370		
	1175	0040		
130	1176	0040	40; 160; 370; 40; 40	
131	1177	0040	40	/←
132				
133				

PAUSE

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001
002
003
004
001
002      *1200
003
004      /DUPLICATOR-CODER SECTION OF PROGRAM
005
006      /ACTUAL START AT TAG 'DUP'
007 1200 0000 LOOK, 0 /LOOK AT KEYBOARD
008 1201 7200 CLA
009 1202 4140 JMS Z RLO
010 1203 5600 JMP I LOOK
011 1204 0000 NUMBER, 0 /CHECK FOR LEGAL KEYBOARD
012 1205 3175 DCA STORE /CHARACTER
013 1206 1175 TAD STORE
014 1207 1013 TAD MG
015 1210 7650 SNA CLA /IS IT 'G'0?
016 1211 5254 JMP GO /YES
017 1212 1175 TAD STORE
018 1213 1015 TAD MCR
019 1214 7650 SNA CLA /IS IT CR FOR A RESET?
020 1215 5235 JMP START /YES: START AGAIN
021 1216 1175 TAD STORE
022 1217 0012 AND P7770
023 1220 1022 TAD M260
024 1221 7640 SZA CLA /IS IT A NUMBER 0-7?
025 1222 5275 JMP QC /NO: CHECK FOR 'C'
026 1223 1175 TAD STORE /YES: STORE NUMBER
027 1224 0021 AND P7
028 1225 3175 DCA STORE
029 1226 1172 TAD CODE
    1227 7104
    1230 7104
030 1231 7104 CLL RAL; CLL RAL; CLL RAL
031 1232 1175 TAD STORE
032 1233 3172 DCA CODE
033 1234 5604 JMP I NUMBER
034 1235 6041 START, TSF
035 1236 5235 JMP -- 1
036 1237 6032 DUP, KCC
037 1240 3172 DCA CODE /CLEAR CODE NO.
038 1241 3164 DCA LINK /CLEAR 'C'ONTINUE
039 1242 3165 DCA CKL /MAKE 'C' LEGAL
040 1243 4200 JMS LOOK /LOOK AT KEYBOARD
041 1244 6046 TLS /ECHO
042 1245 4204 JMS NUMBER /CHECK IF LEGAL
043 1246 7040 CMA
044 1247 3165 DCA CKL /MAKE 'C' LEGAL
045 1250 4200 ASSMBL, JMS LOOK
046 1251 6046 TLS
047 1252 4204 JMS NUMBER

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048	1253	5250		JMP ASSMBL	/REPEAT ASSMBL
049	1254	4046	GO,	JMS INITIL	/INITILIZE READER-PUNCH &
050	1255	4025		JMS LDTR	/PUNCH LEADER
051	1256	4106		JMS GET	/GET CHARACTER FROM TAPE
052	1257	7650		SNA CLA	/CHECKING FOR BLANK TAPE
053	1260	5256		JMP GO+2	
054	1261	3166		DCA TEMP	/CLEAR CHECKSUM
055	1262	1167		TAD COLLECT	
056	1263	0020		AND P200	
057	1264	7440		SZA	/CHECKING FOR LEADER CODE
058				/200	
059	1265	5256		JMP GO+2	
060	1266	4124		JMS PUNCH	/FOUND START OF PROGRAM
061	1267	4106	OVER,	JMS GET	/PUNCH FIRST CHARACTER
062	1270	0020		AND P200	
063	1271	7640		SZA CLA	/CHECKING FOR TRAILER
064	1272	5315		JMP END	
065	1273	4124		JMS PUNCH	/PUNCH BODY OF PROGRAM
066	1274	5267		JMP OVER	
067	1275	2165	QC,	ISZ CKL	/IS 'C' LEGAL?
068	1276	7410		SKP	
069	1277	5307		JMP BACK	
070	1300	1175		TAD STORE	
071	1301	1014		TAD MC	
072	1302	7640		SZA CLA	
073	1303	5307		JMP BACK	
074	1304	7040		CMA	/MAKE 'C' LEGAL
075	1305	3164		DCA LINK	
076	1306	5254		JMP GO	
077	1307	1204	BACK,	TAD NUMBER	
078	1310	1023		TAD M3	
079	1311	3204		DCA NUMBER	
080	1312	7040		CMA	
081	1313	3165		DCA CKL	
082	1314	5604		JMP I* NUMBER	
083	1315	1173	END,	TAD HOLDC	/DO CKSUM CALCULATION
084	1316	7106		CLL RTL	
	1317	7006			
085	1320	7006		RTL; RTL	
086	1321	1171		TAD HOLDB	
087	1322	1171		TAD HOLDB	
088	1323	1173		TAD HOLDC	
089	1324	7041		CIA	
090	1325	1166		TAD TEMP	
091	1326	7640		SZA CLA	/IS CKSUM OK?
092	1327	5361		JMP ERROR	/NO: TELL OPERATOR
093	1330	2164		ISZ LINK	/WAS COMMAND MODE 'C'?
094	1331	5337		JMP DECIDE	
095	1332	1024	PUNC,	TAD P300	/YES: PUNCH CODE 300 IN
096	1333	3167		DCA COLLECT	/TRAILER
097	1334	4124		JMS PUNCH	
098	1335	7200		CLA	
099	1336	5356		JMP NO CODE	
100	1337	1172	DECIDE,	TAD CODE	

	1340	7012		
	1341	7012		
101	1342	7012	RTR; RTR; RTR	
102	1343	0017	AND P77	
103	1344	7450	SNA	/IS THIS A CODE OR JUST
104	1345	5356	JMP NOCODE	/DUPLICATE?
105	1346	1020	TAD P200	/YES: PUNCH TRAILER CODE
106	1347	3167	DCA COLLECT	
107	1350	4124	JMS PUNCH	
108	1351	1172	TAD CODE	/PUNCH TRAILER CODE #2
109	1352	0017	AND P77	
110	1353	1020	TAD P200	
111	1354	3167	DCA COLLECT	
112	1355	4124	JMS PUNCH	
113	1356	4025	NOCODE, JMS LDTR	/PUNCH TRAILER
114	1357	7000	REPEAT, NOP	/CAN ALSO BE 4071, JMS Z CHECK:
115				/CHECK FOR LO SPEED I-O, IN
116				/WHICH CASE THERE WILL BE A HALT
117	1360	5773	JMP I PSTART	/RETURN TO LABEL PROGRAM
118	1361	1176	ERROR, TAD MSG	/TYPE ERROR MESSAGE
119	1362	3170	DCA HOLDA	
120	1363	4036	JMS CRLF	
121	1364	1570	AGAIN, TAD I HOLDA	
122	1365	7450	SNA	
123	1366	5357	JMP REPEAT	
124	1367	4153	JMS PORD	
125	1370	7200	CLA	
126	1371	2170	ISZ HOLDA	
127	1372	5364	JMP AGAIN	
128	1373	0207	PSTART, LOOP+2	
	1374	0207		
	1375	0207		
	1376	0207		
	1377	0207		
129	1400	0207	TAG, 207; 207; 207; 207; 207	
	1401	0303		
	1402	0310		
	1403	0305		
	1404	0303		
130	1405	0313	303; 310; 305; 303; 313	
	1406	0323		
	1407	0325		
	1410	0315		
	1411	0240		
131	1412	0255	323; 325; 315; 240; 255	
	1413	0240		
	1414	0322		
	1415	0305		
	1416	0301		
132	1417	0304	240; 322; 305; 301; 304	
	1420	0305		
	1421	0322		
	1422	0240		
	1423	0305		

133 1424 0322
1425 0322
1426 0317
1427 0322
1430 0215
134 1431 0212
135 1432 0000
136

305; 322; 240; 305; 322

322; 317; 322; 215; 212
0

ACCEPT 0304
AGAIN 1364
ASSMBL 1250
A377 0267
BACK 1307
CHAR 0277
CHECK 0071
CKL 0165
CNT 0275
CODE 0172
COLLCT 0167
CONT 0250
COUNT 0245
CK 0010
CRLF 0036
DECIDE 1337
DIFF 0300
DUP 1237
D240 0272
END 1315
ERROR 1361
GET 0106
GO 1254
HIRD 0161
HOLDA 0170
HOLDB 0171
HOLDC 0173
INITIL 0046
INPUT 0320
LDTR 0025
LF 0011
LINK 0164
LOC 0301
LOOK 1200
LOOP 0205
LORD 0160
MC 0014
MCR 0015
MG 0013
MLDR 0016
MREPEA 0240
MSG 0176
MSTART 0200
MTAG 0400
M144 0270
M260 0022

M 3	0023
M 6	0273
NK 146	0303
NK 215	0271
NOCODE	1356
NUMBER	1204
OUT	0266
OVER	1267
PDUP	0302
PHI	0163
PIRD	0146
PLO	0162
PNCH	0261
PORD	0153
PSTART	1373
PUNC	1332
PUNCH	0124
P200	0020
P300	0024
P7	0021
P77	0017
P7770	0012
QC	1275
READ	0174
REPEAT	1357
RHI	0132
RLO	0140
START	1235
STOP	0103
STORE	0175
TAG	1374
TEMA	0274
TEMP	0166
TRAIL	0236
TYPE	0312
WC	0276
WRITE	0177

