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PROGRAM LIBRARY

DECUS NO.	FOCAL8-151
TITLE	FAST MATRIX INVERSION FOR REAL NUMBERS
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DATE	December 2, 1970
SOURCE LANGUAGE	FOCAL-8

FAST MATRIX INVERSION FOR REAL NUMBERS

DECUS Program Library Write-up

DECUS No. FOCAL8-151

ABSTRACT

This program will invert a matrix, up to size 17×17 , of real numbers using modified Gauss-Jordan methods. It is translated from DECUS No. 8-72 (Professor A. E. Sapega of Trinity College in FORTRAN II). If the error check is omitted sizeable errors will appear.

WRITE ALL
C:FOCAL-11,TEST

```

1.05 ERASE
1.10 A !"FAST MATRIX INVERSION.  SIZE OF MATRIX? "N,!"ENTER ELEMENTS.

1.20 S LAST=N*N
1.40 FOR J=1,N;T !;F I=J,N,LAST-N+J;A A(I)
1.50 T !"ORIGINAL:"!;D 4
1.60 DO 2
1.70 T !"INVERSE:"!;D 4
1.80 D 2
1.90 T !"INVERSE(INVERSE):"!;D 4
1.95 QUIT

2.05 C INVERT MATRIX
2.10 FOR J=1,N; DO 6

4.05 C PRINT MATRIX
4.60 F Z=1,N;T %2,"ROW "Z;S NC=0;F I=Z,N,LAST-N+Z;DO 5
4.70 T !!

5.10 T "  "%7.06,,A(I)
5.20 S NC=NC+1;IF (NC-4)5.7;T !;S NC=0
5.70 R

6.10 FOR I=1,N;S A(LAST+I)=0
6.20 S A(LAST+J)=1
6.30 CLEAR PIVOT ROW
6.40 I (A(J))6.5,9.01;
6.50 F KP=J+N,N,LAST+J;S A(KP)=A(KP)/A(J)
6.60 CALCULATE REMAINING ROWS.
6.70 FOR KR=1,N;D 7
6.80 C SHIFT ARRAY TO ELIMINATE LEADING UNIT VECTOR.
6.90 FOR I=1,LAST; S A(I)=A(I+N)

7.10 I (KR-J)7.4,5.7;
7.40 S KP=J
7.50 S RW=A(KR)
7.60 FOR Q=KR+N,N,LAST+KR;S KP=KP+N; S A(Q)=A(Q)-RW*A(KP);D 8

8.10 IF (1E-5-FABS(A(Q)))8.2;S A(Q)=0
8.20 R

9.01 T "FOR "?J?," INTERCHANGE PLEASE."!;QUIT

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**
*
*GO

```

FAST MATRIX INVERSION. SIZE OF MATRIX? :4
ENTER ELEMENTS.

```

:3 :8 :5 :6
: 3 :8 :5 :5.98
: 4 :6 :8 :8
: 4 :2 :9 :7

```

ORIGINAL:

```

ROW = 1 = 3.000000 = 8.000000 = 5.000000 = 6.000000
ROW = 2 = 3.000000 = 8.000000 = 5.000000 = 5.980000
ROW = 3 = 4.000000 = 6.000000 = 8.000000 = 8.000000
ROW = 4 = 4.000000 = 2.000000 = 9.000000 = 7.000000

```

FOR J= 2.000000 INTERCHANGE PLEASE.

```

*
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**
*
*
*
*GO

```

FAST MATRIX INVERSION. SIZE OF MATRIX? :4
ENTER ELEMENTS.

```

:1/1 :1/2 :1/3 :1/4
:1/2 :1/3 :1/4 :1/5
:1/3 :1/4 :1/5 :1/6
:1/4 :1/5 :1/6 :1/7

```

ORIGINAL:

```

ROW = 1 = 1.000000 = 0.500000 = 0.333333 = 0.250000
ROW = 2 = 0.500000 = 0.333333 = 0.250000 = 0.200000
ROW = 3 = 0.333333 = 0.250000 = 0.200000 = 0.166667
ROW = 4 = 0.250000 = 0.200000 = 0.166667 = 0.142857

```

INVERSE:

```

ROW = 1 = 15.99900 = -119.9880 = 239.9710 = -139.9810
ROW = 2 = -119.9900 = 1199.880 = -2699.700 = 1679.800
ROW = 3 = 239.9770 = -2699.720 = 6479.320 = -4199.550
ROW = 4 = -139.9860 = 1679.830 = -4199.570 = 2799.720

```

INVERSE(INVERSE):

```

ROW = 1 = 0.999702 = 0.499780 = 0.333158 = 0.249855
ROW = 2 = 0.499775 = 0.333167 = 0.249868 = 0.199890
ROW = 3 = 0.333152 = 0.249866 = 0.199894 = 0.166578
ROW = 4 = 0.249848 = 0.199888 = 0.166578 = 0.142783

```

Abbreviated Fast Matrix Inversion
without error checking
for FOCAL-8 or FOCAL-11

C:FOCAL-11,TEST

```

1.05 ERASE
1.10 A !"FAST MATRIX INVERSION.  SIZE OF MATRIX? "N,!"ENTER ELEMENTS.

1.20 S LAST=N*N
1.40 FOR J=1,N;T !;F I=J,N,LA-N+J;A A(I)
1.50 T !"ORIGINAL:"!;D 4
1.60 DO 2
1.70 T !"INVERSE:"!;D 4
1.80 DO 2
1.90 T !"INVERSE(INVERSE):"!;D 4
1.95 QUIT

2.10 F J=1,N;D 6

4.60 F Z=1,N;T %2,!"ROW "Z;S NC=0;F I=Z,N,LA-N+Z;DO 5
4.70 T !!

5.10 T "  "Z7.06,,A(I)
5.20 S NC=NC+1;IF (NC-4)5.7;T !;S NC=0
5.70 R

6.10 F I=1,N;S A(LA+I)=0
6.20 S A(LA+J)=1
6.50 F KP=J+N,N,LA+J;S A(KP)=A(KP)/A(J)
6.70 F KR=1,N;D 7
6.90 F I=1,LA;S A(I)=A(I+N)

7.10 I (KR-J)7.4,5.7;
7.40 S KP=J;S RW=A(KR)
7.60 F Q=KR+N,N,LA+KR;S KP=KP+N;S A(Q)=A(Q)-RW*A(KP)

```

*

NO ERROR CHECK; NO YES CHECK

*
*GO

FAST MATRIX INVERSION. SIZE OF MATRIX? :4
ENTER ELEMENTS.

:3 :8 :5 :6
: 3 :8 :5 :5.98
: 4 :6 :8 :8
: 4 :2 :9 :7
ORIGINAL:

ROW = 1	=	3.000000	=	8.000000	=	5.000000	=	6.000000
ROW = 2	=	3.000000	=	8.000000	=	5.000000	=	5.980000
ROW = 3	=	4.000000	=	6.000000	=	8.000000	=	8.000000
ROW = 4	=	4.000000	=	2.000000	=	9.000000	=	7.000000

INVERSE:

ROW = 1	=	776.0000	=	-708.0000	=	-30.98840	=	16.99370
ROW = 2	=	-102.6250	=	95.000000	=	3.498460	=	-1.999160
ROW = 3	=	-361.3750	=	333.0000	=	12.99460	=	-6.997050
ROW = 4	=	49.97910	=	-49.98080	=	0.000786	=	-0.000429

INVERSE(INVERSE):

ROW = 1	=	2.690540	=	7.174900	=	4.484220	=	5.401080
ROW = 2	=	2.690540	=	7.174870	=	4.484210	=	5.381080
ROW = 3	=	6.053740	=	11.47690	=	11.42290	=	12.16580
ROW = 4	=	0.331847	=	-7.781730	=	2.886410	=	-0.260863

LARGE
ERRORS

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*
*
*
*
*GO

FAST MATRIX INVERSION. SIZE OF MATRIX? :4
ENTER ELEMENTS.

:1/1 :1/2 :1/3 :1/4
:1/2 :1/3 :1/4 :1/5
:1/3 :1/4 :1/5 :1/6
:1/4 :1/5 :1/6 :1/7

ORIGINAL:

ROW = 1 = 1.000000 = 0.500000 = 0.333333 = 0.250000
ROW = 2 = 0.500000 = 0.333333 = 0.250000 = 0.200000
ROW = 3 = 0.333333 = 0.250000 = 0.200000 = 0.166667
ROW = 4 = 0.250000 = 0.200000 = 0.166667 = 0.142857

INVERSE:

ROW = 1 = 15.99900 = -119.9880 = 239.9710 = -139.9810
ROW = 2 = -119.9900 = 1199.880 = -2699.700 = 1679.800
ROW = 3 = 239.9770 = -2699.720 = 6479.320 = -4199.550
ROW = 4 = -139.9860 = 1679.830 = -4199.570 = 2799.720

INVERSE(INVERSE):

ROW = 1 = 0.999702 = 0.499780 = 0.333158 = 0.249855
ROW = 2 = 0.499775 = 0.333167 = 0.249868 = 0.199890
ROW = 3 = 0.333152 = 0.249866 = 0.199894 = 0.166578
ROW = 4 = 0.249848 = 0.199888 = 0.166578 = 0.142783

MOST
ACCURATE

**P

