

Real matrix

MCOPY

MCOPY		ORG			1
		REM	*B2 → *B2, IF B1 = 0,		2
		REM	*B2 → USTAR, IF B1 = B2,		3
		REM	UNDUP *B2, COPY -*B2 IF		4
		REM	ENTRY IS AT ORDER 3,		5
					6
VSPACE		REF	*VSPACE		7
MSPACE		REF	*MSPACE		10
ERPR		REF	*ERPR		11
ENTRY		REF	*ENTRY		12
DUMMY		REF	*DUMY		13
		REF	*****		14
		REF	*MCOPY		15
					16
		TRA	a*ENTRY		17
	*T4	BEU	CC-1, CC+1		20
	-*T4	BEU	CC-1		21
		RPE, WTG	MOVE		22
	T7	20002	aZ, B6+1		23
	-Z	TRA	a*SAVE, U→R		24
	B2	IF(NZE) TRA	aCC+1		25
		SB2	aUSTAR	<i>orig B2 → R</i>	26
		SUR, LT4	B2, U→B3	<i>R → U, -CC</i>	27
		IF(ZER) TRA	aERROR		30
	B1	IF(NZE) TRA	aCC+1		31
		SB1	aUSTAR		32
	B1	IF(NZE) SKP	aB2		33
		CLA	DUMMY, U→B1		34
		CLA+2	aB1, B6+1		35
	T4	CRL	a+15, R→B5		36
	B5	STO	aROW, R→Z		37
		CLA+2	aROW, B6+1		40
	T4	AND	4400 00000, R→B4		41
		IF(NUL) TRA	aVECT, B4+1		42
		LDR	B3+1		43
	Z	LLS	a+15, U→B4		44
		STO	aCOL		45
		CLA+2	aCOL, B6+1		46
		TSR	a*MSPACE, CC+1		47
		TRA	aCC+1		50
VECT		TSR	a*VSPACE, CC+1		51
	Z	BRU	B1, U→B1		52
		BAU	aB1+1, U→T5		53
	B2	LT5, STF	T5, U→B3		54
	B4	LT4, STF	B2, U→B2		55
LOOP	B5	MLN	a24000, U→B1		56
MOVE	(Z)	AB1	a77776, U→*T5		57
		AB2	a77776		60
	B2	IF(PNZ) TRA	aLOOP		61
		CLA	DUMMY, U→B4		62
	Z	LDR→	B4, R→B1		63
	R	IF(NUL) TRA	aOUT		64
		REM	*****		65
	R	LDR→	B3, R→B2		66
	B3	RPA	B1		67
	Z	BAU→	B2, CC+1		70
ERROR	03	TRA	a*ERPR		71
					72
					73

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OUT		TRA	a*UNSAVE	74
		LT7	B6-1,B6-1	75
	PF	MLF	a4000,U+CC	76
				77
USTAR		EQU	10	100
SAVE		EQU	136	101
UNSAVE		EQU	137	102
				103
ROW		OCT	Z	104
COL		OCT	Z	105
				106
		END		107
				110

VSPACE	77771	65	62574	04	2400	00000	
MSPACE	77772	54	62574	04	2400	00000	
ERPR	77773	75	44615	76	1400	00000	
ENTRY	77774	75	44556	36	1400	00000	
DUMMY	77775	75	43645	47	0400	00000	
	77776	75	75757	57	5400	00000	
	77777	54	42565	77	0400	00000	
	1	01	01000	00	4401	77772	ENTRY
	2	04	21000	20	0001	77776	
	3	14	21000	00	0001	77776	
	4	01	20741	00	0001	00034	MOVE
	5	07	20002	26	4000	00000	
	6	10	01000	02	4400	00136	SAVE
	7	42	01050	00	4001	00001	
	10	01	40002	00	4000	00010	USTAR
	11	01	53440	43	0004	00000	
	12	01	01010	00	4001	00037	ERROR
	13	41	01050	00	4001	00001	
	14	01	40001	00	4000	00010	USTAR
	15	41	02050	00	4004	00000	
	16	01	21700	41	0001	77756	DUMMY
	17	01	21702	26	4002	00000	
	20	04	45066	55	4000	00017	
	21	45	20001	10	4001	00034	ROW
	22	01	21702	26	4001	00033	ROW
	23	04	50314	54	0001	00034	+0000A
	24	01	01040	24	4001	00006	VECT
	25	01	50400	00	0010	00001	
	26	00	45062	44	4000	00017	
	27	01	20001	00	4001	00027	COL
	30	01	21702	26	4001	00026	COL
	31	01	40000	20	4401	77740	MSPACE
	32	01	01000	00	4001	00001	
VECT	33	01	40000	20	4401	77735	VSPACE
	34	00	20300	41	0002	00000	
	35	01	20100	05	4002	00001	
	36	42	50550	43	0000	00005	
	37	44	50540	42	0004	00000	
LOOP	40	45	42002	41	4000	24000	
MOVE	41	20	41001	05	4000	77776	
	42	01	41002	00	4000	77776	
	43	42	05150	00	4001	77773	LOOP
	44	01	21700	44	0001	77730	DUMMY
	45	00	50401	51	0020	00000	
	46	02	01040	00	4001	00004	OUT
	47	02	50401	52	0010	00000	
	50	43	21601	00	0002	00000	
	51	00	20101	20	0004	00000	
ERROR	52	03	01000	00	4401	77720	ERPR
OUT	53	01	01000	00	4400	00137	UNSAVE
	54	01	50470	66	0100	77776	
	55	47	42006	40	4000	04000	
ROW	56	00	00000	00	0000	00000	
COL	57	00	00000	00	0000	00000	

+0000A	60	00	00000	00	4400	00000	

MADD

MADD
ERPR
ENTRY

ORG
REF
REF
REF

*←ERPR
*←ENTRY
*MADD

REM
REM
REM

ADD MATRIX OR VECTOR (B1) TO
MATRIX OR VECTOR (B2).
RESULT IN USTAR.

TRA

*ENTRY

*T4

BEU

CC←1

RPE

ADDV

RPE

ADDM

-Z

TRA

*SAVE, U←R

Z

BAU+2

-ML, B6+1

T7

20002

a1, I←B5

B6

RWT

SAVEB6, B6+1

B1

IF(ZER)SKP

aUSTAR

B1

IF(NZF)TRA

CC←I

Z

SB1

USTAR, U←B5

B2

IF(ZER)SKP

aUSTAR

B2

IF(NZF)TRA

CC←I

Z

SB2

USTAR, U←B5

SUR, LT6

B1, U←R

IF(NUL)TRA

EMPTY, U←B3

Z

LLS

17, U←T4

SUR, LT7

B2, U←R

IF(NUL)TRA

EMPTY, U←B4

Z

LLS

17, U←T5

T4

IF(ZER)SKP

T5

CC

TRA

INCOMP

T5

IF(NEG)SKP

T4

LT5

T4

T6

AND

ABIT

IF(NUL)TRA

VECTOR

LDR

B3←I

Z

LLS

17, U←T6

LDR

B4←I

Z

LLS

17, U←T7

T6

IF(ZER)SKP

T7

CC

TRA

INCOMP

T6

IF(NEG)SKP

T7

LT6

T7

B5

IF(ZER)TRA

NOMSPC, R←Z

T5

LRS

17

T6

LUL

17

ORU

MSPCWD

ORU

R, U←T7

ISR

*XCWD

CLA

B1, U←B3

NOMSPC

T5

LT4, STF

B2, U←B1

MLN

BATR

MLOOP

T6

SB2

*T6

SB6

*USTAR

SB4

*B1←B3

-B4

BNA

Z

AB6

*U, B4+1

B4

RWT

ADDM

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ADDM	*T4	SPF,ERM	Z-1	74
	P1	FAD+3	PF+(Z),B2-1	75
		IF(ZER)SKP	a1	76
SAVEB6		TSR	MLDOP,B1-1	77
		LT7	(Z),I+36	100
		MLF	*B6=1,B6-1	101
		LT4	a*UNSAVE,I+CC	102
		TRA	PF	103
VECTOR	P5	IF(NUL)TRA	NOVSPC,R+Z	104
	T5	LRS	17	105
	R	ORU	VSPCWD,U+T7	106
		TSR	*XCWD	107
		CLA	B1,U+B3	110
NOVSPC	T5	LT4,STF	B2,U+B1	111
		MLN	BATR	112
		SB6	*USTAR	113
		SB5	B1+B3	114
	-B5	BNA	Z	115
		AB6	*U,B5+1	116
	B5	RWT	ADDV	117
ADDV	*T4	SPF,ERM	Z-1	120
		FAD+3	PF+(Z),B1-1	121
		TSR	SAVEB6	122
				123
EMPTY	C3	TRA	*ERPR	124
	Z	SB1	USTAR,U+B2	125
		TSR	*STEX	126
		TSR	SAVEB6	127
				130
INCOMP		RWT	RETURN	131
	C5	TRA	*ERPR	132
RETURN		TRA	(Z)	133
				134
USTAR		EQU	10	135
XCWD		EQU	126	136
STEX		EQU	135	137
SAVE		EQU	136	140
UNSAVE		EQU	137	141
				142
BATR		EQU	4000	143
MSPCWD	C	4	USTAR,20	144
VSPCWD	C	2	USTAR,20	145
ABIT	C	0	a7	146
				147
				150
				151
		END		152

ERPR	77775	75	44615	76	1400	00000	
ENTRY	77776	75	44554	76	1400	00000	
	77777	54	40434	72	5400	00000	
	1	01	01000	00	4401	77774	ENTRY
	2	04	21000	00	0001	77776	
	3	01	20701	00	0001	00103	ADDV
	4	01	20701	00	0001	00056	ADDM
	5	10	01000	02	4400	00136	SAVE
	6	00	20102	26	1000	77772	
	7	07	20002	75	4000	00001	
	10	46	21641	26	0001	00055	SAVEB6
	11	41	02010	00	4000	00010	USTAR
	12	41	01050	00	4001	00001	
	13	00	40001	45	4000	00010	USTAR
	14	42	02010	00	4000	00010	USTAR
	15	42	01050	00	4001	00001	
	16	00	40002	45	4000	00010	USTAR
	17	01	53460	02	0002	00000	
	20	01	01040	43	4001	00070	EMPTY
	21	00	45062	04	4000	00017	
	22	01	53470	02	0004	00000	
	23	01	01040	44	4001	00065	EMPTY
	24	00	45062	05	4000	00017	
	25	04	02010	00	0000	00005	
	26	40	01000	00	4001	00066	INCOMP
	27	05	02510	00	0000	00004	
	30	01	50450	00	0000	00004	
	31	06	50314	00	0001	00070	ABIT
	32	01	01040	00	4001	00037	VECTOR
	33	01	50400	00	0010	00001	
	34	00	45062	06	4000	00017	
	35	01	50400	00	0020	00001	
	36	00	45062	07	4000	00017	
	37	06	02010	00	0000	00007	
	40	40	01000	00	4001	00054	INCOMP
	41	06	02510	00	0000	00007	
	42	01	50460	00	0000	00007	
	43	45	01010	10	4001	00006	NOMSPC
	44	05	45015	00	4000	00017	
	45	06	45020	00	4000	00017	
	46	01	50010	00	0001	00051	MSPCWD
	47	01	50010	07	0000	00002	
	50	01	40000	00	4400	00126	XCWD
	51	01	21700	43	0002	00000	
NOMSPC	52	05	50540	41	0004	00000	
	53	01	42002	00	4000	04000	BATR
MLOOP	54	06	40002	00	4400	00006	
	55	01	40006	00	4400	00010	USTAR
	56	01	40004	00	4412	00000	
	57	54	21600	00	0000	00000	
	60	01	41006	24	4400	00001	
	61	44	21641	00	0001	00001	ADDM
	62	01	40027	00	4000	77776	
ADDM	63	04	10403	62	0200	00000	
	64	41	02010	00	4000	00001	
	65	01	40000	61	4001	77765	MLOOP
SAVEB6	66	01	50470	76	0000	00000	
	67	01	42006	66	4500	77776	
	70	01	50440	70	4400	00137	UNSAVE
	71	01	01000	00	4200	00000	
VECTOR	72	45	01040	10	4001	00004	NOVSPC
	73	05	45015	00	4000	00017	
	74	02	50010	07	0001	00024	VSPCWD
	75	01	40000	00	4400	00126	XCWD

NOVSPC	76	01	21700	43	0002	00000	
	100	01	42002	00	4000	04000	BATR
	101	01	40006	00	4400	00010	USTAR
	102	01	40005	00	4012	00000	
	103	55	21600	00	0000	00000	
	104	01	41006	25	4400	00001	
	105	45	21641	00	0001	00001	ADDV
	106	01	40027	00	4000	77776	
ADDV	107	04	10403	61	0200	00000	
	110	01	40000	00	4001	77754	SAVEB6
EMPTY	111	03	01000	00	4401	77663	ERPR
	112	00	40001	42	4000	00010	USTAR
	113	01	40000	00	4400	00135	STEX
	114	01	40000	00	4001	77750	SAVEB6
INCOMP	115	01	21641	00	0001	00001	RETURN
	116	05	01000	00	4401	77656	ERPR
RETURN	117	01	01000	00	4000	00000	
MSPCWD	120	00	00004	20	0000	00010	USTAR
VSPCWD	121	00	00002	20	0000	00010	USTAR
ABIT	122	00	00000	00	4000	00000	

316	ERPR	0	77776	1	200000000000000	0
317	ENTRY	0	77776	1	300000000000000	0
320	ADDV	0	107	1	127000000000000	0
321	ADDV	0	63	1	103000000000000	0
322	SAVE	0	136	0	143000000000000	0
323	SAVEB6	0	66	1	106000000000000	0
324	USTAR	0	10	0	140000000000000	0
325	EMPTY	0	111	1	131000000000000	0
326	INCOMP	0	115	1	135000000000000	0
327	ABIT	0	122	1	150000000000000	0
330	VECTOR	0	72	1	112000000000000	0
331	NOMSPC	0	52	1	720000000000000	0
332	MSPCWD	0	120	1	146000000000000	0
333	XCWD	0	126	0	141000000000000	0
334	BATR	0	4000	0	145000000000000	0
335	MLOOP	0	54	1	740000000000000	0
336	UNSAVE	0	137	0	144000000000000	0
337	NOVSPC	0	77	1	117000000000000	0
340	VSPCWD	0	121	1	147000000000000	0
341	STEX	0	125	0	142000000000000	0
342	RETURN	0	117	1	137000000000000	0

MSUB

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MSUB          ORG
MAD           REF      *MADD
ENTRY         REF      *ENTRY
              REF      *MSUB

              TRA      *ENTRY
              BEU      CC-1
              STX      2
              TRA      *MAD,CC+X

              END
  
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PROGRAM MSUB 3/07/67 15.14

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MAD 77775 54 40434 32 5400 00000
ENTRY 77776 75 44554 36 1400 00000
      77777 54 62644 12 5400 00000
      1 01 01000 00 4401 77774 ENTRY
      2 14 21000 00 0001 77776
      3 01 43005 00 4000 00002
      4 01 01000 30 4401 77770 MAD
  
```

316	MAD	0 77775	1	2000000000000000	0
317	ENTRY	0 77776	1	3000000000000000	0

MMPY

MMPY		ORG		1
				2
ERPR		REF	*←ERPR	3
ENTRY		REF	*←ENTRY	4
		REF	*MMPY	5
				6
		REM	MULTIPLY VECTORS AND/OR MATRICES,	7
		REM	RESULT STORED IN U,T7 OR USTAR,	12
		TRA	*ENTRY	13
	-Z	TRA	a*SAVE,U←R	14
	T7	STO	aB6,B6+1	15
	B1	IF(NZE)TRA	aCC+1	16
		SB1	aUSTAR	17
	B2	IF(NZE)TRA	aCC+1	20
		SB2	aUSTAR	21
	I	LT5	B2,U←B4	22
		LT4	B1,U←B5	23
	T5	AND	T4	24
		IF(NUL)TRA	aNONE	25
	T5	AND	ABIT,U←T7	26
		IF(NUL)TRA	aVEC1	27
		CLA	T5,U←B5	30
		LDR	B5+1	31
	Z	LLS	a d15,U←B5	32
VEC1	T5	CRL	a d15,R←B3	33
	T4	CRL	a d15,R←PF	34
	T4	AND	ABIT,U←T6	35
		IF(NUL)TRA	aVEC2	36
	T4	SB4	aPF,U←PF	37
		LDR	PF+1	40
	Z	LLS	a d15,U←PF	41
VEC2	PF	IF(ZER)SKP	aB3,U←PF	42
	O5	TRA	*ERPR	43
MORE	PF	IF(POS)TRA	aCC+1,R←Z	44
		AB3	aPF	45
	T6	AND	T7	46
		IF(NZE)TRA	aMATMAT	47
	T6	ORU	T7	50
		IF(NZE)TRA	aVECMAT	51
	Z	SB1	aB3,U←T7	52
	I	LT4,STF	T4,U←B3	53
VVLOOP	*T4	FMP+20	*T5	54
		FAD←	T7,B1-1	55
	B1	IF(PNZ)TRA	aVVLOOP	56
		TRA	aOUT	57
VECMAT	B5	MPY	aB4	60
		CRR	a d15	61
		ORU	VECT	62
		TRA	aSETUP	63
MATMAT	B4	LRS	a d15	64
	B5	LUL	a d15	65
		ORU	R	66
		ORU	MATR	67
SETUP		BAU	aTEMP,U←T7	70
		TSR	a*XCWD,B4-1	71
		LT4,STF	CC,CC+1	72
		NOP	B1+PF	73

		CLA	B1,U=PF	74
	T6	IF(ZER)TRA	aSKIP,B4-1	75
		CLA	aPF+1	76
		RPA	FIX,B4+1	77
FIX		CLA	B4+(Z),U=PF	100
SKIP		SB2	aB5	101
RESET	Z	SB1	aB3,U=T7	102
MVLOOP	*T4	FMP+20	*T5	103
		FAD+	T7,B1-1	104
	B1	IF(PNZ)TRA	aMVLOOP	105
	B4	IF(POS)TRA	aCC+1	106
		SB1	aB2,CC+1	107
		SB1	aB4+1	110
	T7	STO	a*TEMP,B2-1	111
	B2	IF(PNZ)TRA	aRESET	112
	B4	IF(PNZ)TRA	aFIX,B4-1	113
	Z	LT7	B6-1,U=B3	114
OUT		LT4	aUSTAR,I=B1	115
	Z	TSR	a*STEX,U=B2	116
	B3	IF(NZE)TRA	aSCALAR	117
	Z	LDR+	TEMP,R=B2	120
		REM	*****PRESERVE TAG ON CODEWORD*****	
	R	FST	USTAR,I=B1	122
	B1	RPA	B2	123
SCALAR		TRA	a*UNSAVE,B6-1	124
	T7	TRA	aPF	125
				126
NONE	03	TRA	a*ERPR	127
	I	TRA	aOUT,U=B3	130
				131
ABIT	Z	Z	aZ	132
VECT		OCT	00000 0220 0000 00000	133
MATR		OCT	00000 0420 0000 00000	134
TEMP		OCT	Z	135
				136
USTAR		EQU	10	137
XCWD		EQU	126	140
STEX		EQU	135	141
SAVE		EQU	136	142
UNSAVE		EQU	137	143
				144
		END		145
				146

ERPR	77775	75	44615	76	1400	00000	
ENTRY	77776	75	44556	36	1400	00000	
	77777	54	54577	02	5400	00000	
	1	01	01000	00	4401	77774	ENTRY
	2	10	01000	02	4400	00136	SAVE
	3	07	20001	26	4100	00000	
	4	41	01050	00	4001	00001	
	5	01	40001	00	4000	00010	USTAR
	6	42	01050	00	4001	00001	
	7	01	40002	00	4000	00010	USTAR
	10	20	50450	44	0004	00000	
	11	01	50440	45	0002	00000	
	12	05	50314	00	0000	00004	
	13	01	01040	00	4001	00077	NONE
	14	05	50314	07	0001	00100	ABIT
	15	01	01040	00	4001	00003	VEC1
	16	01	21700	45	0000	00005	
	17	01	50400	00	0040	00001	
	20	00	45062	45	4000	00017	
VEC1	21	05	45066	53	4000	00017	
	22	04	45066	57	4000	00017	
	23	04	50314	06	0001	00071	ABIT
	24	01	01040	00	4001	00003	VEC2
	25	04	40004	47	4200	00000	
	26	01	50400	00	0200	00001	
	27	00	45062	47	4000	00017	
VEC2	30	47	02010	47	4010	00000	
	31	05	01000	00	4401	77743	ERPR
MORE	32	47	01110	10	4001	00001	
	33	01	41003	00	4200	00000	
	34	06	50314	00	0000	00007	
	35	01	01050	00	4001	00014	MATMAT
	36	06	50010	00	0000	00007	
	37	01	01050	00	4001	00006	VECMAT
	40	00	40001	07	4010	00000	
	41	20	50540	43	0000	00004	
VVLOOP	42	04	10620	00	0400	00005	
	43	01	10401	61	0000	00007	
	44	41	05150	00	4001	77774	VVLOOP
	45	01	01000	00	4001	00035	OUT
VECMAT	46	45	10200	00	4020	00000	
	47	01	45055	00	4000	00017	
	50	01	50010	00	0001	00045	VECT
	51	01	01000	00	4001	00004	SETUP
MATMAT	52	44	45015	00	4000	00017	
	53	45	45020	00	4000	00017	
	54	01	50010	00	0000	00002	
	55	01	50010	00	0001	00041	MATR
SETUP	56	01	20100	07	4001	00041	TEMP
	57	01	40000	64	4400	00126	XCWD
	60	01	50540	20	0001	00000	
	61	01	30000	00	0202	00000	
	62	01	21700	47	0002	00000	
	63	06	01010	64	4001	00003	SKIP
	64	01	21700	00	4200	00001	
	65	01	21601	24	0001	77777	FIX
FIX	66	01	21700	47	0020	00000	
SKIP	67	01	40002	00	4040	00000	
RESET	70	00	40001	07	4010	00000	
MVLOOP	71	04	10620	00	0400	00005	
	72	01	10401	61	0000	00007	
	73	41	05150	00	4001	77774	MVLOOP
	74	44	01110	00	4001	00001	
	75	01	40001	20	4004	00000	

	76	01	40001	00	4020	00001	
	77	07	20001	62	4401	00020	TEMP
	100	42	05150	00	4001	77766	RESET
	101	44	05150	64	4001	77763	FIX
	102	00	50470	43	0100	77776	
OUT	103	01	50440	71	4000	00010	USTAR
	104	00	40000	42	4400	00135	STEX
	105	43	01050	00	4001	00003	SCALAR
	106	00	50401	52	0001	00011	TEMP
	107	02	20041	71	0000	00010	USTAR
	110	41	21601	00	0004	00000	
SCALAR	111	01	01000	66	4400	00137	UNSAVE
	112	07	01000	00	4200	00000	
NONE	113	03	01000	00	4401	77661	ERPR
	114	20	01000	43	4001	77765	OUT
ABIT	115	00	00000	00	4000	00000	
VECT	116	00	00002	20	0000	00000	
MATR	117	00	00004	20	0000	00000	
TEMP	120	00	00000	00	0000	00000	

316	ERPR	0	77775	1	2000000000000000	0
317	ENTRY	0	77776	1	3000000000000000	0
320	SAVE	0	136	0	1520000000000000	0
321	USTAR	0	10	0	1470000000000000	0
322	NONE	0	113	1	1360000000000000	0
323	ABIT	0	115	1	1400000000000000	0
324	VEC1	0	21	1	3700000000000000	0
325	VEC2	0	30	1	4600000000000000	0
326	MORE	0	32	3	5000000000000000	0
327	MATMAT	0	52	1	7000000000000000	0
330	VECMAT	0	46	1	6400000000000000	0
331	VVLOOP	0	42	1	6000000000000000	0
332	OUT	0	103	1	1210000000000000	0
333	VECT	0	116	1	1420000000000000	0
334	SETUP	0	56	1	7400000000000000	0
335	MATR	0	117	1	1440000000000000	0
336	TEMP	0	120	1	1460000000000000	0
337	XCWD	0	126	0	1500000000000000	0
340	SKIP	0	67	1	1050000000000000	0
341	FIX	0	66	1	1040000000000000	0
342	RESET	0	70	1	1060000000000000	0
343	MVLOOP	0	71	1	1070000000000000	0
344	STEX	0	135	0	1510000000000000	0
345	SCALAR	0	111	1	1340000000000000	0
346	UNSAVE	0	137	0	1530000000000000	0

INV

INV	ORG		1
			2
MCOPY	REF	*MCOPY	3
ERPR	REF	*ERPR	4
ENTRY	REF	*ENTRY	5
	REF	*INV	6
			7
	REM	INV(T7) → USTAR	10
			11
	TRA	*ENTRY	12
Z	RWT	ERSW,CC+1	13
I	RWT	ERSW	14
Z	BAU+2	X,36+1	15
-Z	IF(ZER,EOV)TRA	a*SAVE,U→R	16
	LDR	Z	17
T7	SB3	Z,U→B1	20
P1	SUR	B1,R→B2	21
	IF(NUL)TRA	EMPTY	22
B1	IF(ZER)SKP	aUSTAR,I→B1	23
	TSR	*MCOPY,CC+1	24
Z	STO	aMAXP	25
	CLA	B1,U→B1	26
	CRL	a+15,R→B4	27
P1	RWT	LOOP2,B1+1	30
P1	RWT	MATB4,B1-1	31
	LDR	B1+1	32
Z	LLS	17	33
	IF(POS)SKP	aB4	34
	TSR	LONGER	35
-B4	CPL	aZ	36
	FMP	TWO47	37
	VDF	EPSLN	40
	STO	aERROR	41
ROWSTO	LDR	B1+1,B3+1	42
	LLS	a+15,U→B5	43
P3	LRS	a+15	44
	REM	*****PRESERVE TAG ON CODEWORD*****	45
R	FST	B1+1,B1+1	47
P3	IF(POS)SKP	aB4	50
	TRA	aROWSTO	51
P4	LDR	a1.0,U→PF	52
R	STO	aDET	53
INVLP	STX	5,U→T6	54
	SB2	aPF,I→B1	55
SCAN	IT61	1*USTAR1	56
	LT6	*USTAR,U→B3	57
B1	AB1	a77776,U→T7	60
P3	IF(PNZ)TRA	aSCAN	61
IT61	IF(ZER,EOV)TRA	aSINGLR,U→T6	62
Z	IF(NZE)SKP	-MAXP,U→T5	63
T6	STO	aMAXP,CC+1	64
T6	IF(POS)SKP	MINP	65
T6	STO	aMINP	66
T6	IF(NEG)SKP	T5	67
T6	STO	aMAXP,U→T5	70
T5	FDV	MINP	71
	IF(NEG)SKP	ERROR,R→Z	72
	TRA	aSINGLR	73

	B3	LT4	-H1,0,U-B1	74
	T4	LT5→	*USTAR,R-B2	75
		FDV	T5,U-T4	76
	T5	FMP→	DET,B2+1	77
	B4	SB3,ERM	aB3,U-T6	100
	T4	FMP→	*USTAR,B3-1	101
LOOP1	B4	SB2	aPF,U-B1	102
	B1	IF(ZER)JMP	T7,B4-1	103
	Z	LT5→	*USTAR	104
	T7	SB2	B3,U-B1	105
LOOP2	T5	FMP	*B1+(Z)	106
MATB4		FAD→	*B4+(Z),B2-1	107
	B2	IF(PNZ)TRA	aLOOP2	110
	B4	IF(PNZ)TRA	aLOOP1	111
	T7	SB4	a*T6,U-B3	112
		CLA	USTAR,U-B1	113
	B3	IF(NZE)SKP	aPF	114
		TRA	aTEST,PF-1	115
		CLA	B1+PF,U-B2	116
		REM	*****PRESERVE TAG ON CODEWORD*****	
		LDR→	B1+B3,I-B3	120
	B3	RPA	B2,R-B2	121
		REM	*****PRESERVE TAG ON CODEWORD*****	
	R	FST	B1+PF,I-B3	123
	B3	RPA	B2,PF-1	124
TEST	PF	IF(PNZ)TRA	aINVLP	125
		SB3	aB4,I-B2	126
HUNT		LDR	B1+B3	127
	7	LLS	a+15	130
		IF(ZER)SKP	aB2,B3-1	131
	B3	IF(PNZ)TRA	aHUNT	132
	B2	IF(ZER)SKP	aB3+1	133
		TRA	aSWAP,B3+1	134
	B1	TRA	aFIX,U-PF	135
LAST		SB2	aB2=1,I-B3	136
	B2	IF(PNZ)TRA	aHUNT	137
OUT		TRA	a*UNSAVE	140
		STX	a*36-1,B6-1	141
	PF	LT7,SUR	DET,R-CC	142
SWAP	B1	SB1	aB4,U-PF	143
EXLOOP		LDR	*USTAR	144
	B2	SB2	aB3,U-B3	145
	R	LDR→	*USTAR	146
	B2	SB2	aB3,U-B3	147
	R	STO	*USTAR,B1-1	150
	B1	IF(PNZ)TRA	aExLOOP	151
		CLA	PF+B3	152
		LDR	PF+B2	153
		LLS	a+15,U-R	154
		CRR	a+15	155
		REM	*****PRESERVE TAG ON CODEWORD*****	
		FST	PF+B3	157
FIX		LDR	PF+B2	160
		LLS	a+15	161
	B5	LRS	a+15	162
		REM	*****PRESERVE TAG ON CODEWORD*****	
	R	FST	PF+B2	164
	PF	TRA	aLAST,U-B1	165
SINGLR		CLA	USTAR,U-B1	166

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SINLP		CRL	17,R+B2	167
		LDR	B1+B2	170
		LRL	17	171
	P5	LRS	17	172
		REM	*****PRESERVE TAG ON CODEWORD*****	
	P	FST	B1+B2,B2-1	174
	P2	IF(PNZ)TRA	SINLP	175
ERSW		TRA	ACC+(Z)	176
	04	TRA	*ERPR	177
AFTERM	Z	STO	DET	200
		TRA	ADUT	201
LONGER	06	TRA	*ERPR	202
		TRA	AFTERM	203
EMPTY	03	TRA	*ERPR	204
		TRA	AFTERM	205
				206
EPSLN		DEC	1000000000000000,	207
TWO47		OCT	042000000000000000	210
ERROR		OCT	Z	211
MINP		OCT	Z	212
MAXP		OCT	Z	213
DET		OCT	Z	214
USTAR		EQU	10	215
STEX		EQU	135	216
SAVE		EQU	136	217
UNSAVE		EQU	137	220
				221
				222
				223
		END		

MCOPY	77774	54	42565	77	0400	00000	
ERPR	77775	75	44615	76	1400	00000	
ENTRY	77776	75	44556	36	1400	00000	
	77777	50	55652	52	5400	00000	
	1	01	01000	00	4401	77774	ENTRY
	2	00	21641	20	0001	00153	ERSW
	3	20	21641	00	0001	00152	ERSW
	4	00	20102	26	0000	77775	
	5	10	01310	02	4400	00136	SAVE
	6	01	50400	00	0000	00000	
	7	07	40063	41	4000	00000	
	10	41	53000	52	0002	00000	
	11	01	01040	00	4001	00152	EMPTY
	12	41	02010	71	4000	00010	USTAR
	13	01	40000	20	4401	77760	MCOPY
	14	00	20001	00	4001	00155	MAXP
	15	01	21750	41	0002	00000	
	16	01	45066	54	4000	00017	
	17	41	21641	21	0001	00053	LOOP2
	20	41	21641	61	0001	00053	MATB4
	21	01	50400	00	0002	00001	
	22	00	45062	00	4000	00017	
	23	01	02110	00	4020	00000	
	24	01	40000	00	4001	00135	LONGER
	25	54	50100	00	4000	00000	
	26	01	10600	00	0001	00140	TWO47
	27	01	16700	00	0001	00136	EPSLN
	30	01	20001	00	4001	00137	ERROR
ROWSTO	31	01	50400	23	0002	00001	
	32	01	45062	45	4000	00017	
	33	43	45015	00	4000	00017	
	34	02	20041	21	0002	00001	
	35	43	02110	00	4020	00000	
	36	01	01000	00	4001	77771	ROWSTO
	37	44	50400	47	0001	00134	+0000A
	40	02	20001	00	4001	00132	DET
INVLP	41	00	43005	06	4000	00005	
	42	01	40002	71	4000	00000	
SCAN	43	26	02110	00	2400	00010	USTAR
	44	41	50460	43	0400	00010	USTAR
	45	43	41001	07	4000	77776	
	46	41	05150	00	4001	77773	SCAN
	47	26	01310	06	4001	00077	SINGLR
	50	00	02050	05	1001	00121	MAXP
	51	06	20001	20	4001	00120	MAXP
	52	06	02110	00	0001	00116	MINP
	53	06	20001	00	4001	00115	MINP
	54	06	02510	00	0000	00005	
	55	06	20001	05	4001	00114	MAXP
	56	05	10700	00	0001	00112	MINP
	57	01	02510	10	0001	00110	ERROR
	60	01	01000	00	4001	00066	SINGLR
	61	43	50440	41	1001	00112	+0000A
	62	04	50451	52	0400	00010	USTAR
	63	01	10700	04	0000	00005	
	64	05	10601	22	0001	00106	DET
	65	44	40023	06	4040	00000	
	66	04	10601	63	0400	00010	USTAR
LOOP1	67	44	40002	41	4200	00000	
	70	41	03010	64	0000	00007	
	71	00	50451	00	0400	00010	USTAR
	72	07	40002	41	4040	00000	
LOOP2	73	05	10600	00	0402	00000	
MATB4	74	01	10401	62	0420	00000	

	75	42	05150	00	4001	77774	LOOP2
	76	44	05150	00	4001	77767	LOOP1
	77	07	40004	43	4400	00006	
	100	01	21700	41	0000	00010	USTAR
	101	43	02050	00	4200	00000	
	102	01	01000	67	4001	00005	TEST
	103	01	21700	42	0202	00000	
	104	01	50401	73	0012	00000	
	105	43	21601	52	0004	00000	
	106	02	20041	73	0202	00000	
	107	43	21601	67	0004	00000	
TEST	110	47	05150	00	4001	77727	INVLP
	111	01	40003	72	4020	00000	
HUNT	112	01	50400	00	0012	00000	
	113	00	45062	00	4000	00017	
	114	01	02010	63	4004	00000	
	115	43	05150	00	4001	77773	HUNT
	116	42	02010	00	4010	00001	
	117	01	01000	23	4001	00006	SWAP
	120	41	01000	47	4001	00021	FIX
LAST	121	01	40002	73	4004	77776	
	122	42	05150	00	4001	77766	HUNT
OUT	123	01	01000	00	4400	00137	UNSAVE
	124	01	43005	66	4500	77776	
	125	47	53470	50	0001	00045	DET
SWAP	126	41	40001	47	4020	00000	
EXLOOP	127	01	50400	00	0400	00010	USTAR
	130	42	40002	43	4010	00000	
	131	02	50401	00	0400	00010	USTAR
	132	42	40002	43	4010	00000	
	133	02	20001	61	4400	00010	USTAR
	134	41	05150	00	4001	77771	EXLOOP
	135	01	21700	00	0210	00000	
	136	01	50400	00	0204	00000	
	137	01	45062	02	4000	00017	
	140	01	45055	00	4000	00017	
	141	01	20041	00	0210	00000	
FIX	142	01	50400	00	0204	00000	
	143	01	45062	00	4000	00017	
	144	45	45015	00	4000	00017	
	145	02	20041	00	0204	00000	
	146	47	01000	41	4001	77751	LAST
SINGLR	147	01	21700	41	0000	00010	USTAR
	150	01	45064	52	4000	00017	
SINLP	151	01	50400	00	0006	00000	
	152	01	45002	00	4000	00017	
	153	45	45015	00	4000	00017	
	154	02	20041	62	0006	00000	
	155	42	05150	00	4001	77772	SINLP
ERSW	156	01	01000	00	4001	00000	
	157	04	01000	00	4401	77615	ERPR
AFTERM	160	00	20001	00	4001	00012	DET
	161	01	01000	00	4001	77740	OUT
LONGER	162	06	01000	00	4401	77612	ERPR
	163	01	01000	00	4001	77773	AFTERM
EMPTY	164	03	01000	00	4401	77610	ERPR
	165	01	01000	00	4001	77771	AFTERM
EPSLN	166	06	01106	04	7162	50000	
TW047	167	06	20000	00	0000	00000	
ERROR	170	00	00000	00	0000	00000	
MINP	171	00	00000	00	0000	00000	
MAXP	172	00	00000	00	0000	00000	
DET	173	00	00000	00	0000	00000	

+000CA	174	01	00100	00	0000	00000	

318	RECOPY	0	77777	1	2000000000000000	0
317	ERPR	0	77775	1	3000000000000000	0
320	ENTRY	0	77776	1	4000000000000000	0
321	ERSW	0	156	1	2240000000000000	0
322	SAVE	0	136	0	2520000000000000	0
323	EMPTY	0	164	1	2320000000000000	0
324	USTAR	0	10	0	2500000000000000	0
325	MAXP	0	172	1	2450000000000000	0
326	LOOP2	0	73	1	1100000000000000	0
327	MATB4	0	74	1	1110000000000000	0
330	LONGER	0	162	1	2300000000000000	0
331	TWO47	0	167	1	2370000000000000	0
332	EPSLN	0	166	1	2350000000000000	0
333	ERROR	0	170	1	2410000000000000	0
334	ROWSTO	0	31	1	4100000000000000	0
335	+0000A	0	174	1	2550000000000000	0
336	DET	0	173	1	2470000000000000	0
337	INVLP	0	41	1	5600000000000000	0
340	SCAN	0	43	1	6000000000000000	0
341	SINGLR	0	147	1	2100000000000000	0
342	MINP	0	171	1	2430000000000000	0
343	LOOP1	0	67	1	1040000000000000	0
344	TEST	0	110	1	1370000000000000	0
345	HUNT	0	112	1	1410000000000000	0
346	SWAP	0	126	1	1550000000000000	0
347	FIX	0	142	1	1760000000000000	0
350	LAST	0	121	1	1500000000000000	0
351	OUT	0	123	1	1520000000000000	0
352	UNSAVE	0	137	0	2530000000000000	0
353	EXLOOP	0	127	1	1560000000000000	0
354	SINLP	0	151	1	2120000000000000	0
355	AFTERM	0	160	1	2260000000000000	0
356	STEX	0	135	0	2510000000000000	0

TRAN

TRAN		ORG			1
ERPR		REF	*ERPR		2
ENTRY		REF	*ENTRY		3
		REF	*TRAN		4
					5
		REM	GENIE TRAN(T7) → USTAR		6
					7
		TRA	*ENTRY		10
-Z		TRA	a*SAVE,U→R		11
Z		BAU	T7,U→B5		12
		LDR	B5,R→B2		13
R		IF(NUL)TRA	ERR		14
		LLS	a+15,U→B1		15
		LDR	B2+1		16
		LLS	a+15,U→B2		17
B2		LDR	MATWRD		20
		LRS	a+30		21
R		BAU	aB1		22
		LUL	a+15		23
		BAU	aDUMY,U→T7		24
		TSR	a*XCWD		25
		CLA	DUMY,U→B3		26
		BIU	ASB2		27
		BAU	aB3+1,U→T6		30
		MLN	a4000		31
B3		RPA	FIX		32
B2		LT4,STF	B5,U→B3		33
I		LT5	MODB1,U→B5		34
B3		TSR,ERM	aFIX,U→B4		35
		LT5,STF	T6		36
TRNLP		SB2,ERM	aB3		37
	*T4	AB2	a77776,U→*T5		40
		AB1	a77776		41
B1		IF(PNZ)TRA	aTRNLP		42
B3		LT5	MODB2,U→B4		43
		SPF,ERM	aFIX+2		44
FIX	T5	RPI	B5+(Z),B4-1		45
		TRA	aPF		46
		LT4	aUSTAR,I→B1		47
	Z	TSR	a*STEX,U→B2		50
	Z	LDR→	DUMY,R→B3		51
		REM	*****PRESERVE TAG ON CODEWORD*****		52
	R	FST	USTAR,I→B1		54
	B1	RPA	B3		55
EXIT		TRA	*UNSAVE		56
	PF	MLF	a4000,U→CC		57
					60
ERR	O3	TRA	*ERPR		61
	Z	SB1	aUSTAR,U→B2		62
		TSR	*STEX		63
		TRA	EXIT		64
ASB2		OCT	000000000404000000		65
MODB1		OCT	000000000000200000		66
MODB2		OCT	000000000000400000		67
DUMY		OCT	000000000000000000		70
MATWRD		OCT	042000000000000000		71
					72
USTAR		EQU	10		73

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PAGE 2

XCWD EQU
STEX EQU
SAVE EQU
UNSAVE EQU
END

126
135
136
137

74
75
76
77
100
101
102

ERPR	77775	75	44615	76	1400	00000	
ENTRY	77776	75	44556	36	1400	00000	
	77777	63	61405	52	5400	00000	
	1	01	01000	00	4401	77774	ENTRY
	2	10	01000	02	4400	00136	SAVE
	3	00	20100	45	0000	00007	
	4	01	50400	52	0040	00000	
	5	02	01040	00	4001	00041	ERR
	6	01	45062	41	4000	00017	
	7	01	50400	00	0004	00001	
	10	01	45062	42	4000	00017	
	11	42	50400	00	0001	00045	MATWRD
	12	01	45015	00	4000	00036	
	13	02	20100	00	4002	00000	
	14	01	45020	00	4000	00017	
	15	01	20100	07	4001	00040	DUMY
	16	01	40000	00	4400	00126	XCWD
	17	01	21700	43	0001	00036	DUMY
	20	01	20200	00	0001	00032	ASB2
	21	01	20100	06	4010	00001	
	22	01	42002	00	4000	04000	
	23	43	21601	00	0001	00012	FIX
	24	42	50540	43	0040	00000	
	25	20	50450	45	0001	00026	MODB1
	26	43	40020	44	4001	00007	FIX
	27	01	50550	00	0000	00006	
TRNLP	30	01	40022	00	4010	00000	
	31	04	41002	05	4000	77776	
	32	01	41001	00	4000	77776	
	33	41	05150	00	4001	77773	TRNLP
	34	43	50450	44	0001	00020	MODB2
	35	01	40027	00	4001	00002	FIX + 2
FIX	36	05	21501	64	0040	00000	
	37	01	01000	00	4200	00000	
	40	01	50440	71	4000	00010	USTAR
	41	00	40000	42	4400	00135	STEX
	42	00	50401	53	0001	00013	DUMY
	43	02	20041	71	0000	00010	USTAR
	44	41	21601	00	0010	00000	
EXIT	45	01	01000	00	4400	00137	UNSAVE
	46	47	42006	40	4000	04000	
ERR	47	03	01000	00	4401	77725	ERPR
	50	00	40001	42	4000	00010	USTAR
	51	01	40000	00	4400	00135	STEX
	52	01	01000	00	4001	77771	EXIT
ASB2	53	00	00000	00	4404	00000	
MODB1	54	00	00000	00	0002	00000	
MODB2	55	00	00000	00	0004	00000	
DUMY	56	00	00000	00	0000	00000	
MATWRD	57	04	20000	00	0000	00000	

316	ERPR	0	77775	1	2000000000000000	0
317	ENTRY	0	77776	1	3000000000000000	0
320	SAVE	0	136	0	1050000000000000	0
321	ERR	0	47	1	6400000000000000	0
322	MATWRD	0	57	1	1010000000000000	0
323	DUMY	0	56	1	7700000000000000	0
324	XCWD	0	126	0	1030000000000000	0
325	ASB2	0	53	1	7100000000000000	0
326	FIX	0	36	1	4600000000000000	0
327	MODB1	0	54	1	7300000000000000	0
330	TRNLP	0	30	1	4000000000000000	0

331	MODE	0	38	1	7300000000000000	0
332	USTAR	0	10	0	1020000000000000	0
333	STEX	0	135	0	1040000000000000	0
334	EXIT	0	45	1	6200000000000000	0
335	UNSAVE	0	137	0	1060000000000000	0

SMMPY

SMMPY		ORG				
MCOPY		REF		*MCOPY		
ERPR		REF		*ERPR		
ELOC		REF		*ELOC		
		REM		U X *B1 → USTAR		
		TRA		CC+2, U→R		
		TRA		CC+3		
		TRA		CC+3		
	PF	BNA		NAME		
		STO		*ELOC, R→U		
		LDR		INST1, CC+1		
		LDR		INST2		
		XUR→		aARITH, B6+1		
	T7	STO		aB6-1, R→T7		
	-Z	TRA		a*SAVE, U→R		
	B1	IF(NZE)TRA		aNOUSTR, U→B2		
		CLA		USTAR, U→B3		
		CLA		B3		
		LUR		a+15		
		IF(ZER)TRA		aCC+1		
		TSR		a*MCOPY, CC+1		
		SB1		aUSTAR		
NOUSTR	I	SUR		B1, R→B5		
		IF(NUL)TRA		ERR, R→Z		
	B1	IF(ZER)SKP		aUSTAR, R→B1		
		TSR		*MCOPY, CC+1		
	Z	BEU		T7		
		IF(NUL)TRA		CC+1		
	T7	IF(NZE)SKP		a1, 0, CC+1		
	T7	IF(NZE)SKP		a1		
		TRA		EXIT		
		SUR, LT6		USTAR, U→B1		
	T6	AND		STAR		
		IF(NUL)TRA		VECT		
	I	LDR		B1+1, U→B2		
		LLS		a+15, U→B4		
	T6	CRL		a+15, R→B5		
		TRA		aLOOP		
VECT	T6	CRL		a+15, R→B4		
LOOP	B5	SB3, ERM		aB4, U→B1		
ARITH		OCT		Z		
		AB5		a77776		
	B5	IF(PNZ)TRA		LOOP-1, CC+1		
ERR	03	TRA		*ERPR		
EXIT		TRA		*UNSAVE		
		LT7		B5-1, B6-1		
		TRA		aPF		
NAME		BCD		SMMPY0000		
INST1	T7	10621		*T6, B3-1		
INST2	T7	17701		*T6, B3-1		
STAR		OCT		4000 00000		
USTAR		EQU		10		
SAVE		EQU		136		
UNSAVE		EQU		137		

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END

PAGE 2

74
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MCOPY	77775	54	42565	77	0400	00000
ERPR	77776	75	44615	76	1400	00000
ELOC	77777	75	44535	64	2000	00000
	1	01	01000	02	4001	00002
	2	01	01000	00	4001	00003
	3	01	01000	00	4001	00003
	4	47	21600	00	0001	00046
	5	01	20001	11	4401	77771
	6	01	50400	20	0001	00045
	7	01	50400	00	0001	00045
	10	01	54001	26	4001	00033
	11	07	20001	17	4100	77776
	12	10	01000	02	4400	00136
	13	41	01050	42	4001	00006
	14	01	21700	43	0000	00010
	15	01	21700	00	0010	00000
	16	01	45010	00	4000	00017
	17	01	01010	00	4001	00001
	20	01	40000	20	4401	77754
	21	01	40001	00	4000	00010
NOUSTR	22	20	53000	55	0002	00000
	23	01	01040	10	4001	00023
	24	41	02010	51	4000	00010
	25	01	40000	20	4401	77747
	26	00	21000	00	0000	00007
	27	01	01040	00	4001	00001
	30	07	02050	20	0001	00026
	31	07	02050	00	4000	00001
	32	01	01000	00	4001	00015
	33	01	53460	41	0000	00010
	34	06	50314	00	0001	00021
	35	01	01040	00	4001	00004
	36	20	50400	42	0002	00001
	37	01	45062	44	4000	00017
	40	06	45066	55	4000	00017
	41	01	01000	00	4001	00001
VECT	42	06	45066	54	4000	00017
LOOP	43	45	40023	41	4020	00000
ARITH	44	00	00000	00	0000	00000
	45	01	41005	00	4000	77776
	46	45	05150	20	4001	77772
ERR	47	03	01000	00	4401	77726
EXIT	50	01	01000	00	4400	00137
	51	01	50470	66	0100	77776
	52	01	01000	00	4000	00000
NAME	53	62	54545	77	0000	00000
INST1	54	07	10621	63	0400	00006
INST2	55	07	17701	63	0400	00006
STAR	56	00	00000	00	4000	00000

NAME
ELOC
INST1
INST2
ARITH
SAVE
NOUSTR
USTAR

MCOPY
USTAR

ERR
USTAR
MCOPY

*0000A

EXIT
USTAR
STAR
VECT

LOOP

LOOP -1
ERPR
UNSAVE

*0000A	57	01	00100	00	0000	00000
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317	MCOPY	0	77775	1	20000000000000	0
320	ERPR	0	77776	1	30000000000000	0
321	ELOC	0	77777	1	40000000000000	0
322	NAME	0	53	1	64000000000000	0
323	INST1	0	54	1	65000000000000	0
324	INST2	0	55	1	66000000000000	0
325	ARITH	0	44	1	54000000000000	0
326	SAVE	0	136	0	72000000000000	0
327	NOUSTR	0	22	1	31000000000000	0
330	USTAR	0	10	0	71000000000000	0
331	ERR	0	47	1	57000000000000	0

333	EXIT	0	50	1	6000000000000000	0
334	STAR	0	56	1	7000000000000000	0
335	VECT	0	42	1	5100000000000000	0
336	LOOP	0	43	1	5200000000000000	0
337	UNSAVE	0	127	0	7300000000000000	0

SMDIV

SMDIV		ORG	
SMMPY		REF	*SMMPY
ELOC		REF	*ELOC
ERPR		REF	*ERPR
		REM	*B1/U → USTAR
		TRA	CC+1, U→T7
		TRA	CC+2, U→T7
	PF	21600	NAME
		STO	*ELOC
	T7	IF(ZER) TRA	ERR
		STX	2
		TRA	*SMMPY, CC+X
ERR	07	TRA	*ERPR
	Z	SBI	USTAR, U→B2
		TRA	*STEX
NAME		BCD	SMDIV0000
USTAR		EQU	10
STEX		EQU	135
		END	

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PROGRAM SMDIV 10/06/66 12.54

SMMPY	77775	62	54545	77	0400	00000	
ELOC	77776	75	44535	64	2000	00000	
ERPR	77777	75	44615	76	1400	00000	
*B1/U → USTAR							
	1	01	01000	07	4001	00001	
	2	01	01000	07	4001	00002	
	3	47	21600	00	0001	00007	NAME
	4	01	20001	00	4401	77771	ELOC
	5	07	01010	00	4001	00002	ERR
	6	01	43005	00	4000	00002	
	7	01	01000	30	4401	77765	SMMPY
ERR	10	07	01000	00	4401	77766	ERPR
	11	00	40001	42	4000	00010	USTAR
	12	01	01000	00	4400	00135	STEX
NAME	13	62	54435	06	5000	00000	

315	SMMPY	0	77775	1	2000000000000000	0
316	ELOC	0	77776	1	3000000000000000	0
317	ERPR	0	77777	1	4000000000000000	0
320	NAME	0	13	1	2300000000000000	0
321	ERR	0	10	1	1700000000000000	0
322	USTAR	0	10	0	2400000000000000	0
323	STEX	0	135	0	2500000000000000	0

MFLT

MFLT		ORG		1
				2
				3
MCOPY		REF	*MCOPY	4
ERPR		REF	*+ERPR	5
ENTRY		REF	*+ENTRY	6
		REF	*MFLT	7
				10
		REM	GENIE MATRIX FLOAT (B1)	11
				12
		TRA	*ENTRY	13
	-Z	TRA	a*SAVE,U+R	14
	B1	IF(ZER)TRA	NOCOPY,U+B2	15
	B1	IF(ZER)SKP	aUSTAR,I+B1	16
		TSR	*MCOPY,CC+1	17
NOCOPY		SBI	USTAR	20
		SUR,LT5	B1,U+T6	21
		IF(NUL)TRA	ERR,U+B1	22
		AND	4000 00000	23
		IF(NUL)TRA	VCTR,U+B2	24
		CLA	B1+1	25
		CRL	d15,R+B2	26
VCTR	T6	CRL	a+15,R+B3	27
	B6	LT4	06200000000000000000,U+T6	30
OLOOP		SBI	aB3	31
ILOOP		-LDU	-*T5,I+B6	32
		FMP+2	T4,B1-1	33
	B1	IF(PN7)TRA	ILOOP	34
	B2	IF(NEG)SKP	a1	35
		TRA	OLOOP,B2-1	36
OUT	T6	TRA	*UNSAVE,U+B6	37
		TRA	PF	40
				41
ERR	03	TRA	*ERPR	42
	B6	TRA	OUT,U+T6	43
				44
USTAR		EQU	10	45
SAVE		EQU	136	46
UNSAVE		EQU	137	47
				50
		END		51
				52

MCOPY	77774	54	42565	77	0400	00000
ERPR	77775	75	44415	76	1400	00000
ENTRY	77776	75	44556	76	1400	00000
	77777	54	45536	72	5400	00000
	1	01	01000	00	4401	77774
	2	10	01000	02	4400	00136
	3	41	01010	42	4001	00002
	4	41	02010	71	4000	00010
	5	01	40000	20	4401	77766
NOCOPY	6	01	40001	00	4000	00010
	7	01	53450	06	0002	00000
	10	01	01040	41	4001	00016
	11	01	50314	00	0001	00017
	12	01	01040	42	4001	00002
	13	01	21700	00	0002	00001
	14	01	45066	52	4000	00017
VCTR	15	06	45066	53	4000	00017
	16	46	50440	06	0001	00013
OLLOOP	17	01	40001	00	4010	00000
ILOOP	20	01	50414	76	1400	00005
	21	01	10602	61	0000	00004
	22	41	05150	00	4001	77774
	23	42	02510	00	4000	00001
	24	01	01000	62	4001	77771
OUT	25	06	01000	46	4400	00137
	26	01	01000	00	4000	00000
ERR	27	03	01000	00	4401	77745
	30	46	01000	06	4001	77773

ENTRY
SAVE
NOCOPY
USTAR
MCOPY
USTAR

ERR
+0000A
VCTR

+0000B

ILOOP

OLLOOP
UNSAVE

ERPR
OUT

+0000A	31	00	00000	00	4000	00000
+0000B	32	06	20000	00	0000	00000

316	MCOPY	0	77774	1	2000000000000000	0
317	ERPR	0	77775	1	3000000000000000	0
320	ENTRY	0	77776	1	4000000000000000	0
321	SAVE	0	136	0	4300000000000000	0
322	NOCOPY	0	6	1	1700000000000000	0
323	USTAR	0	10	0	4200000000000000	0
324	ERR	0	27	1	4000000000000000	0
325	+0000A	0	31	1	4600000000000000	0
326	VCTR	0	15	1	2600000000000000	0
327	+0000B	0	32	1	4700000000000000	0
330	OLLOOP	0	17	1	3000000000000000	0
331	ILOOP	0	20	1	3100000000000000	0
332	OUT	0	25	1	3600000000000000	0
333	UNSAVE	0	137	0	4400000000000000	0

MC MPL

MCMPL		ORG		1
		REM	MAKES REAL MATRIX(B1) COMPLEX	2
		REM	IN CSTAR, (B1)=0+USTAR	3
				5
CSTAR		REF	*CSTAR	6
		REF	*+ + + + +	7
MCOPY		REF	*MCOPY	10
ERPR		REF	*+ERPR	11
ENTRY		REF	*+ENTRY	12
		REF	*MCMPL	13
				14
		TRA	*ENTRY	15
	-Z	TRA	*SAVE,U+R	16
	P1	IF(NZE)TRA	CC+1	17
		SBI	USTAR	20
		CLA	B1	21
		IF(NUL)TRA	EMPTY	22
	P1	IF(ZER)SKP	USTAR	23
	B1	TRA	COPY,U+B2	24
SWTCH		CLA	CSTAR,U+B1	25
	Z	TSR	*STEX,U+B2	26
				27
	Z	REM	***PRESERVE TAG ON CODEWORD***	
		CDR+	USTAR,R+B2	31
	F	REM	***PRESERVE TAG ON CODEWORD***	
	B1	FST	B1	33
		RWT	B2	34
		TRA	IMAG	35
COPY		CLA	CSTAR,U+B1	36
		TSR	*MCOPY,CC+1	37
IMAG		LDR	B1,R+B3	40
		LLS	d15,U+B1	41
	P	AND	4000 00000 00000	42
		IF(NUL)TRA	VECT	43
		LDR	B3+1	44
		LRL	3	45
		CLA	a0420,CC+1	46
VECT		CLA	a0220,R+Z	47
		LRS	d12	50
	P1	LRS	d15	51
	R	BAU	CSTAR+1,U+T7	52
		TSR	*XCWD	53
EXIT		TRA	*UNSAVE	54
		TRA	PF	55
				56
EMPTY	03	TRA	*ERPR	57
		CLA	CSTAR,U+B1	60
	Z	TSR	*STEX,U+B2	61
		TSR	*STEX,B1+1	62
		TRA	EXIT	63
				64
USTAR		EQU	10	65
XCWD		EQU	126	66
STEX		EQU	135	67
SAVE		EQU	136	70
UNSAVE		EQU	137	71
				72
		END		73

CSTAR	77772	42	62634	06	1400	00000	
	77773	75	75757	57	5400	00000	
MCOPY	77774	54	42565	77	0400	00000	
ERPR	77775	75	44615	76	1400	00000	
ENTRY	77776	75	44554	36	1400	00000	
	77777	54	42545	75	3400	00000	
	1	01	01000	00	4401	77774	ENTRY
	2	10	01000	02	4400	00136	SAVE
	3	41	01000	00	4201	00001	
	4	01	40001	00	4000	00010	USTAR
	5	01	21700	00	0002	00000	
	6	01	01040	00	4001	00030	EMPTY
	7	41	02010	00	4000	00010	USTAR
	10	41	01000	42	4001	00006	COPY
SWTCH	11	01	21700	41	0001	77760	CSTAR
	12	00	40000	42	4400	00135	STEX
	13	00	50401	52	0000	00010	USTAR
	14	02	20041	00	0002	00000	
	15	41	21641	00	0004	00000	
	16	01	01000	00	4001	00002	IMAG
COPY	17	01	21700	41	0001	77752	CSTAR
	20	01	40000	20	4401	77753	MCOPY
IMAG	21	01	50400	53	0002	00000	
	22	01	45062	41	4000	00017	
	23	02	50314	00	0001	00020	+0000A
	24	01	01040	00	4001	00003	VECT
	25	01	50400	00	0010	00001	
	26	01	45002	00	4000	00003	
	27	01	21700	20	4000	00420	
VECT	30	01	21700	10	4000	00220	
	31	01	45015	00	4000	00014	
	32	41	45015	00	4000	00017	
	33	02	20100	07	0001	77737	CSTAR +1
	34	01	40000	00	4400	00126	XCWD
EXIT	35	01	01000	00	4400	00137	UNSAVE
	36	01	01000	00	4200	00000	
EMPTY	37	03	01000	00	4401	77735	ERPR
	40	01	21700	41	0001	77731	CSTAR
	41	00	40000	42	4400	00135	STEX
	42	01	40000	21	4400	00135	STEX
	43	01	01000	00	4001	77770	EXIT

+0000A	44	00	00400	00	0000	00000	

316	CSTAR	0	77772	1	1300000000000000	0
317	MCOPY	0	77774	1	1500000000000000	0
320	ERPR	0	77775	1	1600000000000000	0
321	ENTRY	0	77776	1	1700000000000000	0
322	SAVE	0	136	0	1010000000000000	0
323	USTAR	0	10	0	7600000000000000	0
324	EMPTY	0	27	1	7100000000000000	0
325	COPY	0	17	1	5100000000000000	0
326	SWTCH	0	11	3	3100000000000000	0
327	STEX	0	135	0	1000000000000000	0
330	IMAG	0	21	1	5300000000000000	0

332	VECT	0	30	1	6200000000000000	0
333	XCWD	0	126	0	7700000000000000	0
334	EXIT	0	25	1	6700000000000000	0
335	UNSAVE	0	127	0	1020000000000000	0

MINDEX

MINDEX		ORG			1
ERPR		REF	*-ERPR		2
ENTRY		REF	*-ENTRY		3
		REF	*MINDEX		4
					5
					6
		TRA	*ENTRY		7
	-Z	TRA	*SAVE, U-R		10
	Z	BAU	B6+DEL-1, U-B1		11
	-I	LT6	B1, U-R		12
	B1	RPA,WTG	STORE, R-B1		13
	Z	BIU	T6, B1-1		14
		AND	EXITA, U-B4		15
		IF(NUL)TRA	VECT, U-B2		16
		CLA	*B6+B1+DEL, U-B4		17
		CLA	*B6+B1+DEL-1, U-B2		20
		AB1	a77775		21
VECT	Z	BAU	B6+B1+DEL, U-R		22
		LDR	*R, B1-1		23
	B1	RPA,WTG	EXITA, R-B3		24
	T6	IF(NUL)TRA	ERR		25
		CLA	*B6+B1+DEL, U-B5		26
SPEC	T6	LDR	a32+B3+B4+B5, U-B1		27
	R	IF(NUL)TRA	RESET		30
	-B5	TRA	SHIFT, U-R		31
RESET	-I	SB3	a1, U-R		32
	I	SB4	a2, U-B2		33
SHIFT	T6	LUR	ad24, U-B5		34
	B5	LUR	ad3, U-B5		35
		AB1	aB5, R-B5		36
		CLA	a20000, U-R		37
		LUL	aB3+2, U-T4		40
	R	LUL	aB4+2, U-T5		41
	-B5	IF(NUL)TRA	IEQZ		42
	T6	BAU	aB5+B1, U-T6		43
	-B5	LRS	ad12		44
	T6	LUR	ad39		45
		LRS	ad15		46
	R	RPL	T6		47
IEQZ	B3	IF(ZER)TRA	STORE		50
	T6	AND	CC+Z, CC+1		51
		OCT	740000000		52
		ORU	T4		53
		BLU,BAU	T6, U-T6		54
		REM	*****PRESERVE TAG ON CODEWORD*****		
STORE	T6	FST	(Z)		56
		AND	CC+Z, CC+1		57
		OCT	400000000		60
		IF(NUL)TRA	EXIT		61
	B2	IF(NUL)TRA	JEQZ		62
	-B2	LDR	Z+B1, U-B2		63
	R	LUR	ad24, U-B5		64
	B5	LUR	ad3, U-B5		65
	-B2	AB5	aB2, U-B2		66
	B2	AND	a7777, R-Z		67
		LRS	ad27, R-T4		70
	T6	CRL	ad15, R-B2		71
LOOP		CLA	B1+B2-1, U-B3		72
		AND	CC+Z, CC+1		73

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		OCT	777770000777700000	74
		ORU	T4	75
		BAU	aB3+B5	76
		REM	*****PRESERVE TAG ON CODEWORD*****	
		FST	B1+B2-1, B2-1	100
JEQZ	B2	IF(NZE)TRA	LOOP	101
	B4	IF(NUL)TRA	EXIT	102
	T6	CRL	a+15, R+B2	103
		CLA	IEQZ+2, U+T4	104
	T4	AND	B1+B2-1	105
		ORU	T5	106
		REM	*****PRESERVE TAG ON CODEWORD*****	
		BLU,BAU,WTG+	B1+B2-1, B2-1	110
	B2	IF(NZE)TRA	CC-5, CC+1	111
ERR	03	TRA	*ERPR	112
EXIT		TRA	*UNSAVE	113
EXITA	PF	AB6	a(12), U+CC	114
				115
SAVE		EQU	136	116
UNSAVE		EQU	137	117
DEL		EQU	77765	120
		END		121
				122

ERPR	77775	75	44615	76	1400	00000	
ENTRY	77776	75	44556	36	1400	00000	
	77777	54	50554	34	4400	00000	
	1	01	01000	00	4401	77774	ENTRY
	2	10	01000	02	4400	00136	SAVE
	3	00	20100	41	0100	77764	DEL - 1
	4	30	50460	02	0002	00000	
	5	41	21641	51	0001	00041	STORE
	6	00	20200	61	0000	00006	
	7	01	50314	44	0001	00073	EXITA
	10	01	01040	42	4001	00003	VECT
	11	01	21700	44	0502	77765	DEL
	12	01	21700	42	0502	77764	DEL - 1
	13	01	41001	00	4000	77775	
VECT	14	00	20100	02	0102	77765	DEL
	15	01	50400	61	0400	00002	
	16	41	21641	53	0001	00064	EXITA
	17	06	01040	00	4001	00061	ERR
	20	01	21700	45	0502	77765	DEL
SPEC	21	06	50400	41	4074	00000	
	22	02	01040	00	4001	00001	RESET
	23	55	01000	02	4001	00002	SHIFT
RESET	24	30	40003	02	4000	00001	
	25	20	40004	42	4000	00002	
SHIFT	26	06	45010	45	4000	00030	
	27	45	45010	45	4000	00003	
	30	01	41001	55	4040	00000	
	31	01	21700	02	4000	20000	
	32	01	45020	04	4010	00002	
	33	02	45020	05	4020	00002	
	34	55	01040	00	4001	00005	IEQZ
	35	06	20100	06	4042	00000	
	36	55	45015	00	4000	00014	
	37	06	45010	00	4000	00047	
	40	01	45015	00	4000	00017	
	41	02	20301	00	0000	00006	
IEQZ	42	43	01010	00	4001	00004	STORE
	43	06	50314	20	0001	00000	
	44	00	00000	00	7400	00000	
	45	01	50010	00	0000	00004	
	46	01	21500	06	0000	00006	
STORE	47	06	20041	00	0000	00000	
	50	01	50314	20	0001	00000	
	51	00	00000	00	4000	00000	
	52	01	01040	00	4001	00027	EXIT
	53	42	01040	00	4001	00016	JEQZ
	54	52	50400	42	0002	00000	
	55	02	45010	45	4000	00030	
	56	45	45010	45	4000	00003	
	57	52	41005	42	4004	00000	
	60	42	50314	10	4000	07777	
	61	01	45015	14	4000	00033	
	62	06	45066	52	4000	00017	
LOOP	63	01	21700	43	0006	77776	
	64	01	50314	20	0001	00000	
	65	77	77700	00	7777	00000	
	66	01	50010	00	0000	00004	
	67	01	20100	00	4050	00000	
	70	01	20041	62	0006	77776	
	71	42	01050	00	4001	77770	LOOP
JEQZ	72	44	01040	00	4001	00007	EXIT
	73	06	45066	52	4000	00017	
	74	01	21700	04	0001	77746	IEQZ + 2
	75	04	50314	00	0006	77776	

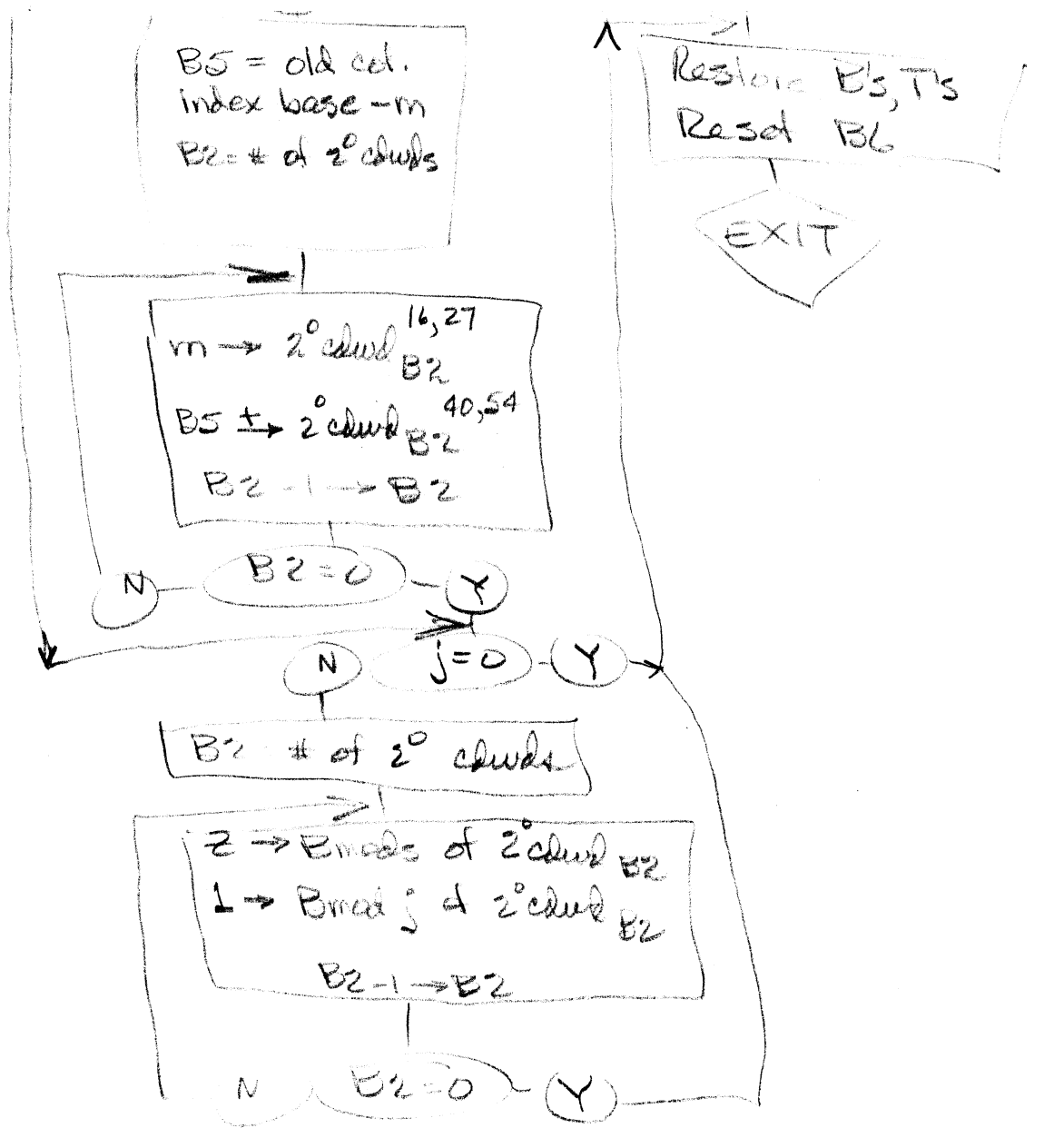
	76	01	50010	00	0000	00005	
	77	01	21541	62	0006	77776	
	100	42	01050	20	4001	77772	
ERR	101	03	01000	00	4401	77673	ERPR
EXIT	102	01	01000	00	4400	00137	UNSAVE
EXITA	103	47	41006	40	4000	00000	

316	ERPR	0	77775	1	200000000000000	0
317	ENTRY	0	77776	1	300000000000000	0
320	SAVE	0	136	0	132000000000000	0
321	DEL	0	77765	0	134000000000000	0
322	STORE	0	47	1	610000000000000	0
323	EXITA	0	103	1	131000000000000	0
324	VECT	0	14	1	200000000000000	0
325	ERR	0	101	1	127000000000000	0
326	SPEC	0	21	3	250000000000000	0
327	RESET	0	24	1	300000000000000	0
330	SHIFT	0	26	1	320000000000000	0
331	IEQZ	0	42	1	460000000000000	0
332	EXIT	0	102	1	130000000000000	0
333	JEQZ	0	72	1	113000000000000	0
334	LOOP	0	63	1	760000000000000	0
335	UNSAVE	0	137	0	133000000000000	0

INDEX for Gene Spind; see Mathematical
Subalgebra notation for Spind.

EXECUTE MINDEX (n, i, j); change initial
index of V to n with B-modified i

EXECUTE MINDEX (n, i, m, j, M); change
row initial index of M to n with row B-mod i;
change column initial index to m with col B-mod j.



MINsert

MINSER		ORG			
					1
					2
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Label	Instruction	Address	Hex	Dec
	T6	TSR	*XCWD, U+T7	74
	T6	21600 BNA	0600 0000 00000, U+T7	75-
		TSR	*XCWD	76
		LDR	T5	77
	P3	IF(NUL)TRA	CC-T, CC+1	100
		SB3	a34+1	101
	T5	AND	CC, CC+1	102
		OCT	777770000777700000	103
		ORU	TWO, U+T6	104
	Z	LLS	a430, U+85	105
	P5	LUR	a3, U+35	106
		LDR	BASE, 35-1	107
		LRS	a415, R+T5	110
AGAIN	P3	RPA	T5, U+T7	111
		TSR	*XCWD, B1-1	112
	P5	IF(ZER)TRA	OKAY	113
	P3	RPA	T5, U+T7	114
		TSR	*XCWD	115
OKAY	P1	IF(PNZ)TRA	AGAIN, 33+1	116
		TRA	EXIT1	117
BASE		OCT	11600000000000000000	120
TWO		OCT	01200000000000	121
				122
XCWD		EQU	126	123
SAVE		EQU	136	124
UNSAVE		EQU	137	125
DEL		EQU	77765	126
		END		127
				130

	1	10	01000	02	4400	00136	SAVE	
	2	00	20100	02	0100	77764	DEL	-1
SBIT	3	00	20200	00	0400	00002		
	4	01	50314	17	0001	77775	SBIT	
	5	01	01040	10	4001	00010	VECT	
	6	00	20100	00	0500	77762	DEL	-3
	7	01	45015	00	4000	00014		
	10	00	20100	00	0500	77763	DEL	-2
	11	01	45015	00	4000	00014		
	12	00	20100	00	0500	77761	DEL	-4
	13	01	45015	00	4000	00017		
	14	02	50011	00	0000	00007		
	15	01	01000	00	4001	00012	ABIT	+1
VECT	16	07	45015	00	4000	00017		
	17	00	20100	00	0500	77763	DEL	-2
	20	01	45015	00	4000	00014		
	21	00	45015	00	4000	00014		
	22	00	20100	00	0500	77762	DEL	-3
	23	01	45015	00	4000	00017		
	24	02	50010	07	0001	00027	FIVE	
	25	01	40000	00	4400	00126	XCWD	
	26	01	01000	00	4400	00137	UNSAVE	
ABIT	27	47	41006	40	4000	77774		
	30	07	50314	42	0001	00022	NRF	
	31	01	50010	06	0001	00022	FIVE	
	32	07	45066	51	4000	00036		
	33	41	45010	41	4000	00003		
	34	41	02010	00	4000	00002		
	35	01	01000	00	4001	00017	ROWS	
	36	01	50400	54	0004	00000		
	37	00	45062	41	4000	00017		
	40	00	45062	43	4000	00017		
	41	43	45010	43	4000	00003		
	42	06	21600	07	0001	00054	+0000A	
	43	01	40000	00	4400	00126	XCWD	
SETB	44	43	21601	07	0000	00006		
	45	01	40000	61	4400	00126	XCWD	
	46	41	05150	23	4001	77774	SETB	
EXIT1	47	01	50470	00	0001	00050	+0000B	
	50	01	40000	00	4400	00126	XCWD	
EXIT2	51	01	01000	00	4400	00137	UNSAVE	
	52	47	41006	40	4000	77773		
NRF	53	77	77700	00	7777	77777		
FIVE	54	00	00011	50	0000	00000		
ROWS	55	07	45066	51	4000	00017		
	56	07	45010	43	4000	00014		
	57	43	45010	43	4000	00003		
	60	41	05150	00	4001	00002	PLUS	
	61	06	40000	07	4400	00126	XCWD	
	62	01	01000	00	4001	77765	EXIT2	
PLUS	63	01	21700	05	0004	00000		
	64	05	45066	54	4000	00017		
	65	01	45066	55	4000	00017		
	66	45	45010	45	4000	00003		
	67	05	41004	45	4040	77776		
	70	01	50450	00	0060	00000		
	71	06	40000	07	4400	00126	XCWD	
	72	06	21600	07	0001	00024	+0000A	
	73	01	40000	00	4400	00126	XCWD	
	74	01	50400	00	0000	00005		
	75	43	01040	20	4001	77776		
	76	01	40003	00	4020	00001		
	77	05	50314	20	0001	00000		
	100	77	77700	00	7777	00000		

	101	01	50010	06	0001	00014	TWO
	102	00	45062	45	4000	00036	
	103	45	45010	45	4000	00003	
	104	01	50400	45	0001	00010	BASE
	105	01	45015	15	4000	00017	
AGAIN	106	43	21601	07	0000	00006	
	107	01	40000	61	4400	00126	XCWD
	110	45	01010	00	4001	00002	OKAY
	111	43	21601	07	0000	00005	
	112	01	40000	00	4400	00126	XCWD
OKAY	113	41	05150	23	4001	77771	AGAIN
	114	01	01000	00	4001	77731	EXIT1
BASE	115	11	60000	00	0000	00000	
TWO	116	00	00001	20	0000	00000	

+0000A	117	00	00006	00	0000	00000	
+0000B	120	00	00007	00	0000	00000	

316	SAVE	0	136	0	1260000000000000	0
317	DEL	0	77745	0	1300000000000000	0
320	SBIT	0	3	1	4000000000000000	0
321	VECT	0	16	1	1700000000000000	0
322	ABIT	0	27	1	3000000000000000	0
323	FIVE	0	54	1	5700000000000000	0
324	XCWD	0	126	0	1250000000000000	0
325	UNSAVE	0	127	0	1270000000000000	0
326	NRF	0	53	1	5500000000000000	0
327	ROWS	0	55	1	6000000000000000	0
330	+0000A	0	117	1	1320000000000000	0
331	SETB	0	44	1	4500000000000000	0
332	EXIT1	0	47	1	5000000000000000	0
333	+0000B	0	120	1	1330000000000000	0
334	EXIT2	0	51	1	5200000000000000	0
335	PLUS	0	63	1	6600000000000000	0
336	TWO	0	116	1	1240000000000000	0
337	BASE	0	115	1	1220000000000000	0
340	AGAIN	0	106	1	1120000000000000	0
341	OKAY	0	113	1	1170000000000000	0

MPATCH

MPATCH	ORG		
			1
			2
			3
	-Z	TRA	*SAVE, U→R
	Z	BAU	B6+DEL-1, U→B5
	P5	RPA,WTG	STORE
	-1	LT7	B5, U→B5
	Z	BIU	EXIT, U→T5
	T5	AND	T7
		IF(NUL)TRA	V2, B5-1
		CLA	*R6+B5+DEL, B5-1
V2		LDR	*R6+B5+DEL, U→B4
	Z	BAU	B6+B5+DEL-1, U→B3
		LT6	B3, B5-1
	P3	RPA,WTG	FETCH, R→B3
	T5	AND	T6, B5-1
		IF(NUL)TRA	V1, B5-1
		CLA	*R6+B5+DEL+1, B5-1
V1		LDR	*R6+B5+DEL+1, U→B2
	P6	SPF	aR2+B4, U→T7
	PF	IF(NUL)TRA	NSET, R→B1
		CLA	*R6+B5+DEL, B5-1
NSET		LDR	*R6+B5+DEL, U→PF
	P5	RPA,WTG	EXIT, R→B5
	Z	RPA,WTG	RESET, B5-1
	Z	RPA,WTG	RESET+1, R→T6
	PF	IF(NUL)TRA	STAR-1, PF-1
	P2	IF(NUL)TRA	UEQZ, B2+1
	P4	IF(NUL)TRA	VEQZ, B4+1
COLS	T7	AB2	aPF=1, U→B6
		AB4	aPF=1, PF+1
		AB1	aB5
STAR	P1	AB3	aB5, U→T4
	P3	TRA	NSTOR, U→T5
UEQZ	P2	RPA,WTG	RESET, B4+1
	P5	IF(NZF)TRA	COLS, I→B6
	P6	AB1	aPF, U→CC
VEQZ	P4	RPA,WTG	RESET+1
	P5	IF(NZF)TRA	COLS, I→B6
	P6	AB3	aPF, U→CC
RESET		TRA	CC+Z
	T4	TRA	CC, U→B1
	T5	TRA	CC+Z, U→B2
NSTOR	T6	NOP	Z, U→B5
FETCH		CLA,WTG	*(FETCH), U→R
	P1	SB1	B3, U→B3
	P2	SB2	B4, U→B4
STORE	P	STD,WTG	*(STORE), B5-1
	P1	SB1	B3-1, U→B3
	P2	SB2	B4, U→B4
	P5	IF(PNZ)TRA	FETCH, B3-1
		SB2	aB2-1, PF-1
	PF	IF(PNZ)TRA	RESET, B4-1
		TRA	*UNSAVE
EXIT	PF	AB6	a(Z), U→CC
DEL		EQU	77765
SAVE		EQU	136
UNSAVE		EQU	137

02/03/68 12.41

END

PAGE 2

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75

	1	10	01000	02	4400	00136	SAVE	
	2	00	20100	45	0100	77764	DEL	-1
	3	45	21641	00	0001	00051	STORE	
	4	30	50470	45	0040	00000		
	5	00	20200	05	0001	00056	EXIT	
	6	05	50314	00	0000	00007		
	7	01	01000	45	4001	00001	V2	
V2	10	01	21700	45	0540	77765	DEL	
	11	01	50400	44	0540	77765	DEL	
	12	00	20100	43	0140	77764	DEL	-1
	13	01	50460	45	0010	00000		
	14	43	21641	53	0001	00035	FETCH	
	15	05	50314	45	0000	00006		
	16	01	01040	45	4001	00001	V1	
	17	01	21700	45	0540	77766	DEL	+1
V1	20	01	50400	42	0540	77766	DEL	+1
	21	46	40007	07	4024	00000		
	22	47	01040	51	4001	00001	NSET	
	23	01	21700	45	0540	77765	DEL	
NSET	24	01	50400	47	0540	77765	DEL	
	25	45	21641	55	0001	00036	EXIT	
	26	00	21641	45	0001	00017	RESET	
	27	00	21641	16	0001	00017	RESET	+1
	30	47	01040	67	4001	00004	STAR	-1
	31	42	01040	22	4001	00006	UEQZ	
	32	44	01000	24	4001	00010	VEQZ	
COLS	33	07	41002	46	4200	77776		
	34	01	41004	27	4200	77776		
	35	01	41001	00	4040	00000		
STAR	36	41	41003	04	4040	00000		
	37	43	01000	05	4001	00011	NSTOR	
UEQZ	40	42	21641	24	0001	00005	RESET	
	41	45	01050	76	4001	77770	COLS	
	42	46	41001	40	4200	00000		
VEQZ	43	44	21641	00	0001	00003	RESET	+1
	44	45	01050	76	4001	77765	COLS	
	45	46	41003	40	4200	00000		
RESET	46	01	01000	00	4001	00000		
	47	04	01000	41	4001	00000		
	50	05	01000	43	4001	00000		
NSTOR	51	06	30000	45	0000	00000		
FETCH	52	01	21740	02	0400	00000		
	53	41	40001	43	4010	00000		
	54	42	40002	44	4020	00000		
STORE	55	02	20041	45	4400	00000		
	56	41	40001	43	4010	77776		
	57	42	40002	44	4020	00000		
	60	45	05150	63	4001	77770	FETCH	
	61	01	40002	67	4004	77776		
	62	47	05150	64	4001	77762	RESET	
	63	01	01000	00	4400	00137	UNSAVE	
EXIT	64	47	41006	40	4000	00000		

316	SAVE	0	126	0	4700000000000000	0
317	DEL	0	77765	0	6600000000000000	0
320	STORE	0	55	1	5600000000000000	0
321	EXIT	0	64	1	4500000000000000	0
322	V2	0	11	1	1200000000000000	0
323	FETCH	0	52	1	5300000000000000	0
324	V1	0	20	1	2100000000000000	0
325	NSET	0	24	1	2500000000000000	0
326	RESET	0	46	1	4700000000000000	0
327	STAR	0	36	1	3700000000000000	0
330	UEQZ	0	40	1	4100000000000000	0
331	VEQZ	0	43	1	4400000000000000	0
332	COLS	0	33	1	3400000000000000	0
333	NSTOR	0	51	1	5200000000000000	0
334	UNSAVE	0	137	0	7000000000000000	0

PATCH See Spiral Spiral (see Mathematics
and Culture notebook for Spiral version)

EXECUTE PATCH (n, r, V_1, s, V_2)

Copy n elements beginning at element
 r of vector V_1 into vector V_2 beginning
at element s .

EXECUTE PATCH ($n, 1, r, V, s, v, M$)

Copy n elements beginning at
element r of vector V into column v
of matrix M , starting at row s .

EXECUTE PATCH ($1, m, r, V, s, v, M$)

Copy m elements beginning at
element r of vector V into row s of
matrix M , starting at column v .

EXECUTE PATCH ($n, 1, r, u, M, s, V$)

Copy n elements from column u of
matrix M , beginning at row r , into vector
 V starting at element s .

EXECUTE PATCH (i, m, r, u, M, s, V)

Copy m elements from row r of matrix M , beginning at column u , into vector V beginning at element s .

EXECUTE PATCH($n, m, r, u, M_1, s, v, M_2$)

Copy n rows and m columns of matrix M_1 , beginning at row r and column u , into matrix M_2 beginning at row s and column v .

MPOWER

MPOWER		ORG			1
INV		REF	*INV		2
MMULT		REF	*MMPY		3
ELOC		REF	*ELOC		4
MCOPY		REF	*MCOPY		5
ERPR		REF	*ERPR		6
					7
		REM	*U TO THE R → USTAR		10
					11
		TRA	CC+1,U→T6		12
		TRA	CC+2,U→T6		13
	PF	21600	NAME		14
		STO	*ELOC		15
	T6	RWT	ARG		16
	R	RWT	EXP		17
	-Z	TRA	*SAVE,U→R		20
ARG	T7	LT4+2	aZ,B6+1		21
	T4	IF(NZE)TRA	CC+1,U→B3		22
		LT4	aUSTAR,I→B3		23
		CLA	B3,U→B4		24
		IF(NUL)TRA	EMPTY,R→Z		25
		CRL	17,R→T5		26
		CLA	B4+1,R→Z		27
		CRL	17,R→B1		30
	T5	IF(NEG)SKP	R,U→T6		31
		LT5	R		32
EXP	Z	IF(ZER)SKP	aZ,I→B4		33
	B3	TRA	EXP NZE,U→T7		34
	T5	LRS	17		35
	T5	LUL	17		36
		ORU	R		37
		ORU	MSPACE,U→T7		40
	T5	TSR	*XCWD,U→B2		41
	T5	LT4	d1,0,U→B1		42
	T4	STO	*USTAR,B1-1		43
	B1	IF(PNZ)TRA	CC-2,B2-1		44
		TRA	EXIT		45
					46
					47
EXP NZE	B4	IF(POS)TRA	EXP POS,B4-1		50
	T6	IF(NZE)TRA	NSQNEG,B4+1		51
		TSR	*INV,CC+1		52
	T7	IF(ZER)TRA	EXIT		53
	1B41	SB3	aUSTAR,U→B4		54
		TRA	TSTONE,B4-1		55
					56
EXP POS	T6	IF(ZER)TRA	TSTONE,R→Z		57
	Z	TRA	*ERPR		60
		NOP	POS MES		61
		LDR	Z		62
	T5	LRS	17		63
	T5	LUL	17		64
		ORU	R		65
		ORU	MSPACE		66
		BAU	aDUM,U→T7		67
	T5	TSR	*XCWD,U→B1		70
	T5	LT7,STF	B3,U→B2		71
COPYLP	*T7	STO	*DUM,B2-1		72
	B2	IF(PNZ)TRA	COPYLP		73

	T5	AB1	Z-1,U-B2	74
	B1	IF(PNZ)TRA	COPYLP	75
		LT7	aDUM,I-B3	76
TSTONE	B4	IF(NZE)TRA	TSTTWO,B4-1	77
	B3	IF(NZE)SKP	aUSTAR	100
		TRA	EXIT	101
		SB2	B3	102
	B2	IF(ZER)SKP	aDUM,I-B1	103
		TSR	*MCOPY,CC+1	104
	Z	SB1	USTAR,U-B2	105
		TSR	*STEX	106
	Z	LDR-	DUM,R-B1	107
		REM	*****PRESERVE TAG ON CODEWORD*****	
	R	FST	USTAR,I-B2	111
	B2	STO	B1	112
		TRA	EXIT	113
				114
TSTTWO	B4	IF(ZER)TRA	FMULT	115
	B3	IF(ZER)SKP	aUSTAR	116
		TRA	FMULT	117
	Z	SB1	DUM,U-B2	120
		TSR	*STEX	121
	Z	LDR-	USTAR,R-B1	122
	R	STO	DUM,I-B2	123
	B2	STO	B1,U-B3	124
FMULT	B3	SB2	B3,U-B1	125
MULTLP		TSR	*MMULT,CC+1	126
	B4	IF(ZER)TRA	FINISH,B4-1	127
	Z	TRA	MULTLP,U-B2	130
FINISH	Z	SB1	DUM,U-B2	131
OUT		TSR	*STEX	132
EXIT		LT7	B6-1,B6-1	133
		TRA	*UNSAVE	134
		TRA	PF	135
				136
NSQNEG	Z	TRA	*ERPR	137
		NOP	NEGMES	140
CLUSTER	Z	SB1	aUSTAR,U-B2	141
		TRA	OUT	142
				143
EMPTY	C3	TRA	*ERPR	144
		TRA	CLUSTER	145
				146
DUM		OCT	Z	147
MSPACE	0	4	USTAR,20	150
				151
POSMES		BCD	NON-SQUARE ARGUMENT TO POSITIVE POWER	
NEGMES		BCD	NON-SQUARE ARGUMENT TO NEGATIVE POWER	
			NO RESULT/	154
NAME		BCD	MPOWER0000	155
				156
USTAR		EQU	10	157
XCWD		EQU	126	160
STEX		EQU	135	161
SAVE		EQU	136	162
UNSAVE		EQU	137	163
				164
		END		165
				166

INV	77773	50	55652	52	5400	00000	
MMULT	77774	54	54577	02	5400	00000	
ELOC	77775	75	44535	64	2000	00000	
MCOPY	77776	54	42565	77	0400	00000	
ERPR	77777	75	44615	76	1400	00000	
*U TO THE R →	USTAR						
	1	01	01000	06	4001	00001	
	2	01	01000	06	4001	00002	
	3	47	21600	00	0001	00137	NAME
	4	01	20001	00	4401	77770	ELOC
	5	06	21641	00	0001	00002	ARG
	6	02	21641	00	0001	00013	EXP
	7	10	01000	02	4400	00136	SAVE
ARG	10	07	50442	26	4000	00000	
	11	04	01050	43	4001	00001	
	12	01	50440	73	4000	00010	USTAR
	13	01	21700	44	0010	00000	
	14	01	01040	10	4001	00107	EMPTY
	15	01	45066	15	4000	00017	
	16	01	21700	10	0020	00001	
	17	01	45066	51	4000	00017	
	20	05	02510	06	0000	00002	
	21	01	50450	00	0000	00002	
EXP	22	00	02010	74	4000	00000	
	23	43	01000	07	4001	00011	EXPNZE
	24	05	45015	00	4000	00017	
	25	05	45020	00	4000	00017	
	26	01	50010	00	0000	00002	
	27	01	50010	07	0001	00077	MSPACE
	30	05	40000	42	4400	00126	XCWD
	31	05	50440	41	0001	00112	*0000A
	32	04	20001	61	4400	00010	USTAR
	33	41	05150	62	4001	77775	
	34	01	01000	00	4001	00060	EXIT
EXPNZE	35	44	01110	64	4001	00005	EXPPOS
	36	06	01050	24	4001	00061	NSQNEG
	37	01	40000	20	4401	77733	INV
	40	07	01010	00	4001	00054	EXIT
	41	64	40003	44	4000	00010	USTAR
	42	01	01000	64	4001	00020	TSTONE
EXPPOS	43	06	01010	10	4001	00017	TSTONE
	44	00	01000	00	4401	77732	ERPR
	45	01	30000	00	0001	00062	POSSES
	46	01	50400	00	0000	00000	
	47	05	45015	00	4000	00017	
	50	05	45020	00	4000	00017	
	51	01	50010	00	0000	00002	
	52	01	50010	00	0001	00054	MSPACE
	53	01	20100	07	4001	00052	DUM
	54	05	40000	41	4400	00126	XCWD
	55	05	50570	42	0010	00000	
COPYLP	56	07	20001	62	4401	00047	DUM
	57	42	05150	00	4001	77775	COPYLP
	60	05	41001	42	4000	77776	
	61	41	05150	00	4001	77773	COPYLP
	62	01	50470	73	4001	00043	DUM
TSTONE	63	44	01050	64	4001	00013	TSTTWO
	64	43	02050	00	4000	00010	USTAR
	65	01	01000	00	4001	00027	EXIT
	66	01	40002	00	4010	00000	
	67	42	02010	71	4001	00036	DUM
	70	01	40000	20	4401	77705	MCOPY
	71	00	40001	42	4000	00010	USTAR
	72	01	40000	00	4400	00135	STFX

		73	00	50401	51	0001	00032	DUM
*****PRESERVE TAG GN CODEWORD*****								
	74	02	20041	72	0000	00010		USTAR
	75	42	20001	00	4002	00000		
	76	01	01000	00	4001	00016		EXIT
TSTTWO	77	44	01010	00	4001	00007		FMULT
	100	43	02010	00	4000	00010		USTAR
	101	01	01000	00	4001	00005		FMULT
	102	00	40001	42	4001	00023		DUM
	103	01	40000	00	4400	00135		STEX
	104	00	50401	51	0000	00010		USTAR
	105	02	20001	72	4001	00020		DUM
	106	42	20001	43	4002	00000		
FMULT	107	43	40002	41	4010	00000		
MULTLP	110	01	40000	20	4401	77663		MMULT
	111	44	01010	64	4001	00001		FINISH
	112	00	01000	42	4001	77774		MULTLP
FINISH	113	00	40001	42	4001	00012		DUM
OUT	114	01	40000	00	4400	00135		STEX
EXIT	115	01	50470	66	0100	77776		
	116	01	01000	00	4400	00137		UNSAVE
	117	01	01000	00	4200	00000		
NSQNEG	120	00	01000	00	4401	77656		ERPR
	121	01	30000	00	0001	00013		NEGMES
CLUSTER	122	00	40001	42	4000	00010		USTAR
	123	01	01000	00	4001	77767		OUT
EMPTY	124	03	01000	00	4401	77652		ERPR
	125	01	01000	00	4001	77773		CLUSTER
DUM	126	00	00000	00	0000	00000		
MSPACE	127	00	00004	20	0000	00010		USTAR
POSMES	130	55	56552	16	2606	44061		
	131	44	25406	14	6645	44455		
	132	63	25635	62	5575	66250		
	133	63	50654	42	5575	66644		
	134	61	22252	52	5252	52525		
NEGMES	135	55	56552	16	2606	44061		
	136	44	25406	14	6645	44455		
	137	63	25635	62	5554	44640		
	140	63	50654	42	5575	66644		
	141	61	37255	55	6256	14462		
	142	64	53632	22	5252	52525		
NAME	143	54	57566	64	4000	00000		

	0000A	144	01	00100	00	0000	00000	

315	INV	0	77773	1	2000000000000000	0
316	MMULT	0	77774	1	3000000000000000	0
317	ELOC	0	77775	1	4000000000000000	0
320	MCOPY	0	77776	1	5000000000000000	0
321	ERPR	0	77777	1	6000000000000000	0
322	NAME	0	143	1	1660000000000000	0
323	ARG	0	10	1	2200000000000000	0
324	EXP	0	22	1	3400000000000000	0
325	SAVE	0	136	0	1720000000000000	0
326	USTAR	0	10	0	1670000000000000	0
327	EMPTY	0	124	1	1430000000000000	0

330	EXPNZE	0	35	1	4700000000000000	0
331	MSPACE	0	127	1	1470000000000000	0
332	XCWD	0	126	0	1700000000000000	0
333	*0000A	0	144	1	1750000000000000	0
334	EXIT	0	115	1	1340000000000000	0
335	EXPPOS	0	43	1	5500000000000000	0
336	NSQNEG	0	120	1	1370000000000000	0
337	TSTONE	0	63	1	7500000000000000	0
340	POSMES	0	130	1	1510000000000000	0
341	DUM	0	126	1	1460000000000000	0
342	COPYLP	0	56	1	7000000000000000	0
343	TSTTWO	0	77	1	1160000000000000	0
344	STEX	0	135	0	1710000000000000	0
345	FMULT	0	107	1	1260000000000000	0
346	MULTLP	0	110	1	1270000000000000	0
347	FINISH	0	113	1	1320000000000000	0
350	OUT	0	114	1	1330000000000000	0
351	UNSAVE	0	137	0	1730000000000000	0
352	NEGMES	0	135	1	1570000000000000	0
353	CLUSTR	0	122	1	1410000000000000	0

DIAG

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replace by Householder
method

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DIAG		ORG		1
				2
SQR		REF	*SQR	3
				4
		REM	GENIE DIAG(MATRX,UNIT,EPSIL)	5
JTAN		MACRO		7
	*T4	FAD	U,U+T7	10
	B1	SB1	B2,U+R	11
		CLA	*T4,U+T6	12
	B2	SB2	*R,R+B1	13
		LDR	*T4,U+B2	14
	R	FSB→	T6	15
	T6	IF(POS)TRA	CC+1	16
	-T7	NOP	aZ,U+T7	17
		LT4	T4	20
	T7	STO	TSVN	21
	T7	FMP→	T7	22
	T6	FMP	T6	23
		FAD→	T7	24
	B6	AB6	B4+1,U+T5	25
		TSR	*SQR,CC+1	26
	T7	FAD	IT61	27
		VDF	TSVN,U+T7	30
	T5	LT4,STF	T4,U+B6	31
		MEND		32
				33
JHXX		MACRO	BA,BB,SBA,SBB,SIGN	34
	T7	FMP	T7,U+T6	35
	BB	SB3	BA,U+R	36
		CLA	*T4,R+BB	37
		FMP→	T6	40
	*T4	FAD	U	41
		FMP	T7	42
	SIGN	FAD→	T6	43
	BA	SBA	B3,U+R	44
		CLA	*T4,R+BA	45
		FAD→	T6	46
	T7	FMP	T7	47
		FAD	DONE,U+R	50
	T6	FDV	R,U+T6	51
		MEND		52
				53
JHMN		MACRO	BA,SBA,BB,SBB,BC,SBC,BD,SIGN	54
	BA	SBA	B3,U+B3	56
	T7	FMP	*T4,U+T5	57
	BB	SB3	B3,U+B3	60
	SIGN	FAD	*T4	61
		FMP	T6,U+T5	62
	BC	SBC	BD,U+BD	63
		MEND		64
				65
START		NOP	Z	66
		CLA	*B6-1,B6-1	67
		STO	EPSIL	70
		CLA	B6-1,B6-1	71
		RWT	UNIT	72
	T7	LDR→	B6-1	73

	R	RWT	MATRIX	74
	-Z	TRA	*SAVE, U+R	75
				76
MATRIX	I	LT4	Z, U+B3	77
	T4	CRL	d15, R+B4	100
UNIT		LT5	Z, I+B2	101
	B2	IF(ZER)TRA	JZERO, B3+1	102
	B4	LUL	d24, R+B1	103
		BAU	aB4	104
		LUL	d15	105
		GRU	0420 0000 00000	106
		BAU	aB2, U+T7	107
		TSR	*XCWD, U+B5	110
SETUP	B1	LT6	DONE, U+B2	111
	T6	STO	*B5, B1-1	112
	B1	IF(NZE)TRA	SETUP, U+B2	113
JZERO	B3	LT4, STF	*MATRIX, U+B2	114
JONE		TSR	MAXA J 2LR0	115a
	B1	STO	B6+B2	116
	B2	IF(ZER)SKP	aB4	117
		TRA	JONE, B2+1	120
				121
JTWO	Z	TSR	MAXB, U+T7	122
	B2	LT7	EPSIL, U+PF	123
	T7	IF(NZE)TRA	TEST	124
	B4	SB3	B1, U+B1	125
		SB2	B4, CC+1	126
	IT71	IF(NNZ)SKP	I*T41	127
		LT7	*T4	130
		AB1	77776	131
	B1	IF(NZE)TRA	CC-4, B2-1	132
	T7	FMP	TWOB, U+T7	133
	B3	SB2	aPF, U+B1	134
TEST	IT71	IF(POS)SKP	I*T4T	135
	B1	TRA	JTHR, U+B3	136
		TRA	*UNSAVE	137
		LT7	B6-1, B6-1	140
		TRA	PF	141
				142
JTHR		JTAN		143
		JHXX	B2, B1, SB2, SB1, U	144
	T6	STO	T5	145
		JHXX	B1, B2, SB1, SB2, -U	146
	B1	SB1	B2, U+R	147
	T6	STO	*T4, R+B1	150
	B2	SB2	B1, U+R	151
	T5	STO	*T4, R+B2	152
	Z	STO	*T4	153
				154
JFOR	B2	IF(NZE)SKP	aB3+1, B3+1	155
		TRA	JPRO	156
	B1	IF(NZE)SKP	B6+B3	157
		TRA	FIXC	160
		TRA	JFOR	161
JPRO	B3	IF(NZE)SKP	aB4	162
		TRA	JFIV	163
	B1	IF(ZER)SKP	B6+B3+1, B3+1	164
	B2	IF(NZE)SKP	B6+B3	165
				166

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	B2	TRA	FIXD, U-B5	167
		TRA	JPRO	170
FIXC	B1	RPA, WTG	BONE	171
	B2	RPA, WTG	BTWO	172
	B3	TSR	MAXC, U-B2	173
	B1	STO	B6+B2	174
BONE		SB1	(B1)	175
BTWO	B2	SB2	(B2), U-B3	176
		TRA	JFOR	177
FIXD	B1	RPA, WTG	BEE1	200
	B2	SB2	B3, U-B3	201
		TSR	MAXD	202
	B1	STO	B6+B2	203
	B2	SB2	B3, U-B3	204
BEE1		SB1	a(B1)	205
		TRA	JPRO	206
				207
JFIV	T7	STO	TNSTO	210
	T7	FMP	T7	211
		FAD	DONE, U-T7	212
		LT4	T4	213
	B6	AB6	B4+1, U-T6	214
		TSR	*SQR, CC+1	215
	T7	VDF	DONE, U-R	216
	T6	LT7	TNSTO, U-B6	217
		LT4, STF	*MATRX, R-T6	220
LOOP	B3	IF(NZE)SKP	aB2	221
	B1	TRA	HALF, U-B5	222
	B2	SB2	B3, U-B3	223
		JHMN	B1, SB1, B1, SB1, B2, SB2, B3, T5	224
	T5	STO	WAIT	225
		JHMN	B2, SB2, B1, SB1, B1, SB1, B3, -T5	226
		CLA	WAIT, U-T4	227
	B1	SB1	B3, U-B3	230
	T5	STO	*T4	231
	B1	SB1	B3, U-B3	232
	B2	SB2	B3, U-B3	233
		TSR	MAXE	234
HALF	B3	IF(ZER)SKP	aB1+1, B5-1	235
		TRA	JSIX, B3-1	236
	B5	TRA	JATE, U-B3	237
				240
JSIX	B1	SB1	B3, U-B3	241
	T7	FMP	*T4, U-T5	242
	B1	SB1	B3, U-B3	243
	B2	SB2	B3, U-B3	244
	T5	FAD	*T4	245
		FMP	T6, U-T5	246
	B1	LDR	Z+B6+B2, R-B1	247
		LDR	*T4, U-B1	250
	IT51	IF(NEG)SKP	IR1	251
	B1	STO	Z+B6+B2	252
	T7	FMP	*T4, U-R	253
	B2	SB2	B3, U-B3	254
	B1	SB1	B3, U-B3	255
	-R	FAD	*T4	256
		FMP	T6, U-T4	257
	B1	SB1	B3, U-B3	260
	B2	SB2	B3, U-B3	261

	T5	STO	*T4	262
	B2	SB2	B3, U-B3	263
	B1	TRA	HALF, U-B5	264
				265
JSVN	B1	SB1	B2, U-B2	266
		JHMN	B1, SB1, B2, SB2, B1, SB1, B3, -T5	267
	T5	STO	WAIT	270
		JHMN	B1, SB1, B2, SB2, B1, SB1, B2, T5	271
	B2	SB2	B1, U-B1	272
	T5	STO	*T4	273
	B2	SB2	B3, U-B3	274
		CLA	WAIT	275
		STO	*T4, B1-1	276
	B1	SB1	B3, U-B3	277
				300
JATE	B3	IF(NZE)TRA	JSVN	301
		LT4, STF	*UNIT, I-B3	302
	B3	IF(ZER)TRA	JNIN	303
		SB3	B4	304
JATEA	B2	SB2	B3, U-B3	305
		JHMN	B1, SB1, B1, SB1, B2, SB2, B3, T5	306
	T5	STO	WAIT	307
		JHMN	B2, SB2, B1, SB1, B1, SB1, B3, -T5	310
		CLA	WAIT, U-*T4	311
	B1	SB1	B3, U-B3	312
	T5	STO	*T4, B2-1	313
	B1	SB1	B3, U-B3	314
	B2	SB2	B3, U-B3	315
	B3	IF(NZE)TRA	JATEA	316
				317
JNIN		LT4, STF	*MATRIX	320
	B1	RPA, WTG	CC+2	321
		TSR	MAXA	322
	B1	STO	B6+B2	323
	Z	SB2	a(I), U-T7	324
	B2	TSR	MAXAAA, U-B1	325
	B1	STO	B6+B2	326
	B4	TRA	JTWO, U-B2	327
				330
TNSTO		OCT	0	331
DONE		OCT	010010000000000000	332
WAIT		OCT	0	333
TWOB		OCT	720010000000000000	334
EPSIL		OCT	0	335
TSVN		OCT	0	336
				337
MAXA	Z	SB1	aB2-1, U-T7	340
MAXAA	IT71	IF(NEG)SKP	1*T41	341
		TRA	CC+2, B1-1	342
		CLA	*T4, U-T7	343
MAXAAA		SB3	B1, B1-1	344
	B1	IF(NZE)TRA	MAXAA	345
	B3	TRA	PF, U-B1	346
				347
MAXB		CLA	B6+B2, U-B1	350
	IT71	IF(PN7)SKP	1*T41	351
	*T4	SB3	B2, U-T7	352
	B2	IF(ZER)SKP	a2, B2-1	353
		TRA	MAXB	354

		CLA	B6+B3, U-B1	355
	B3	TRA	PF, U-B2	356
				357
MAXC	B1	RPA, WTG	CC+1, U-B3	360
	Z	SB1	aB2-1, U-T6	361
MAXCC	B1	IF(ZER)SKP	a(B1)	362
	IT61	IF(NEG)SKP	I*T41	363
		TRA	CC+2, B1-1	364
		CLA	*T4, U-T6	365
		SB3	B1, B1-1	366
	B1	IF(NZE)TRA	MAXCC	367
	B3	TRA	PF, U-B1	370
				371
MAXD	B1	RPA, WTG	CC+2, U-B5	372
	B3	RPA, WTG	CC+2	373
	Z	SB1	aB2-1, U-T6	374
MAXDD	B1	IF(ZER)SKP	a(B1)	375
	B1	IF(NZE)SKP	a(B3)	376
		TRA	CC+4, B1-1	377
	IT61	IF(NEG)SKP	I*T41	400
		TRA	CC+2, B1-1	401
		CLA	*T4, U-T6	402
		SB5	aB1, B1-1	403
	B1	IF(NZE)TRA	MAXDD	404
	B5	TRA	PF, U-B1	405
				406
MAXE	B2	SB2	B3, U-B3	407
		CLA	*T4, U-T5	410
	B1	SB1	B3, U-B3	411
	IT51	IF(NEG)SKP	I*T41	412
	B3	TRA	CC+1, U-B5	413
	*T4	SB5	B1, U-T5	414
	B1	LDR	B6+B2, R-B1	415
		LDR	*T4, U-B1	416
	IT51	IF(NEG)SKP	IR1	417
	B5	STO	B6+B2	420
	B1	SB1	B3, U-B3	421
	B2	SB2	B3, U-B3	422
		TRA	LOOP, B3-1	423
				424
XCWD		EQU	126	425
SAVE		EQU	136	426
UNSAVE		EQU	137	427
				430
		END		431
				432

SQR	77777	62	60612	52	5400	00000	
	1	01	20000	00	0000	00000	
START	2	01	21700	66	0500	77776	
	3	01	20001	00	4001	00340	EPSIL
	4	01	21700	66	0100	77776	
	5	01	21641	00	0001	00005	UNIT
	6	07	50401	00	0100	77776	
	7	02	21641	00	0001	00001	MATRX
	10	10	01000	02	4400	00136	SAVE
MATRX	11	20	50440	43	0000	00000	
	12	04	45066	54	4000	00017	
UNIT	13	01	50450	72	0000	00000	
	14	42	01010	23	4001	00011	JZERO
	15	44	45020	51	4000	00030	
	16	01	20100	00	4020	00000	
	17	01	45020	00	4000	00017	
	20	01	50010	00	0001	00405	+0000A
	21	01	20100	07	4004	00000	
	22	01	40000	45	4400	00126	XCWD
	23	41	50460	42	0001	00315	DONE
SETUP	24	06	20001	61	4440	00000	
	25	41	01050	42	4001	77775	SETUP
JZERO	26	43	50540	42	0401	77761	MATRX
JONE	27	01	40000	00	4001	00316	MAXA
	30	41	20001	00	4104	00000	
	31	42	02010	00	4020	00000	
	32	01	01000	22	4001	77773	JONE
JTWO	33	00	40000	07	4001	00321	MAXB
	34	42	50470	47	0001	00307	EPSIL
	35	07	01050	00	4001	00010	TEST
	36	44	40003	41	4002	00000	
	37	01	40002	20	4020	00000	
	40	27	04550	00	2400	00004	
	41	01	50470	00	0400	00004	
	42	01	41001	00	4000	77776	
	43	41	01050	62	4001	77773	
	44	07	10600	07	0001	00276	TWOB
	45	43	40002	41	4200	00000	
TEST	46	27	02110	00	2400	00004	
	47	41	01000	43	4001	00003	JTHR
	50	01	01000	00	4400	00137	UNSAVE
	51	01	50470	66	0100	77776	
	52	01	01000	00	4200	00000	
JTHR	53	04	10400	07	0000	00001	
	54	41	40001	02	4004	00000	
	55	01	21700	06	0400	00004	
	56	42	40002	51	4400	00002	
	57	01	50400	42	0400	00004	
	60	02	10501	00	0000	00006	
	61	06	01110	00	4001	00001	
	62	17	30000	07	4000	00000	
	63	01	50440	00	0000	00004	
	64	07	20001	00	4001	00260	TSVN
	65	07	10601	00	0000	00007	
	66	06	10600	00	0000	00006	
	67	01	10401	00	0000	00007	
	70	46	41006	05	4020	00001	
	71	01	40000	20	4401	77705	SQR
	72	07	10400	00	2000	00006	
	73	01	16700	07	0001	00251	TSVN
	74	05	50540	46	0000	00004	
	75	07	10600	06	0000	00007	
	76	41	40001	02	4004	00000	
	77	01	21700	51	0400	00004	

	100	01	10601	00	0000	00006	
	101	04	10400	00	0000	00001	
	102	01	10600	00	0000	00007	
	103	01	10401	00	0000	00006	
	104	42	40002	02	4002	00000	
	105	01	21700	52	0400	00004	
	106	01	10401	00	0000	00006	
	107	07	10600	00	0000	00007	
	110	01	10400	02	0001	00230	DONE
	111	06	10700	06	0000	00002	
	112	06	20001	00	4000	00005	
	113	07	10600	06	0000	00007	
	114	42	40002	02	4002	00000	
	115	01	21700	52	0400	00004	
	116	01	10601	00	0000	00006	
	117	04	10400	00	0000	00001	
	120	01	10600	00	0000	00007	
	121	11	10401	00	0000	00006	
	122	41	40001	02	4004	00000	
	123	01	21700	51	0400	00004	
	124	01	10401	00	0000	00006	
	125	07	10600	00	0000	00007	
	126	01	10400	02	0001	00212	DONE
	127	06	10700	06	0000	00002	
	130	41	40001	02	4004	00000	
	131	06	20001	51	4400	00004	
	132	42	40002	02	4002	00000	
	133	05	20001	52	4400	00004	
JFOR	134	00	20001	00	4400	00004	
	135	42	02050	23	4010	00001	
	136	01	01000	00	4001	00003	JPRO
	137	41	02050	00	0110	00000	
	140	01	01000	00	4001	00007	FIXC
	141	01	01000	00	4001	77772	JFOR
JPRO	142	43	02050	00	4020	00000	
	143	01	01000	00	4001	00022	JFIV
	144	41	02010	23	0110	00001	
	145	42	02050	00	0110	00000	
	146	42	01000	45	4001	00010	FIXD
	147	01	01000	00	4001	77771	JPRO
FIXC	150	41	21641	00	0001	00003	BONE
	151	42	21641	00	0001	00003	BTWO
	152	43	40000	42	4001	00211	MAXC
	153	41	20001	00	4104	00000	
BONE	154	01	40001	00	4000	00000	
BTWO	155	42	40002	43	4000	00000	
	156	01	01000	00	4001	77755	JFOR
FIXD	157	41	21641	00	0001	00004	BEEI
	160	42	40002	43	4010	00000	
	161	01	40000	00	4001	00213	MAXD
	162	41	20001	00	4104	00000	
	163	42	40002	43	4010	00000	
BEEI	164	01	40001	00	4000	00000	
	165	01	01000	00	4001	77753	JPRO
JFIV	166	07	20001	00	4001	00151	TNSTO
	167	07	10600	00	0000	00007	
	170	01	10400	07	0001	00150	DONE
	171	01	50440	00	0000	00004	
	172	46	41006	06	4020	00001	
	173	01	40000	20	4401	77603	SQR
	174	07	16700	02	0001	00144	DONE
	175	06	50470	46	0001	00142	TNSTO
	176	01	50540	16	0401	77611	MATRIX
LOOP	177	43	02050	00	4004	00000	
	200	41	01000	45	4001	00024	HALF
	201	42	40002	43	4010	00000	

	202	41	40001	43	4010	00000	
	203	07	10600	05	0400	00004	
	204	41	40001	43	4010	00000	
	205	05	10400	00	0400	00004	
	206	01	10600	05	0000	00006	
	207	42	40002	43	4010	00000	
	210	05	20001	00	4001	00131	WAIT
	211	42	40002	43	4010	00000	
	212	07	10600	05	0400	00004	
	213	41	40001	43	4010	00000	
	214	15	10400	00	0400	00004	
	215	01	10600	05	0000	00006	
	216	41	40001	43	4010	00000	
	217	01	21700	04	0001	00122	WAIT
	220	41	40001	43	4010	00000	
	221	05	20001	00	4400	00004	
	222	41	40001	43	4010	00000	
	223	42	40002	43	4010	00000	
	224	01	40000	00	4001	00164	MAXE
HALF	225	43	02010	65	4002	00001	
	226	01	01000	63	4001	00001	JSIX
	227	45	01000	43	4001	00050	JATE
JSIX	230	41	40001	43	4010	00000	
	231	07	10600	05	0400	00004	
	232	41	40001	43	4010	00000	
	233	42	40002	43	4010	00000	
	234	05	10400	00	0400	00004	
	235	01	10600	05	0000	00006	
	236	41	50400	51	0104	00000	
	237	01	50400	41	0400	00004	
	240	25	02510	00	2000	00002	
	241	41	20001	00	4104	00000	
	242	07	10600	02	0400	00004	
	243	42	40002	43	4010	00000	
	244	41	40001	43	4010	00000	
	245	12	10400	00	0400	00004	
	246	01	10600	04	0000	00006	
	247	41	40001	43	4010	00000	
	250	42	40002	43	4010	00000	
	251	05	20001	00	4400	00004	
	252	42	40002	43	4010	00000	
	253	41	01000	45	4001	77750	HALF
JSVN	254	41	40001	42	4004	00000	
	255	41	40001	43	4010	00000	
	256	07	10600	05	0400	00004	
	257	42	40002	43	4010	00000	
	260	15	10400	00	0400	00004	
	261	01	10600	05	0000	00006	
	262	41	40001	43	4010	00000	
	263	05	20001	00	4001	00056	WAIT
	264	41	40001	43	4010	00000	
	265	07	10600	05	0400	00004	
	266	42	40002	43	4010	00000	
	267	05	10400	00	0400	00004	
	270	01	10600	05	0000	00006	
	271	41	40001	42	4004	00000	
	272	42	40002	41	4002	00000	
	273	05	20001	00	4400	00004	
	274	42	40002	43	4010	00000	
	275	01	21700	00	0001	00044	WAIT
	276	01	20001	61	4400	00004	
	277	41	40001	43	4010	00000	
JATE	300	43	01050	00	4001	77752	JSVN
	301	01	50540	73	0401	77510	UNIT
	302	43	01010	00	4001	00025	JNIN
	303	01	40003	00	4020	00000	

JATEA	304	42	40002	43	4010	00000	
	305	41	40001	43	4010	00000	
	306	07	10600	05	0400	00004	
	307	41	40001	43	4010	00000	
	310	05	10400	00	0400	00004	
	311	01	10600	05	0000	00006	
	312	42	40002	43	4010	00000	
	313	05	20001	00	4001	00026	WAIT
	314	42	40002	43	4010	00000	
	315	07	10600	05	0400	00004	
	316	41	40001	43	4010	00000	
	317	15	10400	00	0400	00004	
	320	01	10600	05	0000	00006	
	321	41	40001	43	4010	00000	
	322	01	21700	04	0001	00017	WAIT
	323	41	40001	43	4010	00000	
	324	05	20001	62	4400	00004	
	325	41	40001	43	4010	00000	
	326	42	40002	43	4010	00000	
	327	43	01050	00	4001	77753	JATEA
JNIN	330	01	50540	00	0401	77457	MATRX
	331	41	21641	00	0001	00002	
	332	01	40000	00	4001	00013	MAXA
	333	41	20001	00	4104	00000	
	334	00	40002	07	4000	00000	
	335	42	40000	41	4001	00014	MAXAAA
	336	41	20001	00	4104	00000	
	337	44	01000	42	4001	77472	UTWO
TNSTO	340	00	00000	00	0000	00000	
DONE	341	01	00100	00	0000	00000	
WAIT	342	00	00000	00	0000	00000	
TWOB	343	72	00100	00	0000	00000	
EPSIL	344	00	00000	00	0000	00000	
TSVN	345	00	00000	00	0000	00000	
MAXA	346	00	40001	07	4004	77776	
MAXAA	347	27	02510	00	2400	00004	
	350	01	01000	61	4001	00002	
	351	01	21700	07	0400	00004	
MAXAAA	352	01	40003	61	4002	00000	
	353	41	01050	00	4001	77772	MAXAA
	354	43	01000	41	4200	00000	
MAXB	355	01	21700	41	0104	00000	
	356	27	06150	00	2400	00004	
	357	04	40003	07	4004	00000	
	360	42	02010	62	4000	00002	
	361	01	01000	00	4001	77772	MAXB
	362	01	21700	41	0110	00000	
	363	43	01000	42	4200	00000	
MAXC	364	41	21641	43	0001	00001	
	365	00	40001	06	4004	77776	
MAXCC	366	41	02010	00	4000	00000	
	367	26	02510	00	2400	00004	
	370	01	01000	61	4001	00002	
	371	01	21700	06	0400	00004	
	372	01	40003	61	4002	00000	
	373	41	01050	00	4001	77771	MAXCC
	374	43	01000	41	4200	00000	
MAXD	375	41	21641	45	0001	00002	
	376	43	21641	00	0001	00002	
	377	00	40001	06	4004	77776	
MAXDD	400	41	02010	00	4000	00000	
	401	41	02050	00	4000	00000	
	402	01	01000	61	4001	00004	
	403	26	02510	00	2400	00004	
	404	01	01000	61	4001	00002	
	405	01	21700	06	0400	00004	

MAXE

MAXDD

LOOP

+0000A

316	SQR	0	77777	1	2000000000000000	0
317	JTAN	0	34000	0	1000001000000002	0
320	TSVN	0	345	1	3700000000000000	0
321	JHXX	0	34000	0	1200001000000025	0
322	BA	0	0	0	0	1
323	BB	0	0	0	0	1
324	SBA	0	0	0	0	1
325	SBB	0	0	0	0	1
326	SIGN	0	0	0	0	1
327	DONE	0	341	1	3600000000000000	0
330	JHMN	0	34000	0	140000100000107	0
331	BC	0	0	0	0	1
332	SBC	0	0	0	0	1
333	BD	0	0	0	0	1
334	START	0	2	3	1700000000000000	0
335	EPSIL	0	344	1	3660000000000000	0
336	UNIT	0	13	1	3000000000000000	0
337	MATRX	0	11	1	2600000000000000	0
340	SAVE	0	136	0	4520000000000000	0
341	JZERO	0	26	1	4300000000000000	0
342	+0000A	0	428	1	4550000000000000	0
343	XCWD	0	126	0	4510000000000000	0
344	SETUP	0	24	1	4100000000000000	0
345	JONE	0	27	1	4400000000000000	0
346	MAXA	0	346	1	3710000000000000	0
347	JTWO	0	33	1	5000000000000000	0
350	MAXB	0	355	1	4000000000000000	0
351	TEST	0	46	1	6300000000000000	0
352	TWOB	0	343	1	3640000000000000	0
353	JTHR	0	53	1	7000000000000000	0
354	UNSAVE	0	137	0	4530000000000000	0
355	JFOR	0	135	1	1520000000000000	0
356	JPRO	0	142	1	1570000000000000	0
357	FIXC	0	150	1	1650000000000000	0
360	JFIV	0	166	1	2030000000000000	0
361	FIXD	0	157	1	1740000000000000	0
362	BONE	0	154	1	1710000000000000	0
363	BTWO	0	158	1	1720000000000000	0
364	MAXC	0	364	1	4070000000000000	0
365	BEE1	0	164	1	2010000000000000	0
366	MAXD	0	375	1	4200000000000000	0
367	TNSTO	0	340	1	3560000000000000	0
370	LOOP	0	177	1	2140000000000000	0
371	HALF	0	225	1	2420000000000000	0

372	WAIT	0	342	1	362000000000000000	0
373	MAXE	0	411	1	434000000000000000	0
374	JSIX	0	230	1	245000000000000000	0
375	JATE	0	300	1	315000000000000000	0
376	JSVN	0	254	1	271000000000000000	0
377	JNIN	0	335	1	345000000000000000	0
400	JATEA	0	304	1	321000000000000000	0
401	MAXAAA	0	352	1	375000000000000000	0
402	MAXAA	0	347	1	372000000000000000	0
403	MAXCC	0	366	1	411000000000000000	0
404	MAXDD	0	400	1	423000000000000000	0

JACOB (217)

Reference: Corbató, F. J. 'On the Coding of Jacobi's Method of Computing Eigenvalues and Eigenvectors of Real, Symmetric Matrices.' Preprints of papers presented at the 14th national ACM meeting; Cambridge, Massachusetts; September, 1959.

INPUT : B1 : address of codeword for real symmetric matrix stored by row. Either complete or upper triangular form is acceptable.

B2 : if eigenvectors are desired, address of square matrix of same order as symmetric matrix above. JACOB will clear this matrix to a unit matrix initially. If eigenvectors are not desired, $B2 = 0$.

T7 : if zero, JACOB reduces upper off-diagonal elements to quantities smaller than or equal to 2^{-48} times the smallest diagonal element. If the coder desires to specify his own floating point constant in T7, JACOB reduces upper off-diagonal elements to quantities less than or equal to this constant.

OUTPUT : B1 is unchanged. The diagonal elements of the matrix are now the eigen values; the lower off-diagonal elements are unchanged; the upper off-diagonal elements have been reduced as indicated above.

B2 is unchanged. If non-zero, each row of this matrix is the eigenvector corresponding to the eigenvalue in the same row of the B1 matrix.

T7 contains the constant (either given or calculated) which is greater than or equal to all upper off-diagonal elements.

NOTES: Storage. As Jacob clears and sets up a unit matrix each time if eigenvectors are wanted, the same space may be used for consecutive sets of vectors. If storage space for the symmetric matrices is a problem, the following suggestions are offered. After diagonalization, the eigenvalues may be extracted

and stored in vector form in space obtained through program *126; the matrix may then be returned to storage through the use of STEX (program *135).

In the case of large matrices, it may be desirable to store only the upper triangular portion. At present the appropriate codewords must be generated by the coder.

A sample of such a codeword generating program follows.

However, each row of an upper triangular matrix must be treated as a separate vector by MSPIREL for input or output purposes.

Accuracy. The eigenvalue largest in absolute value obtained by JACOBI (when $T1=0$ on input) may be considered correct to ten significant decimal figures. The other eigenvalues and the eigenvector elements are then correct to the same number of decimal places as the largest eigenvalue.

Time. The time needed depends on the size and nature of the matrix and (if $T1=0$ on input) on the size of its eigenvalues. Hence no reliable time estimates can be made. It is suggested

that the coder try examples typical of the data he plans to use to determine the time involved. In some cases the time may be shortened (if eigenvectors are not desired) by setting T_1 to a suitable constant on input.

JACOB saves and restores all fast registers not described above in input-output specifications.

TRIANGULAR CODEWORD GENERATOR

```

276      ORG      0
TRIG     PF RPA EXIT
T7 AND MSKA, U → B1
      ORU MSKB, U → T7
      TSK *126

```

Obtain primary
codeword and
space for secondary
codewords

```

B1 ORU MSKC, U → T7
      TSK *126
      SBI 21

```

Change base

```

LOOP     B1 RPA CC+2, R → R
      B2 LRS ad15, B2-1
      R ORU CC+2, CC+1
      OCT 0120 0004 00000
      TSK *126, U → T7

```

Obtain each
secondary
codeword

```

B1 RPA CC+2, R → R
      LRS ad15, B1+1
      R ORU CC+2, CC+1
      OCT 1160 0000 00000
      TSK *126, U → T7

```

Change track for
each secondary
codeword

```

B2 IF (N2E) TRA LOOP

```

```

      CLA CC+2, CC+1

```

```

      OCT 000010700 0000 00000

```

```

      TSK *126, U → T7

```

Restore base

```

EXIT     Z TRA a(PF), U → T7

```

```

MSKA

```

```

      OCT 7777 0000 0000 77777

```

```

MSKB

```

```

      OCT 0120 4402 00000

```

```

MSKC

```

```

      OCT 0600 0000 00000

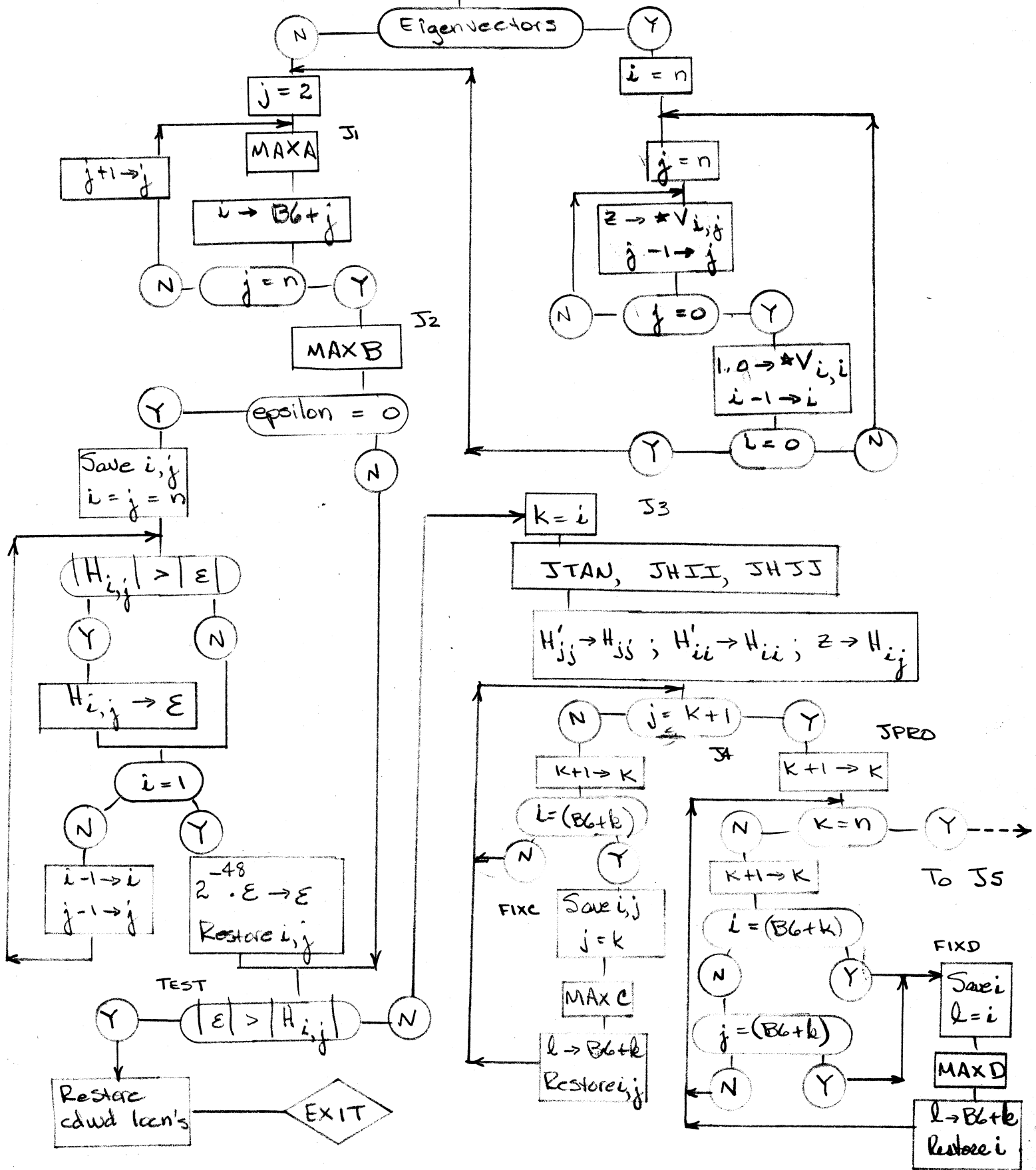
```

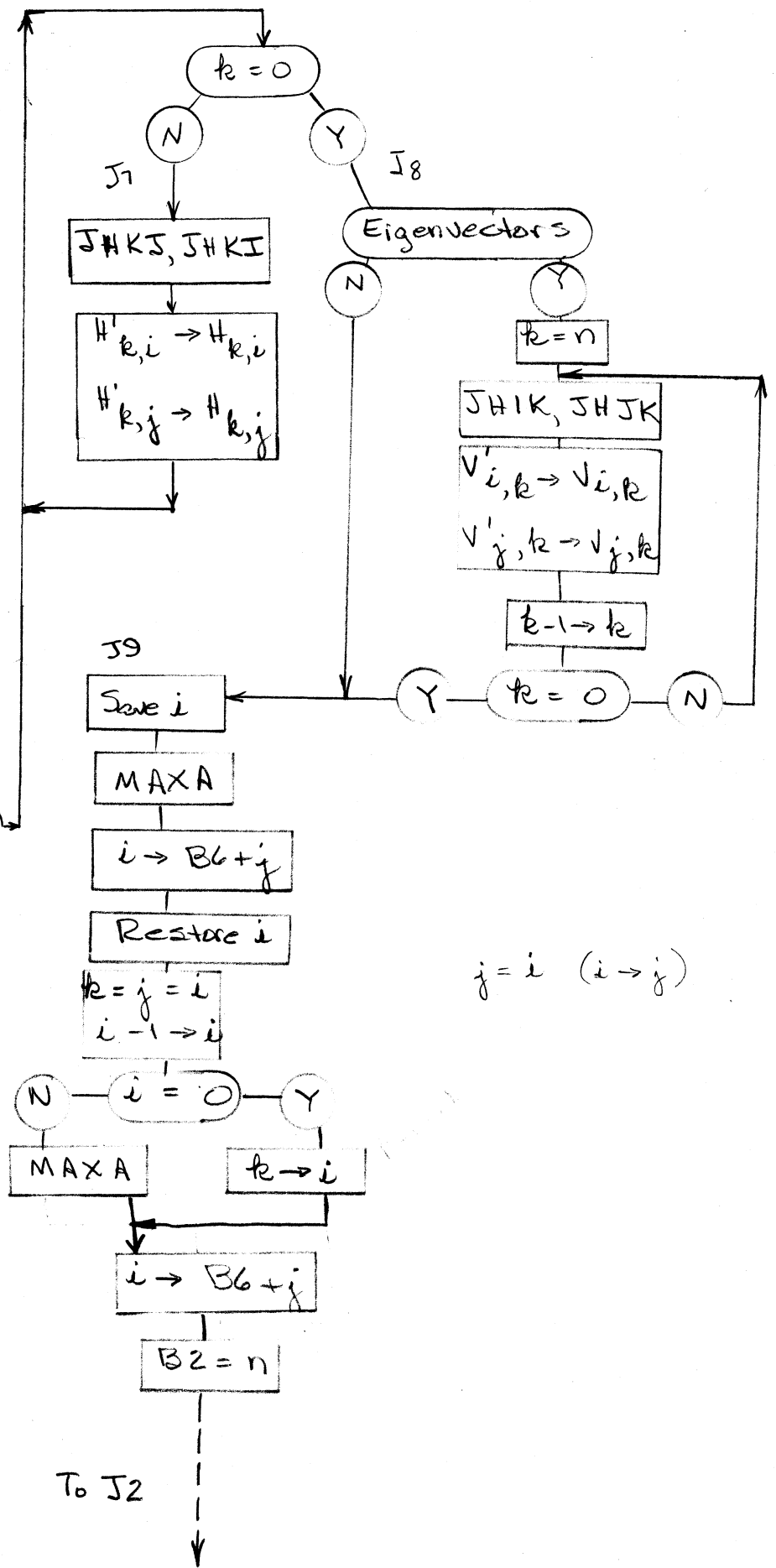
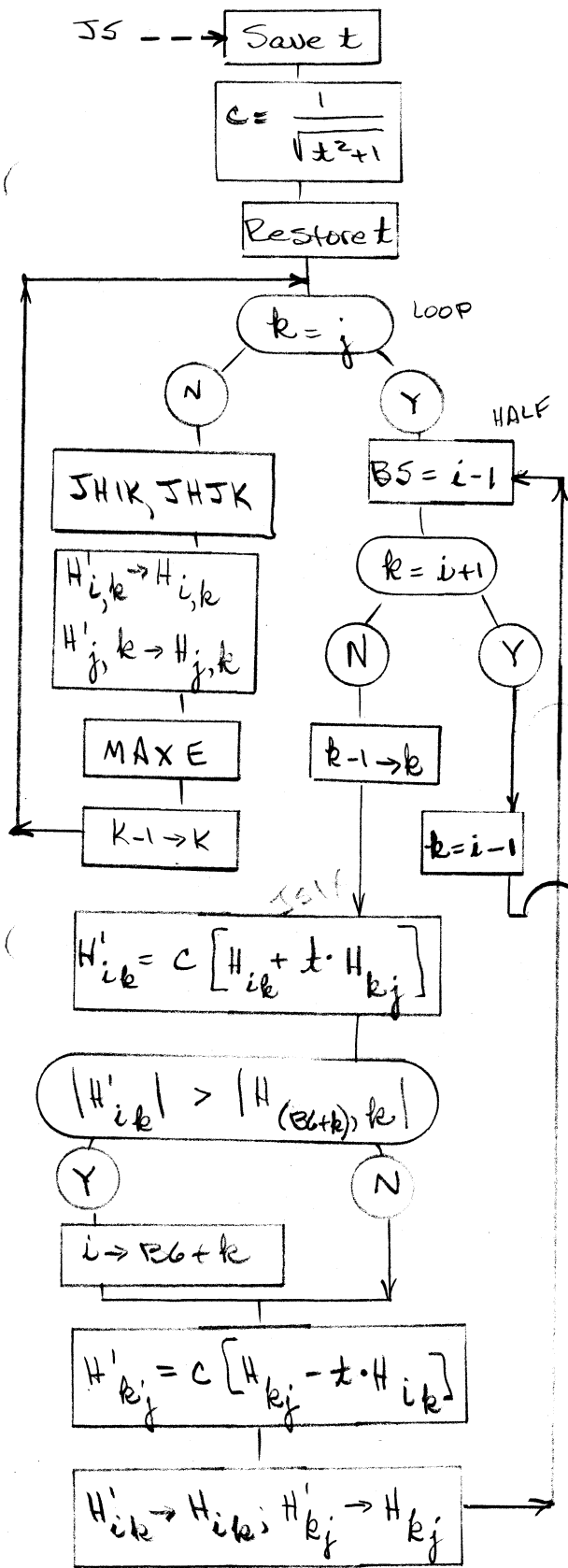
JACOB

Save cduw locn's, exit loc'n, epsilon

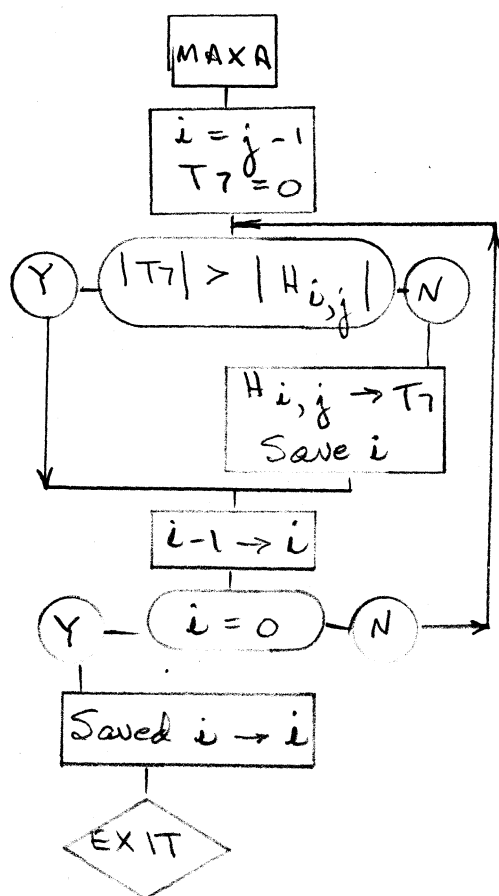
B4 = n

Eigenvectors





JACOB subroutines

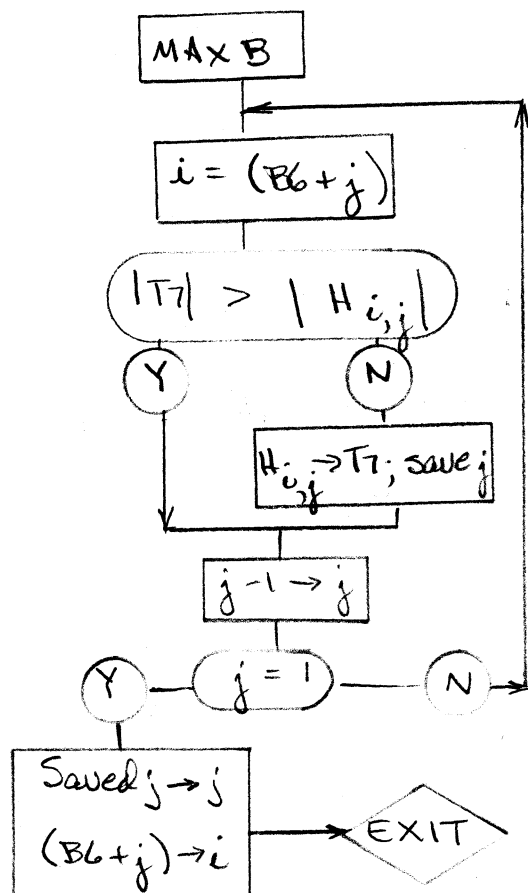


Input: $B2 = j \geq 2, *T4 = H.$

Output: $B1 = i; B2, T4$ unchanged.

Uses $B3, T7.$

Finds i for $\max_{i=1}^{j-1} |H_{i,j}|.$

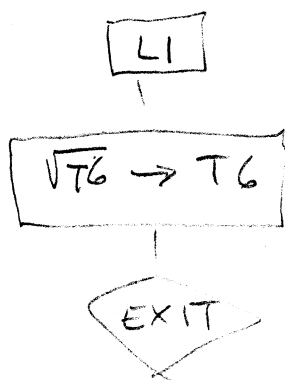


Input: $B2 = j \geq 2, *T4 = H, T7 = 0$

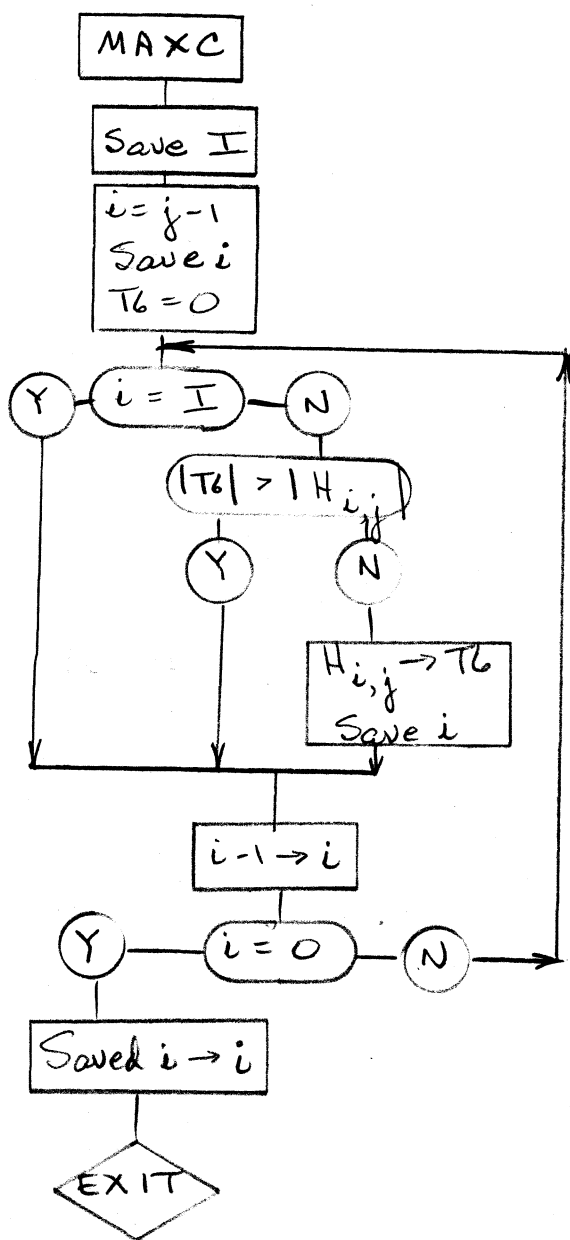
Output: $B1 = I_j, B2 = j$ where

$I_j = (B6 + j). T4, T7$
unchanged. Uses $B3.$

Finds I_j, j for $\max_{j=2}^{B2} |H_{I_j, j}|.$



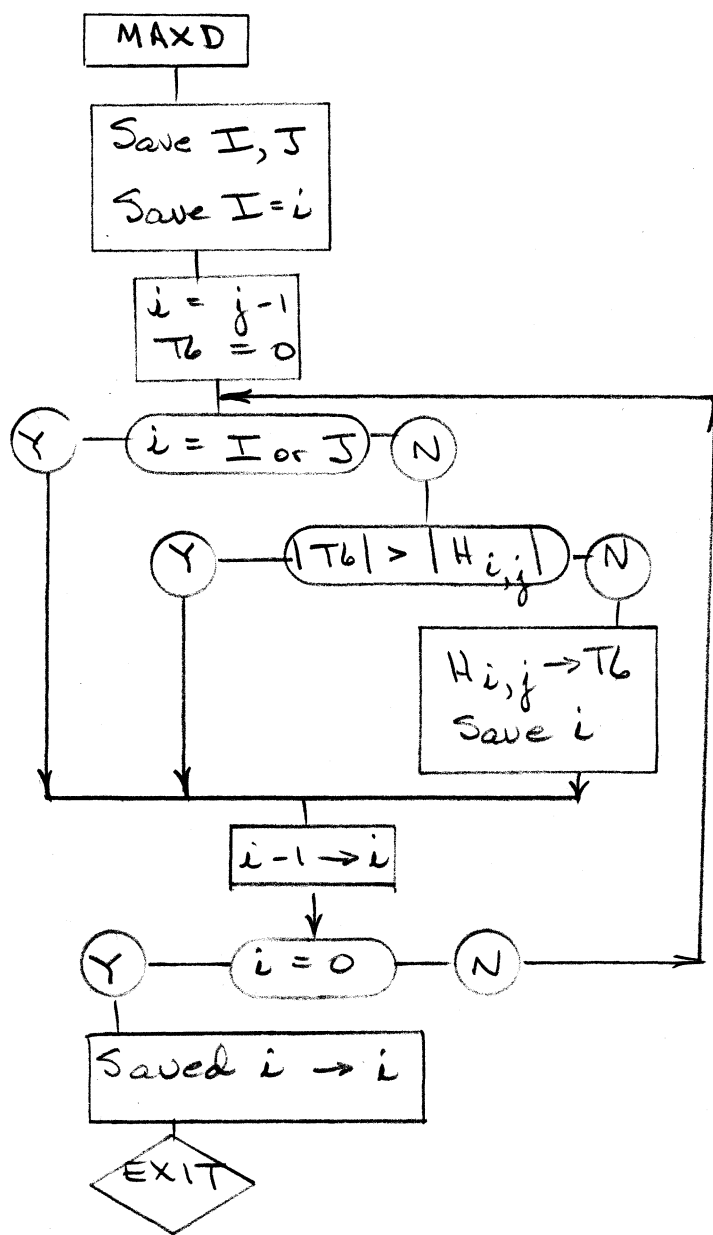
(Program *202 from subroutine library;
not Genie version)



Input: $B1 = I, B2 = j \geq 2,$
 $\star T4 = H$

Output: $B1 = i; B2, T4$
 unchanged.
 Uses $B3, T7.$

Finds i for $\max_{\substack{i=1 \\ i \neq I}}^{j-1} |H_{i,j}|.$

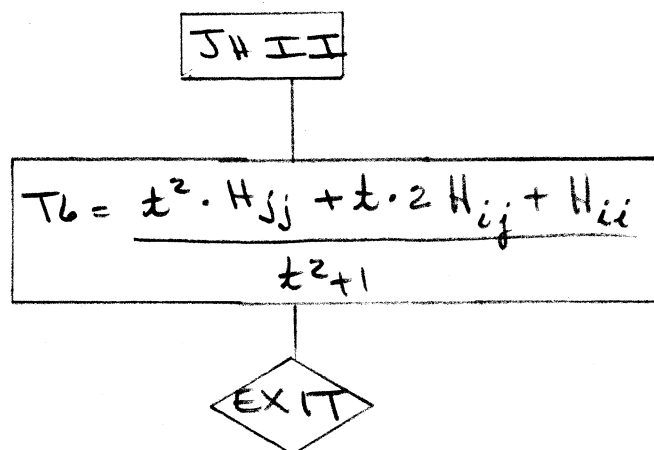
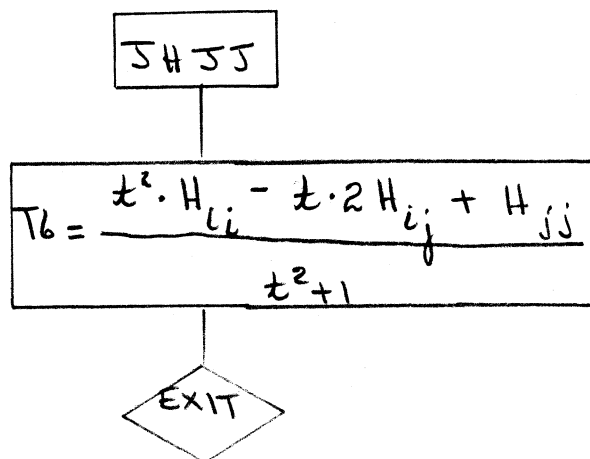


Input: $B1 = I, B2 = j \geq 2,$
 $B3 = J, \star T4 = H.$

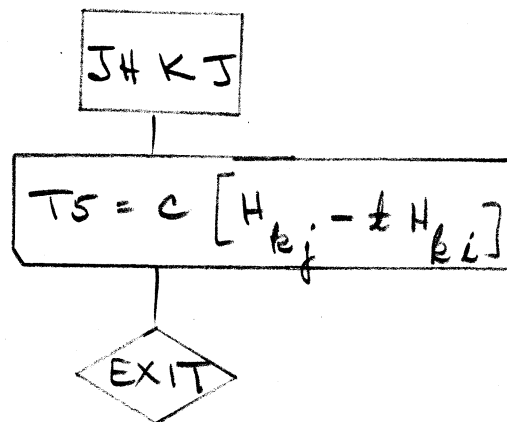
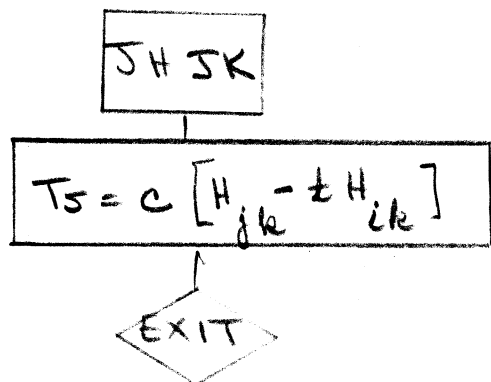
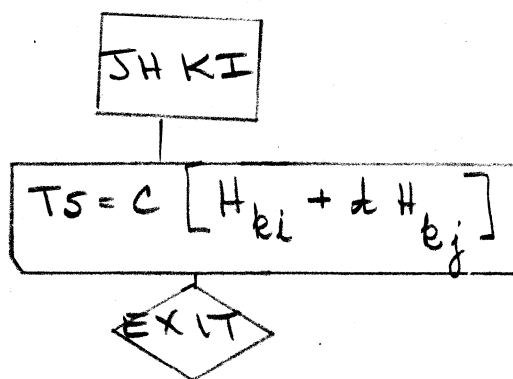
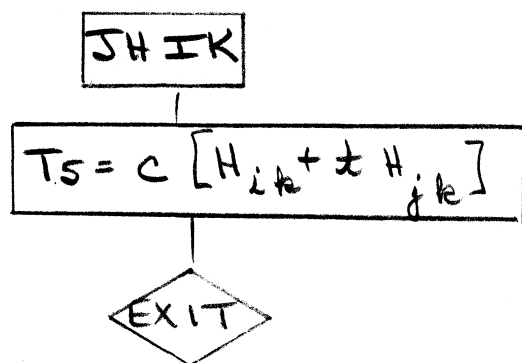
Output: $B1 = i; B2, B3$
 unchanged.
 Uses $B5, T6.$

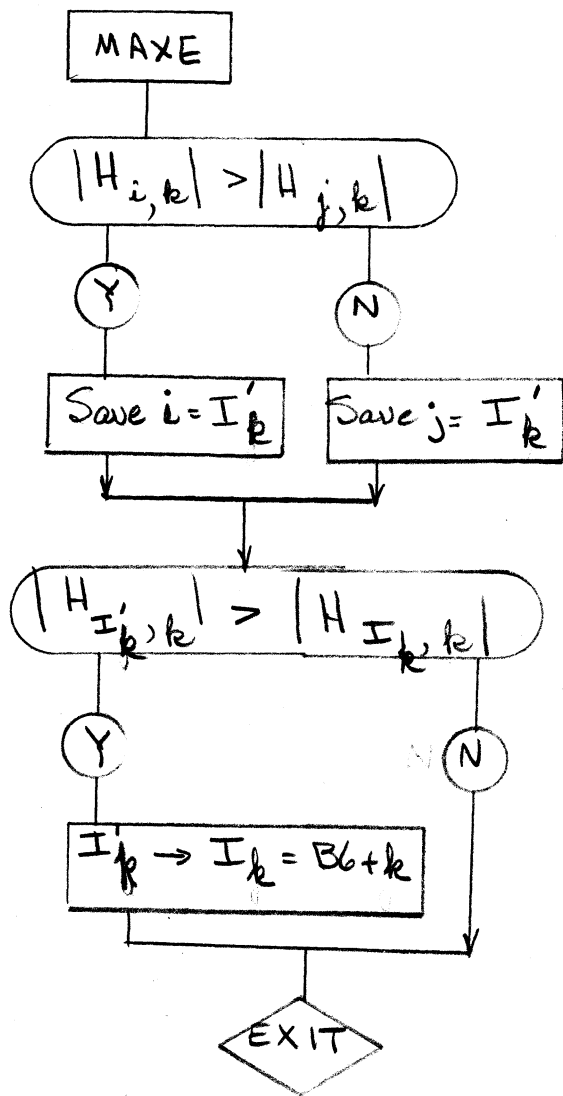
Finds i for $\max_{\substack{i=1 \\ i \neq I \\ i \neq J}}^{j-1} |H_{i,j}|.$

These routines all use $B1=i$, $B2=j$, $*T4=H$, $T1=t$ as input. These registers are not disturbed. Output quantities and other registers used are indicated below.



In addition to the above input, the routines below use $B3=k$ and $T6 = \frac{1}{\sqrt{t^2 + 1}} = C$ as input. Output locn's are indicated below.

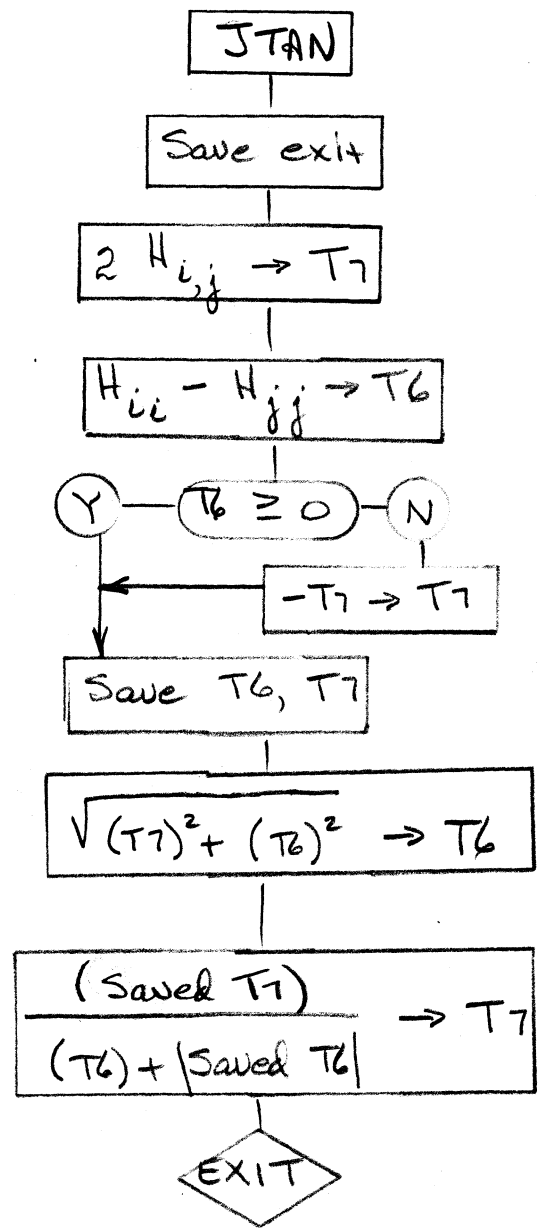




Input: B1 = i, B2 = j, B3 = k,
 *T4 = H, I_k = (B6 + k).

Output: B1, B2, B3, T4 unchanged.
 Uses B5, T5.

Finds max of $|H_{i,k}|$, $|H_{j,k}|$, $|H_{I_k,k}|$
 and stores corresponding
 i, j, or I_k at B6 + k.



Input: B1 = i, B2 = j, *T4 = H.

Output: T7 = ±. B1, B2
 unchanged. Uses
 T6, subr. *202.

Finds $\pm = \frac{(\text{sign}[H_{ii} - H_{jj}]) \cdot 2H_{ij}}{|H_{ii} - H_{jj}| + \sqrt{(H_{ii} - H_{jj})^2 + (2H_{ij})^2}}$

ORTHOG

ORTHOG		ORG			1
					2
SQR		REF	*SQR		3
MCOPY		REF	*MCOPY		4
ERPR		REF	*ERPR		5
ENTRY		REF	*ENTRY		6
		REF	*ORTHOG		7
					10
		REM	ORTHOG(T7) → USTAR		11
					12
		TRA	*ENTRY		13
	-Z	IF(ZER,EOV)TRA	a*SAVE,U→R		14
		CLA	T7,U→B2		15
		CLA	B2		16
		IF(NUL)TRA	aEMPTY		17
	P2	IF(ZER)SKP	aUSTAR,I→B1		20
		TSR	*MCOPY,CC+1		21
		LDR	B1,R→B1		22
	Z	LLS	a+15,U→T4		23
	I	LDR	B1+1,U→B3		24
		LLS	a+15,U→B5		25
	Z	STO	aMAXN		26
	P5	IF(POS)SKP	T4		27
		TRA	DEPEND		30
	-B5	CPL	a7		31
		FMP	TWO47		32
		VDF	EP5LN		33
		STO	aERROR		34
NORM	P5	SB1	aB3,U→B2		35
	P3	LT7	a7,U→B4		36
LOOP		CLA	*USTAR		37
		FMP	U		40
		FAD→	T7,B2-1		41
	P2	IF(PNZ)TRA	aLOOP		42
	T7	IF(ZER,EOV)TRA	aSINGLR,B2+1		43
	Z	IF(NZE)SKP	-MAXN,U→T5		44
	T7	STO	aMAXN,CC+1		45
	T7	IF(POS)SKP	MINN		46
	T7	STO	aMINN		47
	T7	IF(NEG)SKP	T5		50
	T7	STO	aMAXN,U→T5		51
	T5	FDV	MINN		52
		IF(NEG)SKP	ERROR		53
		TRA	aSINGLR		54
		TSR	*SQR,CC+1		55
	Z	SPF,ERM	aB5,U→T6		56
	T7	VDF→	*USTAR,PF-1		57
	P3	IF(NNZ)SKP	T4,B3+1		60
		TRA	aLEAVE		61
MORE	P5	SB1	aB4,U→B2		62
DOTPRD	P3	LT5	*USTAR,U→B1		63
	T5	FMP	*USTAR		64
		SB1	aB4		65
		FAD→	T6,B2-1		66
	P2	IF(PNZ)TRA	aDOTPRD		67
		SB2	aB5,B4-1		70
SUBLP		SB1	aB4+1		71
	T6	FMP	*USTAR		72
					73

		SBI	aB3	74
	-U	FAD→	*USTAR,B2-1	75
	B2	IF(PNZ)TRA	aSUBLP	76
	B4	IF(NEG)TRA	aNDRM	77
	Z	TRA	aMORE,U→T6	100
EMPTY	03	TRA	a*ERPR	101
		TRA	aDEACT	102
DEPEND	06	TRA	a*ERPR	103
		TRA	aDEACT	104
SINGLR	04	TRA	a*ERPR	105
DEACT	Z	SBI	aUSTAR,U→B2	106
		TSR	a*STEX	107
LEAVE		TRA	a*UNSAVE	110
		TRA	aPF	111
				112
EPSLN		DEC	1000000000000000.	113
TWO47		OCT	062000000000000000	114
ERROR		OCT	Z	115
MAXN		OCT	Z	116
MINN		OCT	Z	117
STEX		EQU	135	120
USTAR		EQU	10	121
SAVE		EQU	136	122
UNSAVE		EQU	137	123
				124
				125
		END		126
				127

SQR	77773	62	60612	52	5400	00000	
MCOPY	77774	54	42565	77	0400	00000	
ERPR	77775	75	44415	76	1400	00000	
ENTRY	77776	75	44554	36	1400	00000	
	77777	56	61634	75	6400	00000	
	1	01	01000	00	4401	77774	ENTRY
	2	10	01310	02	4400	00136	SAVE
	3	01	21700	42	0000	00007	
	4	01	21700	00	0004	00000	
	5	01	01040	00	4001	00060	EMPTY
	6	42	02010	71	4000	00010	USTAR
	7	01	40000	20	4401	77764	MCOPY
	10	01	50400	51	0002	00000	
	11	00	45062	04	4000	00017	
	12	20	50400	43	0002	00001	
	13	01	45062	45	4000	00017	
	14	00	20001	00	4001	00065	MAXN
	15	45	02110	00	0000	00004	
	16	01	01000	00	4001	00051	DEPEND
	17	55	50100	00	4000	00000	
	20	01	10600	00	0001	00057	TW047
	21	01	16700	00	0001	00055	EPSLN
	22	01	20001	00	4001	00056	ERROR
NORM	23	45	40001	42	4010	00000	
	24	43	50470	44	4000	00000	
LOOP	25	01	21700	00	0400	00010	USTAR
	26	01	10600	00	0000	00001	
	27	01	10401	62	0000	00007	
	30	42	05100	00	4001	77773	LOOP
	31	07	01310	22	4001	00040	SINGLR
	32	00	02050	05	1001	00047	MAXN
	33	07	20001	20	4001	00046	MAXN
	34	07	02110	00	0001	00046	MINN
	35	07	20001	00	4001	00045	MINN
	36	07	02510	00	0000	00005	
	37	07	20001	05	4001	00042	MAXN
	40	05	10700	00	0001	00042	MINN
	41	01	02510	00	0001	00037	ERROR
	42	01	01000	00	4001	00027	SINGLR
	43	01	40000	20	4401	77727	SQR
	44	00	40027	06	4040	00000	
	45	07	16701	67	0400	00010	USTAR
	46	43	06550	23	0000	00004	
	47	01	01000	00	4001	00025	LEAVE
MORE	50	45	40001	42	4020	00000	
DOTPRD	51	43	50450	41	0400	00010	USTAR
	52	05	10600	00	0400	00010	USTAR
	53	01	40001	00	4020	00000	
	54	01	10401	62	0000	00006	
	55	42	05150	00	4001	77772	DOTPRD
	56	01	40002	64	4040	00000	
SURLP	57	01	40001	00	4020	00001	
	60	06	10600	00	0400	00010	USTAR
	61	01	40001	00	4010	00000	
	62	11	10401	62	0400	00010	USTAR
	63	42	05150	00	4001	77772	SURLP
	64	44	01510	00	4001	77735	NORM
	65	00	01000	06	4001	77761	MORE
EMPTY	66	03	01000	00	4401	77706	ERPR
	67	01	01000	00	4001	00003	DEACT
DEPEND	70	06	01000	00	4401	77704	ERPR
	71	01	01000	00	4001	00001	DEACT
SINGLR	72	04	01000	00	4401	77702	ERPR
DEACT	73	00	40001	42	4000	00010	USTAR

	74	01	4000	00	4400	00135
LEAVE	75	01	01000	00	4400	00137
	76	01	01000	00	4200	00000
EPSLN	77	05	3506F	12	2420	00000
TWO47	100	06	20000	00	0000	00000
ERROR	101	00	00000	00	0000	00000
MAXN	102	00	00000	00	0000	00000
MINN	103	00	00000	00	0000	00000

STEX
UNSAVE

316	SQR	0	77773	1	200000000000000	0
317	MCOPY	0	77774	1	300000000000000	0
320	ERPR	0	77775	1	400000000000000	0
321	ENTRY	0	77776	1	500000000000000	0
322	SAVE	0	125	0	1240000000000000	0
323	EMPTY	0	66	1	7700000000000000	0
324	USTAR	0	10	0	1230000000000000	0
325	MAXN	0	102	1	1170000000000000	0
326	DEPEND	0	70	1	1010000000000000	0
327	TWO47	0	100	1	1130000000000000	0
330	EPSLN	0	77	1	1110000000000000	0
331	ERROR	0	101	1	1150000000000000	0
332	NORM	0	23	1	3400000000000000	0
333	LOOP	0	25	1	3600000000000000	0
334	SINGLR	0	72	1	1030000000000000	0
335	MINN	0	103	1	1210000000000000	0
336	LEAVE	0	75	1	1060000000000000	0
337	MORE	0	50	1	4100000000000000	0
340	DOTPRD	0	51	1	4200000000000000	0
341	SUBLP	0	57	1	7000000000000000	0
342	DEACT	0	73	1	1040000000000000	0
343	STEX	0	135	0	1220000000000000	0
344	UNSAVE	0	137	0	1250000000000000	0

SOLN

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PAGE 1

SOLN		ORG			1
INV		REF	*INV		2
ERPR		REF	*ERPR		3
ENTRY		REF	*ENTRY		4
		REF	*SOLN		5
		REM	SOLN(A,Y) → USTAR		6
		TRA	*ENTRY		7
	-Z	TRA	a*SAVE,U→R		10
		BAU	B6-13,U→B5		11
		BAU	B6-14,U→B4		12
		CLA	B5		13
		IF(NUL)TRA	EMPTY		14
		CLA	B4		15
		IF(NUL)TRA	EMPTY		16
	B3	CRL	a+15,R→B3		17
		LDR	MATWRD		20
		LRS	a+30		21
	R	BAU	aB3+1		22
		LUL	a+15		23
		BAU	aDUMMY,U→T7		24
		TSR	a*XCWD		25
		SB1	aB3,I→B2		26
MATSTO		CLA	*B4		27
		STO	a*DUMMY,B2-1		30
	B2	IF(PNZ)TRA	aMATSTO		31
	P3	AB1	a77776,U→B2		32
	B1	IF(PNZ)TRA	aMATSTO		33
	B3	SB2	aB3+1,U→B1		34
VECSTO		CLA	*B5		35
		STO	a*DUMMY,B1-1		36
	B1	IF(PNZ)TRA	aVECSTO		37
		LT7	aDUMMY		40
		TSR	*INV,CC+1		41
	T7	IF(ZER)TRA	EXIT		42
		CLA	DUMMY,U→B1		43
		REM	*****PRESERVE TAG ON CODEWORD*****		44
		LDR→	USTAR,I→B2		45
	B2	STO	aB1,R→B1		46
	R	STO	aDUMMY,I→B2		47
	B2	STO	aB1		51
	B3	LDR	VECWRD		52
		LRS	a+15		53
	R	BAU	aUSTAR,U→T7		54
		TSR	a*XCWD		55
	P3	SB2	aB3+1,U→B1		56
SOLSTO		CLA	*DUMMY		57
		STO	a*USTAR,B1-1		60
	B1	IF(PNZ)TRA	aSOLSTO		61
EXIT	Z	SB1	DUMMY,U→B2		62
OUT		TSR	*STEX		63
		TRA	a*UNSAVE		64
	PF	AB6	a77775,U→CC		65
EMPTY	O3	TRA	*ERPR		66
	Z	SB1	USTAR,U→B2		67

*Correct
for
EDUMMY*

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PAGE 2

	TRA	OUT	74
			75
MATWRD	OCT	04200000000000000000	76
VECDWRD	OCT	02200000000000000000	77
DUMMY	OCT	Z	100
			101
USTAR	EQU	10	102
XCWD	EQU	126	103
STEX	EQU	135	104
SAVE	EQU	136	105
UNSAVE	EQU	137	106
			107
	END		110
			111

INV	77774	50	55652	52	5400	00000	
ERPR	77775	75	44615	76	1400	00000	
ENTRY	77776	75	44556	36	1400	00000	
	77777	62	56535	52	5400	00000	
	1	01	01000	00	4401	77774	ENTRY
	2	10	01000	02	4400	00136	SAVE
	3	01	20100	45	0100	77764	
	4	01	20100	44	0100	77763	
	5	01	21700	00	0040	00000	
	6	01	01040	00	4001	00047	EMPTY
	7	01	21700	00	0020	00000	
	10	01	01040	00	4001	00045	EMPTY
	11	01	45066	53	4000	00017	
	12	43	50400	00	0001	00046	MATWRD
	13	01	45015	00	4000	00036	
	14	02	20100	00	4010	00001	
	15	01	45020	00	4000	00017	
	16	01	20100	07	4001	00044	DUMMY
	17	01	40000	00	4400	00126	XCWD
	20	01	40001	72	4010	00000	
MATSTO	21	01	21700	00	0420	00000	
	22	01	20001	62	4401	00040	DUMMY
	23	42	05150	00	4001	77774	MATSTO
	24	43	41001	42	4000	77776	
	25	41	05150	00	4001	77772	MATSTO
	26	43	40002	41	4010	00001	
VECSTO	27	01	21700	00	0440	00000	
	30	01	20001	61	4401	00032	DUMMY
	31	41	05150	00	4001	77774	VECSTO
	32	01	50470	00	4001	00030	DUMMY
	33	01	40000	20	4401	77740	INV
	34	07	01010	00	4001	00015	EXIT
	35	01	21700	41	0001	00025	DUMMY
	36	01	50401	72	0000	00010	USTAR
	37	42	20001	51	4002	00000	
	40	02	20001	72	4001	00022	DUMMY
	41	42	20001	00	4002	00000	
	42	43	50400	00	0001	00017	VECWRD
	43	01	45015	00	4000	00017	
	44	02	20100	07	4000	00010	USTAR
	45	01	40000	00	4400	00126	XCWD
	46	43	40002	41	4010	00001	
SOLSTO	47	01	21700	00	1401	00013	DUMMY
	50	01	20001	61	4400	00010	USTAR
	51	41	05150	00	4001	77774	SOLSTO
EXIT	52	00	40001	42	4001	00010	DUMMY
OUT	53	01	40000	00	4400	00135	STEX
	54	01	01000	00	4400	00137	UNSAVE
	55	47	41006	40	4000	77775	
EMPTY	56	03	01000	00	4401	77716	ERPR
	57	00	40001	42	4000	00010	USTAR
	60	01	01000	00	4001	77771	OUT
MATWRD	61	04	20000	00	0000	00000	
VECWRD	62	02	20000	00	0000	00000	
DUMMY	63	00	00000	00	0000	00000	

316	INV	0	77774	1	2000000000000000	0
317	ERPR	0	77775	1	3000000000000000	0
320	ENTRY	0	77776	1	4000000000000000	0
321	SAVE	0	136	0	10700000000000000	0
322	EMPTY	0	56	1	7300000000000000	0
323	MATWRD	0	61	1	7700000000000000	0
324	DUMMY	0	63	1	10300000000000000	0
325	XCWD	0	126	0	10500000000000000	0
326	MATSTO	0	21	1	3100000000000000	0
327	VECSTO	0	27	1	3700000000000000	0
330	EXIT	0	52	1	6700000000000000	0
331	USTAR	0	10	0	10400000000000000	0
332	VECWRD	0	62	1	10100000000000000	0
333	SOLSTO	0	47	1	6400000000000000	0
334	OUT	0	53	1	7000000000000000	0
335	STEX	0	135	0	10600000000000000	0
336	UNSAVE	0	137	0	11000000000000000	0

DET

DET	ORG	
INV	REF	*INV
ERPR	REF	*←ERPR
ENTRY	REF	*←ENTRY
	REF	*DET
	REM	DET(T7) → U,T7
	TRA	*ENTRY
-Z	TRA	a*SAVE,U→R
	STX	2
	TSR	*INV,CC+X
Z	SBI	aUSTAR,U→B2
	TSR	a*STEX
	TRA	a*UNSAVE
T7	TRA	aPF
USTAR	EQU	10
STEX	EQU	135
SAVE	EQU	136
UNSAVE	EQU	137
	END	

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PROGRAM

DET

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INV	77774	50	55652	52	5400	00000	
ERPR	77775	75	44615	76	1400	00000	
ENTRY	77776	75	44556	36	1400	00000	
	77777	43	44632	52	5400	00000	
	1	01	01000	00	4401	77774	ENTRY
	2	10	01000	02	4400	00136	SAVE
	3	01	43005	00	4000	00002	
	4	01	40000	30	4401	77767	INV
	5	00	40001	42	4000	00010	USTAR
	6	01	40000	00	4400	00135	STEX
	7	01	01000	00	4400	00137	UNSAVE
	10	07	01000	00	4200	00000	

316	INV	0	77774	1	2000000000000000	0
317	ERPR	0	77775	3	3000000000000000	0
320	ENTRY	0	77776	1	4000000000000000	0
321	SAVE	0	136	0	2300000000000000	0
322	USTAR	0	10	0	2100000000000000	0
323	STEX	0	135	0	2200000000000000	0
324	UNSAVE	0	137	0	2400000000000000	0

STNDV

STNDV		ORG			1
					2
ERROR		REF	*ERPR		3
SQR		REF	*SQR		4
ENTRY		REF	*ENTRY		5
		REF	*STNDV		6
					7
		REM	STANDARD DEVIATION		10
					11
		TRA	*ENTRY		12
		TRA	a*SAVE,U-R		13
-Z		BAJ	T7,U-B1		14
Z		LDR	B1,R-B2		15
		IF(ZER)TRA	aNIL		16
		LLS	a+15,U-B3		17
		LLS	a+15,U-B4		20
P4		LUR	a2,U-B4		21
Z		AB2	aB4=1,U-T5		22
		-SUR	-+33,R-T6		23
		FMP	TW047,U-T4		24
LOOP		CLA	B2+B3,U-T7		25
		FMP	U,33-1		26
		FAD	T5,U-T5		27
T7		FAD	T6,U-T6		30
P3		IF(PN7)TRA	aLOOP		31
T6		FMP	U		32
		FDV	-T4		33
		FAD	T5,U-T7		34
T4		FSB	d1,0		35
		VDF	T7,U-T7		36
		TSR	*SQR,CC+1		37
		TRA	a*UNSAVE		40
T7		TRA	aPF		41
					42
NIL		TRA	a*ERROR		43
		TRA	aPF,U-T7		44
					45
TW047		OCT	06200000000000000000		46
					47
SAVE		EQU	136		50
UNSAVE		EQU	137		51
					52
					53
		END			54
					55

ERROF	77774	75	44415	76	1400	00000	
SQR	77775	62	60412	52	5400	00000	
ENTRY	77776	75	44556	26	1400	00000	
	77777	62	63554	26	5400	00000	
	1	01	01000	00	4401	77774	ENTRY
	2	10	01000	02	4400	00136	SAVE
	3	00	20100	41	0000	00007	
	4	01	50400	52	0002	00000	
	5	02	01010	20	4001	00023	NIL
	6	01	45062	43	4000	00017	
	7	01	45062	44	4000	00017	
	10	44	45010	44	4000	00003	
	11	00	41002	05	4020	77776	
	12	01	53004	16	5010	00000	
	13	01	10600	04	0001	00017	TWO47
LOOP	14	01	21700	07	0014	00000	
	15	01	10600	63	0000	00001	
	16	01	10400	05	0000	00005	
	17	07	10400	06	0000	00006	
	20	43	05150	00	4001	77772	LOOP
	21	06	10600	00	0000	00001	
	22	01	10700	00	1000	00004	
	23	01	10400	07	0000	00005	
	24	04	10500	00	0001	00007	*0000A
	25	01	16700	07	0000	00007	
	26	01	40000	20	4401	77746	SQR
	27	01	01000	00	4400	00137	UNSAVE
	30	07	01000	00	4200	00000	
NIL	31	03	01000	00	4401	77742	ERROR
	32	00	01000	07	4200	00000	
TWO47	33	06	20000	00	0000	00000	

*0000A	34	01	00100	00	0000	00000	

316	ERROR	0	77774	1	20000000000000	0
317	SQR	0	77775	1	30000000000000	0
320	ENTRY	0	77776	1	40000000000000	0
321	SAVE	0	126	0	45000000000000	0
322	NIL	0	31	1	41000000000000	0
323	TWO47	0	25	1	44000000000000	0
324	LOOP	0	14	1	24000000000000	0
325	*0000A	0	24	1	50000000000000	0
326	UNSAVE	0	127	0	46000000000000	0

CHISQ

CHISO		ORG			1
ERPR		REF		*←ERPR	2
ENTRY		REF		*←ENTRY	3
		REF		*CHISO	4
		REF		*ENTRY	5
	-Z	TRA		*SAVE,U←R	6
		TRA		B6+77763,U←B1	7
		CLA		B1,U←R	10
		CLA		ER,R←B3	11
		IF(NUL)TRA		B15,U←B1	12
		LLS		B15,U←B2	13
		LLS		B3,U←B2	14
	P2	LRS		B31+B2-1,U←B2	15
	P3	ADD		B6+77764,U←B3	16
		CLA		B3,U←R	17
		CLA		ER,R←B5	20
		IF(NUL)TRA		B15,U←B3	21
		LLS		B31	22
	P3	IF(ZER)SKP		PROBS	23
		TRA		B15,U←B4	24
		LLS		B3,U←B4	25
	P4	LRS		A,U←T7	26
	Z	LT5,STF		B3+B4-1,U←B4	27
	B5	ADD		B2,B2-1	30
LOOP	*T5	FSB		B2,B1-1	31
		FMP		U,34-1	32
		FDV		B2,B2-1	33
		FAD→		T7	34
	P1	IF(PNZ)TRA		LOOP	35
LV		TRA		*UNSAVE	36
		STX		77775	37
	T7	TRA		FF,B6+X	40
ER	03	TRA		*ERPR	41
	Z	TRA		LV,U←T7	42
PROBS	05	TRA		*ERPR	43
	Z	TRA		LV,U←T7	44
A		OCT		2000000	45
SAVE		EQU		136	46
UNSAVE		EQU		137	47
		END			50
					51

ERPR	77775	75	44615	76	1400	00000	
ENTRY	77776	75	44556	76	1400	00000	
	77777	42	47506	76	0400	00000	
	1	01	01000	00	4401	77774	ENTRY
	2	10	01000	02	4400	00136	SAVE
	3	01	21700	41	0100	77763	
	4	01	21700	02	0002	00000	
	5	01	01040	53	4001	00026	ER
	6	01	45062	41	4000	00017	
	7	01	45062	42	4000	00017	
	10	42	45015	42	4000	00003	
	11	43	10000	42	4006	77776	
	12	01	21700	43	0100	77764	
	13	01	21700	02	0010	00000	
	14	01	01040	55	4001	00017	ER
	15	01	45062	43	4000	00017	
	16	43	02010	00	4002	00000	
	17	01	01000	00	4001	00016	PROBS
	20	01	45062	44	4000	00017	
	21	44	45015	44	4000	00003	
	22	00	50550	07	0001	00015	A
	23	45	10000	44	4030	77776	
LOOP	24	05	10500	61	0004	00000	
	25	01	10600	64	0000	00001	
	26	01	10700	42	0004	00000	
	27	01	10401	00	0000	00007	
	30	41	05180	00	4001	77772	LOOP
LV	31	01	01000	00	4400	00137	UNSAVE
	32	01	43005	00	4000	77775	
	33	07	01000	76	4200	00000	
ER	34	03	01000	00	4401	77740	ERPR
	35	00	01000	07	4001	77772	LV
PROBS	36	05	01000	00	4401	77736	ERPR
	37	00	01000	07	4001	77770	LV
A	40	00	00000	00	0020	00000	

316	ERPR	0	77775	1	2000000000000000	0
317	ENTRY	0	77776	1	3000000000000000	0
320	SAVE	0	136	0	4600000000000000	0
321	ER	0	34	1	4000000000000000	0
322	PROBS	0	36	1	4200000000000000	0
323	A	0	40	1	4500000000000000	0
324	LOOP	0	24	1	3000000000000000	0
325	LV	0	31	1	3500000000000000	0
326	UNSAVE	0	137	0	4700000000000000	0

MEAN

MEAN		ORG			1
		REM		COMPUTE MEAN	2
ERROR		REF		*ERROR	3
ENTRY		REF		*ENTRY	4
		REF		*MEAN	5
					6
					7
		TRA		*ENTRY	10
	-Z	TRA		a*SAVE,U→R	11
		CLA		T7,U→B1	12
	I	LDR		B1,U→PF	13
	R	IF(ZER)TRA		aNIL,R→B2	14
		LLS		aH15,U→B3	15
		LLS		aH15,U→B4	16
	B4	LUR		aB,U→B4	17
	-B3	CPL		aB2+B4-1,I→B2	20
		FMP		TWO47,U→T5	21
	B2	RPA		CC+1	22
	Z	MLN		24000	23
		FAD		(Z)+PF,B3-1	24
		FDV		T5,U→T7	25
		MLF		4000	26
OUT		TRA		a*UNSAVE	27
	T7	TRA		aPF	30
					31
NIL	C3	TRA		a*ERROR	32
	Z	TRA		OUT,U→T7	33
					34
TWO47		UCT		06200000000000000000	35
SAVE		EQU		136	36
UNSAVE		EQU		137	37
		END			40
					41

ERROR	77775	75	44615	76	1400	00000	
ENTRY	77776	75	44556	76	1400	00000	
	77777	54	44405	52	5400	00000	
	1	01	01000	00	4401	77774	ENTRY
	2	10	01000	02	4400	00136	SAVE
	3	01	21700	41	0000	00007	
	4	20	50400	47	0002	00000	
	5	02	01010	52	4001	00014	NIL
	6	01	45062	43	4000	00017	
	7	01	45062	44	4000	00017	
	10	44	45010	44	4000	00003	
	11	53	50100	72	4024	77776	
	12	01	10400	05	0001	00011	TWO47
	13	42	21601	00	0001	00001	
	14	00	42002	00	4000	24000	
	15	01	10400	63	0200	00000	
	16	01	10700	07	0000	00005	
	17	01	42006	00	4000	04000	
OUT	20	01	01000	00	4400	00137	UNSAVE
	21	07	01000	00	4200	00000	
NIL	22	03	01000	00	4401	77752	ERROR
	23	00	01000	07	4001	77773	OUT
TWO47	24	06	20000	00	0000	00000	

316	ERROR	0	77775	1	5000000000000000	0
317	ENTRY	0	77776	1	6000000000000000	0
320	SAVE	0	136	0	3500000000000000	0
321	NIL	0	27	1	3100000000000000	0
322	TWO47	0	24	1	3400000000000000	0
323	OUT	0	20	1	2700000000000000	0
324	UNSAVE	0	137	0	3600000000000000	0

QCONF

QCONF		ORG			1
EXP		REF	*EXP		2
SQR		REF	*SQR		3
CHISQ		REF	*CHISQ		4
ENTRY		REF	*+ENTRY		5
ERPR		REF	*+ERPR		6
		REF	*QCONF		7
		TRA	*ENTRY		10
	-Z	TRA	*SAVE,U+R		11
		CLA,DBL+2	B6-14,B6+1		12
		TSR	*CHISQ,CC+1		13
		IF(ZER)TRA	OUT2,U+T4		14
		STO	CHI2		15
		CLA	B6,U+B1		16
		CLA	B1,U+R		17
	Z	LLS	d15,U+B1		20
		SB4	Z,B1-1		21
	B1	AND	d1,U+B2		22
	-B1	CPL	Z,I-B5		23
		FMP	TW47,U+T6		24
		TSR	*SQR,CC+1		25
		STO	CHI,U+T5		26
	T6	IF(NNZ)SKP	d2,0		27
		IF(PNZ)TRA	FINK-1,CC+1		30
		TRA	ONEST		31
		SB4	I		32
FINK	-T4	FMP	d0,5,U+T7		33
		TSR	*EXP,CC+1		34
		STO	BETA		35
		IF(ZER)TRA	NULL+1		36
	B4	IF(PNZ)TRA	OUT		37
	B2	IF(ZER)TRA	TWO		40
	T6	FSB	d1,0,U+T4		41
	T5	LT7	d3,0,U+T6		42
		TSR	PART		43
		CLA	CHI		44
		FMP	P		45
		FAD	d1,0		46
		VDF	d1,0,U+T4		47
		FMP	CON+4,U+R		50
		SB3	3		51
LOOP	R	FAD	CON+B3,B3-1		52
		FMP	T4,U+R		53
	B3	IF(POS)TRA	LOOP		54
	R	FAD	T5		55
		FMP	BETA		56
		FMP	TORTP,U+T5		57
	B5	IF(PNZ)TRA	CC+1		60
	T5	TRA	OUT,U+T7		61
		CLA	CHI		62
		FDV	GROOT2		63
		FMP	BETA		64
		BSF	T5,U+T7		65
		TRA	OUT		66
TWO	T6	FSB	d2,0,U+T4		67
		CLA	CHI2		70
		FDV	d2,0,U+T5		71
		LT7	d4,0,U+T6		72
					73

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		TSR	PART	74
	T5	FAD	d1, 0	75
		FMP	BETA, U+T7	76
ONEST		TRA	OUT	77
		IF(PNZ)SKP	-d2, 0	100
		TRA	NULL	101
		FAD	d2, 0, U+T6	102
NULL	I	TRA	FINK, U+B5	103
	02	TRA	*ERPR	104
	Z	TRA	OUT, U+T7	105
OUT2		CLA	d1, 0, U+T7	106
OUT		TRA	*UNSAVE	107
		AB6	ax	110
	T7	TRA	PF	111
PART		STX	5	112
LOOP1	T7	IF(PNZ)JMP	T4	113
	T6	FMP	CHI2	114
		FDV	T7, U+T6	115
		FAD	T5	116
	T7	FAD	d2, 0, U+T7	117
		TRA	LOOP1	120
		TRA	PF	121
SAVE		EQU	136	122
UNSAVE		EQU	137	123
TORTP		OCT	773142042463650331	124
P		DEC	.2316419	125
CON		DEC	.31938153	126
		DEC	-.356563782	127
		DEC	1.781477937	130
		DEC	-1.821255978	131
		DEC	1.330274429	132
GROOT2		DEC	1.2533141369	133
TW47		OCT	062000000000000000	134
CHI		BSS	1	135
CHI2		BSS	1	136
BETA		BSS	1	137
		END		140
				141

EXP	77772	44	67572	52	5400	00000	
SQR	77773	62	60612	52	5400	00000	
CHISQ	77774	42	47506	26	0400	00000	
ENTRY	77775	75	44556	36	1400	00000	
ERPR	77776	75	44615	76	1400	00000	
	77777	60	42565	54	5400	00000	
	1	01	01000	00	4401	77773	ENTRY
	2	10	01000	02	4400	00136	SAVE
	3	01	21706	26	0100	77763	
	4	01	40000	20	4401	77767	CHISQ
	5	01	01010	04	4001	00070	OUT2
	6	01	20001	00	4001	00115	CHI2
	7	01	21700	41	0100	00000	
	10	01	21700	02	0002	00000	
	11	00	45082	41	4000	00017	
	12	01	40004	61	4000	00000	
	13	41	50314	42	4000	00001	
	14	51	50100	75	0000	00000	
	15	01	10600	06	0001	00104	TW47
	16	01	40000	20	4401	77754	SQR
	17	01	20001	05	4001	00103	CHI
	20	06	06550	00	0001	00105	+0000A
	21	01	05150	20	4001	00001	FINK -1
	22	01	01000	00	4001	00045	ONEST
	23	01	40004	00	4000	00001	
FINK	24	14	10600	07	0001	00102	+0000B
	25	01	40000	20	4401	77744	EXP
	26	01	20001	00	4001	00076	BETA
	27	01	01010	00	4001	00045	NULL +1
	30	44	05150	00	4001	00046	OUT
	31	42	01010	00	4001	00026	TWO
	32	06	10500	04	0001	00075	+0000C
	33	05	50470	06	0001	00075	+0000D
	34	01	40000	00	4001	00045	PART
	35	01	21700	00	0001	00065	CHI
	36	01	10600	00	0001	00054	P
	37	01	10400	00	0001	00070	+0000C
	40	01	16700	04	0001	00067	+0000C
	41	01	10600	02	0001	00056	CON +4
	42	01	40003	00	4000	00003	
LOOP	43	02	10400	63	0011	00050	CON
	44	01	10600	02	0000	00004	
	45	43	01110	00	4001	77774	LOOP
	46	02	10400	00	0000	00005	
	47	01	10600	00	0001	00055	BETA
	50	01	10600	05	0001	00041	TORTP
	51	45	05150	00	4001	00001	
	52	05	01000	07	4001	00024	OUT
	53	01	21700	00	0001	00047	CHI
	54	01	10700	00	0001	00044	GROOT2
	55	01	10600	00	0001	00047	BETA
	56	01	14500	07	0000	00005	
	57	01	01000	00	4001	00017	OUT
TWO	60	06	10500	04	0001	00045	+0000A
	61	01	21700	00	0001	00042	CHI2
	62	01	10700	05	0001	00043	+0000A
	63	01	50470	06	0001	00046	+0000E
	64	01	40000	00	4001	00015	PART
	65	05	10400	00	0001	00042	+0000C
	66	01	10600	07	0001	00036	BETA
	67	01	01000	00	4001	00007	OUT
ONEST	70	01	06150	00	1001	00035	+0000A
	71	01	01000	00	4001	00002	NULL
	72	01	10400	06	0001	00033	+0000A

	73	20	01000	45	4001	77727	FINK
NULL	74	02	01000	00	4401	77701	ERPR
	75	00	01000	07	4001	00001	OUT
OUT2	76	01	21700	07	0001	00031	*0000C
OUT	77	01	01000	00	4400	00137	UNSAVE
	100	01	41006	00	4000	77775	
	101	07	01000	00	4200	00000	
PART	102	01	43005	00	4000	00005	
LOOP1	103	07	07150	00	0000	00004	
	104	06	10600	00	0001	00017	CHI2
	105	01	10700	06	0000	00007	
	106	01	10401	00	0000	00005	
	107	07	10400	07	0001	00016	*0000A
	110	01	01000	00	4001	77771	LOOP1
	111	01	01000	00	4200	00000	
TORTP	112	77	31420	42	4636	50331	
P	113	77	07323	16	1060	70420	
CON	114	77	12160	57	6352	22761	
	115	77	64456	03	6151	27633	
	116	01	00162	00	7360	11372	
	117	01	77613	34	1053	04154	
	120	01	00125	10	6335	33641	
GROOT2	121	01	00120	15	4461	77314	
TW47	122	06	20000	00	0000	00000	
CHI	123	00	00000	00	0000	00000	
CHI2	124	00	00000	00	0000	00000	
BETA	125	00	00000	00	0000	00000	

*0000A	126	01	00200	00	0000	00000	
*0000B	127	77	20000	00	0000	00000	
*0000C	130	01	00100	00	0000	00000	
*0000D	131	01	00300	00	0000	00000	
*0000E	132	01	00400	00	0000	00000	

316	EXP	0	77772	1	200000000000000	0
317	SQR	0	77773	1	300000000000000	0
320	CHISQ	0	77774	1	400000000000000	0
321	ENTRY	0	77775	1	500000000000000	0
322	ERPR	0	77776	1	600000000000000	0
323	SAVE	0	136	0	121000000000000	0
324	OUT2	0	76	1	105000000000000	0
325	CHI2	0	124	1	150000000000000	0
326	TW47	0	122	1	144000000000000	0
327	CHI	0	123	1	146000000000000	0
330	*0000A	0	126	1	154000000000000	0
331	FINK	0	24	1	330000000000000	0
332	ONEST	0	70	1	770000000000000	0
333	*0000B	0	127	1	155000000000000	0
334	BETA	0	125	1	152000000000000	0
335	NULL	0	74	1	103000000000000	0
336	OUT	0	77	1	106000000000000	0
337	TWO	0	60	1	670000000000000	0
340	*0000C	0	130	1	156000000000000	0
341	*0000D	0	131	1	157000000000000	0
342	PART	0	102	1	111000000000000	0
343	P	0	113	1	126000000000000	0

344	CUN	0	114	1	1300000000000000	0
345	LOOP	0	43	1	5200000000000000	0
346	TORTP	0	112	1	1240000000000000	0
347	GRÖOT2	0	121	1	1420000000000000	0
350	*0000E	0	132	1	1600000000000000	0
351	UNSAVE	0	137	0	1220000000000000	0
352	LOOP1	0	103	1	1120000000000000	0

CRCOR

CRCOR	ORG			1
ERPR	REF	*ERPR		2
ENTRY	REF	*ENTRY		3
	REF	*CRCOR		4
	TRA	*ENTRY		5
	CLA, DBL+2	SL, B6+1		6
	CLA, DBL+2	ML, B6+1		7
	CLA+2	ATTR1, B6+1		10
-Z	TRA	*SAVE, U+R		11
B6	RPA	LV		12
	CLA	B6-22, U+B1		13
	CLA	B6-21, U+B2		14
	CLA	*B6-20, U+B3		15
	SLF			16
B1	IF (ZER) SKP			17
	SLN	aB2		20
	LDR			21
R	IF (NUL) TRA	B1, R+B1		22
	LLS	ER2		23
	LLS	d15, U+B5		24
PF	LUR	d15, U+PF		25
	AB1	3, U+PF		26
	LDR	aPF=1		27
R	IF (NUL) TRA	B2, R+B2		30
Z	LLS	ER2		31
	RPA	d15, U+T6		32
	LLS	LNTH		33
PF	LUR	d15, U+PF		34
	AB2	3, U+PF		35
B3	IF (NZE) SKP	aPF=1		36
	TSR	aZ		37
	CLA	FIXB3		40
	ORU	aUSTAR		41
	LLS	CODEWD, U+R		42
B3	LRS	d15		43
	TSR	d15, R+T7		44
T6	IF (ZER) SKP	*XCWD		45
	TRA	aB5		46
	STX	ER		47
	IF (SLN) SKP	a2		50
B3	IF (PNZ) JMP			51
B3	SUB	T6		52
	IF (NNZ) SKP	T6		53
	TSR	T6		54
	SLN	ER1		55
	STX	2		56
I	IF (SLN) SKP	aX		57
	TRA	4, B3+1		60
B3	LUR	NOCROS, B3-1		61
	ADD	1, U+B3		62
NOCROS	ADD	USTAR, U+B6		63
MORE	ADD	T6, U+B5		64
	CLA, ST1+	B5		65
-T6	CPL	aZ		66
	FMP	TW047		67
	STO	NORM		70
B1	RPA	INST1		71
	LT5, STF	U		72
B2	RPA	INST2, I+PF		73

		LT7	INST3,U→T6	74
	PF	STO	ATTR1	75
		TLN	ATT1	76
	Z	SB2	6,U→B1	77
NEXT	I	LT4	aZ,U→B4	100
	B2	MLN	TRMLT,U→CC	101
INST2	*T5	FMP	B4+B1+Z,B4+1	102
		FAD	T4	103
		FDV+2	NORM,B6+1	104
		IF(SLN)SKP	2	105
		AB6	aX	106
		CLA	-11,0,B1+1	107
		FAD→	NORM	110
	B1	IF(POS)SKP	aB3	111
		TSR	NEXT	112
		CLA→	B5	113
		SLF	2	114
		IF(SLN)SKP	4	115
		TRA	LV	116
		CLA,DBL	T5,U→B2	117
	-B3	ADD	aB6=1,U→B6	120
LNGTH	-1	ADD	aZ,U→T6	121
		SLF	4,B3-1	122
	B3	IF(ZER)TRA	LV,R→B1	123
		TRA	MORE,B2+1	124
LV		LT5	aZ,1→B6	125
		SLF	4	126
		TLF	ATT1	127
		ILF	AT1	130
	Z	IF(ZER,TG1)TRA	*UNSAVE	131
		CLA	B6-1,B6-1	132
		STO	ATTR1,B6-1	133
		TLN	*B6,B6-1	134
		MLN	*B6,B6-1	135
		ILN	*B6,B6-1	136
		SLN	*B6	137
	PF	AB6	Z-3,U→CC	140
FIXB3	Z	IF(SLF)SKP	4,U→B3	141
		AB3	B5-1	142
	PF	AB3	B5,U→CC	143
ER	06	TRA	*ERPR	144
		TRA	OUT	145
ER1	00	TRA	*ERPR	146
		NOP	aMESS	147
		TRA	FIXB3	150
ER2	03	TRA	*ERPR	151
OUT	Z	SB1	USTAR,U→B2	152
		TSR	*STEX	153
		TRA	LV	154
MESS		BCD	IMPROPER INPUT PARAMETERS/	155
TWO47		OCT	062000000000000000	156
CODEWD		OCT	000000220000000000	157
NORM		OCT	Z	160
INST1		NOP	B4+Z	161
INST3		FAD→	T4,CC+X	162
STEX		EQU	135	163
SAVE		EQU	136	164
UNSAVE		EQU	137	165
XCWD		EQU	126	166

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ATTRI	EQU
ATTLI	EQU
ATILI	EQU
TRMLT	EQU
USTAR	EQU
	END

15
40000
40000
10000
10

167
170
171
172
173
174
175

ERPR	77775	75	44615	76	1400	00000	
ENTRY	77776	75	44556	36	1400	00000	
	77777	42	61425	66	1400	00000	
	1	01	01000	00	4401	77774	ENTRY
	2	01	21706	26	0000	77770	
	3	01	21706	26	0000	77772	
	4	01	21702	26	0000	00015	ATTR1
	5	10	01000	02	4400	00136	SAVE
	6	46	21601	00	0001	00111	LV
	7	01	21700	41	0100	77755	
	10	01	21700	42	0100	77756	
	11	01	21700	43	0500	77757	
	12	01	42004	00	4000	00004	
	13	41	02010	00	4004	00000	
	14	01	42000	00	4000	00004	
	15	01	50400	51	0002	00000	
	16	02	01040	00	4001	00125	ER2
	17	01	45062	45	4000	00017	
	20	01	45062	47	4000	00017	
	21	47	45010	47	4000	00003	
	22	01	41001	00	4200	77776	
	23	01	50400	52	0004	00000	
	24	02	01040	00	4001	00117	ER2
	25	00	45062	06	4000	00017	
	26	01	21601	00	0001	00065	LNPTH
	27	01	45062	47	4000	00017	
	30	47	45010	47	4000	00003	
	31	01	41002	00	4200	77776	
	32	43	02050	00	4000	00000	
	33	01	40000	00	4001	00100	FIXB3
	34	01	21700	00	4000	00010	USTAR
	35	01	50010	02	0001	00116	CODEWD
	36	01	45062	00	4000	00017	
	37	43	45015	17	4000	00017	
	40	01	40000	00	4400	00126	XCWD
	41	06	02010	00	4040	00000	
	42	01	01000	00	4001	00074	ER
	43	01	43085	00	4000	00002	
	44	01	02030	00	4000	00004	
	45	43	07150	00	0000	00006	
	46	43	10100	00	0000	00006	
	47	01	06550	00	0000	00006	
	50	01	40070	00	4001	00070	ER1
	51	01	42000	00	4000	00002	
	52	01	43075	00	4000	77775	
	53	20	02030	23	4000	00004	
	54	01	01000	63	4001	00001	NOCROS
	55	43	45010	43	4000	00001	
NOCROS	56	01	10000	46	0000	00010	USTAR
MORE	57	42	10000	45	0000	00006	
	60	01	21711	00	0040	00000	
	61	16	50100	00	4000	00000	
	62	01	10600	00	0001	00070	TWO47
	63	01	20001	00	4001	00071	NORM
	64	41	21601	00	0001	00071	INST1
	65	01	50550	00	0000	00001	
	66	42	21601	77	0001	00006	INST2
	67	01	50470	06	0001	00067	INST3
	70	47	20001	00	4000	00015	ATTR1
	71	01	42003	00	4000	40000	ATT11
	72	00	40002	41	4000	00006	
NEXT	73	20	50440	44	4000	00000	
	74	42	42002	40	4000	10000	TRMLT
INST2	75	05	10600	24	0022	00000	

	76	01	10400	00	0000	00004	
	77	01	10702	26	0001	00055	NORM
	100	01	02030	00	4000	00002	
	101	01	41006	00	4000	77775	
	102	01	21700	21	1001	00055	*0000A
	103	01	10401	00	0001	00051	NORM
	104	41	02110	00	4010	00000	
	105	01	40000	00	4001	77764	NEXT
	106	01	21701	00	0040	00000	
	107	01	42004	00	4000	00002	
	110	01	02030	00	4000	00004	
	111	01	01000	00	4001	00006	LV
	112	01	21704	42	0000	00005	
	113	53	10000	46	4100	77776	
LNGTH	114	30	10000	06	4000	00000	
	115	01	42004	63	4000	00004	
	116	43	01010	51	4001	00001	LV
	117	01	01000	22	4001	77736	MORE
LV	120	01	50450	76	4000	00000	
	121	01	42004	00	4000	00004	
	122	01	42007	00	4000	40000	ATTLI
	123	01	42005	00	4000	40000	ATILI
	124	00	01011	00	4400	00137	UNSAVE
	125	01	21700	66	0100	77776	
	126	01	20001	66	4000	00015	ATTRI
	127	01	42003	66	4500	00000	
	130	01	42002	66	4500	00000	
	131	01	42001	66	4500	00000	
	132	01	42000	00	4500	00000	
	133	47	41006	40	4000	77774	
FIXB3	134	00	02070	43	4000	00004	
	135	01	41003	00	4040	77776	
	136	47	41003	40	4040	00000	
ER	137	06	01000	00	4401	77635	ERPR
	140	01	01000	00	4001	00004	OUT
ER1	141	00	01000	00	4401	77633	ERPR
	142	01	30000	00	4001	00005	MESS
	143	01	01000	00	4001	77767	FIXB3
ER2	144	03	01000	00	4401	77630	ERPR
OUT	145	00	40001	42	4000	00010	USTAR
	146	01	40000	00	4400	00135	STEX
	147	01	01000	00	4001	77747	LV
MESS	150	50	54576	15	6574	46125	
	151	50	55576	46	3255	74061	
	152	40	54446	34	4616	22225	
TWO47	153	06	20000	00	0000	00000	
CODEWD	154	00	00002	20	0000	00000	
NORM	155	00	00000	00	0000	00000	
INST1	156	01	30000	00	0020	00000	
INST3	157	01	10401	30	0000	00004	

*0000A	160	01	00100	00	0000	00000	

316	ERPR	0	77775	1	2000000000000000	0
317	ENTRY	0	77776	1	3000000000000000	0
320	ATTRI	0	15	0	1740000000000000	0
321	SAVE	0	136	0	1710000000000000	0
322	LV	0	120	1	1240000000000000	0
323	ER2	0	144	1	1500000000000000	0
324	LNGTH	0	114	1	1200000000000000	0
325	FIXB3	0	134	1	1400000000000000	0
326	USTAR	0	10	0	2000000000000000	0
327	CODEWD	0	154	1	1630000000000000	0
330	XCWD	0	126	0	1730000000000000	0

331	ER	0	137	1	143000000000000000	0
332	ERI	0	141	1	145000000000000000	0
333	NOCROS	0	56	1	620000000000000000	0
334	MORE	0	57	1	630000000000000000	0
335	TWO47	0	155	1	161000000000000000	0
336	NORM	0	155	1	165000000000000000	0
337	INST1	0	156	1	166000000000000000	0
340	INST2	0	75	1	101000000000000000	0
341	INST3	0	157	1	167000000000000000	0
342	ATTL1	0	40000	0	175000000000000000	0
343	NEXT	0	73	1	770000000000000000	0
344	TRMLT	0	10000	0	177000000000000000	0
345	*0000A	0	160	1	202000000000000000	0
346	ATIL1	0	40000	0	176000000000000000	0
347	UNSAVE	0	137	0	172000000000000000	0
350	OUT	0	145	1	151000000000000000	0
351	MESS	0	150	1	155000000000000000	0
352	STEX	0	135	0	170000000000000000	0

CRCOR - cross or auto correlation of two vectors
execution: implicit

~~errors~~ input: two codeword addresses

+ one integer address on B6-list

output: standard vector ~~ten~~ with codeword
at USTAR

errors: if either input vector non-existent

~~if third argument $\neq$ length~~

if input vectors not same
length result is left zeros
and control returned to
calling program

if third argument $\neq 0$ or $>$ length n
of input vectors for auto-
correlation

or $> 2 \text{ length}^n - 1$ for cross
correlation it is set to
the maximum, message if
originally too large.

~~note: if $\text{the } F$ even and cross correlation~~

~~is performed then $E_F = 0$~~

~~where E is the output vector~~

if the first two arguments are ~~the~~ equal
auto correlation is performed
and

$$E_i = \sum_{j=1}^{n-i+1} \left[A_j B_{j+i-1} - \frac{1}{n-i+1} \right] i = 1, F, \quad A, B \text{ input vectors}$$

other wise ~~as~~ cross correlation is ~~not~~ performed

$$E_i = \sum_{j=1}^{n+i-\frac{F+1}{2}} \left[A_{j-i+\frac{F+1}{2}} B_j \frac{1}{n-\frac{F-1}{2}+i} \right] i = 1, \frac{F-1}{2}$$

$$= \sum_{j=1}^{n-i+\frac{F+1}{2}} \left[\frac{1}{n-i+\frac{F+1}{2}} A_j B_{j+i-\frac{F+1}{2}} \right] i = \frac{F+1}{2}, 2(F/2)$$

note: if F even and cross-correlation is performed then $E_F = 0$.

~~Handwritten scribbles and symbols, possibly including F , $F+1$, and $F/2$.~~

CMCON

CMCON	ORG			
	REM		CONSTRUCTS COMPLEX MATRIX *CSTAR	1
	REM		FROM REAL MATRICES *B1 AND *B2,	2
	REM		B1 OR B2 = Z←USTAR	3
				6
ERPR	REF		*←ERPR	7
MCOPY	REF		*MCOPY	10
MREAL	REF		*CSTAR	11
MIMAG	REF		*←←←←	12
ENTRY	REF		*←ENTRY	13
	REF		*CMCON	14
				15
	TRA		*ENTRY	16
	TRA		*SAVE, U←R	17
-Z	IF(NZE) TRA		CC+1	20
B1	SB1		USTAR	21
	IF(NZE) TRA		CC+1	22
B2	SB2		USTAR	23
	STO		B5, B6+1	24
T7	SUR, LT6		B1, U←R	25
	IF(NUL) TRA		EMPTY, U←B3	26
Z	LLS		a←15, U←T4	27
	SUR, LT7		B2, U←R	30
	IF(NUL) TRA		EMPTY, U←B4	31
Z	LLS		a←15, U←T5	32
T5	IF(ZER) SKP		T4	33
	TRA		INCOMP	34
T6	AND		ABIT	35
	IF(NUL) TRA		FORM	36
	LDR		B3+1	37
Z	LLS		a←15, U←T6	40
	LDR		B4+1	41
Z	LLS		a←15, U←T7	42
T6	IF(ZER) SKP		T7	43
	TRA		INCOMP	44
FORM	B1		B2, U←B4	45
	CLA		MIMAG, U←B1	46
	Z		*STEX, U←B2	47
	TSR		*STEX, B1=1	50
	B4		aUSTAR	51
	B4		COPY1, U←B2	52
	REM		*****PRESERVE TAG ON CODEWORD*****	53
SW1	Z		USTAR, R←B2	55
	REM		*****PRESERVE TAG ON CODEWORD*****	57
	R		B1	60
	B1		B2, CC+1	61
COPY1	TSR		*MCOPY, CC+1	62
	B5		aUSTAR, B1+1	63
	B5		COPY2, U←B2	65
	REM		*****PRESERVE TAG ON CODEWORD*****	67
SW2	Z		USTAR, R←B2	70
	REM		*****PRESERVE TAG ON CODEWORD*****	71
	R		B1	72
	B1		B2, CC+1	73
COPY2	TSR		*MCOPY, CC+1	
EXIT	LT7		B6-1, B6-1	
	TRA		*UNSAVE	

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EMPTY	03	TRA	PF	74
		TRA	*ERPR	75
		TRA	EXIT	76
INCOMP	05	TRA	*ERPR	77
		TRA	EXIT	100
				101
ABIT	Z	00000	*Z	102
				103
USTAR		EQU	10	104
STEX		EQU	135	105
SAVE		EQU	136	106
UNSAVE		EQU	137	107
		END		110
				111
				112

ERPR	77772	75	44615	76	1400	00000	
MCOPY	77773	54	42565	77	0400	00000	
MREAL	77774	42	62634	06	1400	00000	
MIMAG	77775	75	75757	57	5400	00000	
ENTRY	77776	75	44556	36	1400	00000	
	77777	42	54425	65	5400	00000	
	1	01	01000	00	4401	77774	ENTRY
	2	10	01000	02	4400	00136	SAVE
	3	41	01000	00	4001	00001	
	4	01	40001	00	4000	00010	USTAR
	5	42	01000	00	4001	00001	
	6	01	40002	00	4000	00010	USTAR
	7	07	20001	26	4100	00000	
	10	01	53460	02	0002	00000	
	11	01	01040	43	4001	00041	EMPTY
	12	00	45062	04	4000	00017	
	13	01	53470	02	0004	00000	
	14	01	01040	44	4001	00036	EMPTY
	15	00	45062	05	4000	00017	
	16	05	02010	00	0000	00004	
	17	01	01000	00	4001	00035	INCOMP
	20	06	50314	00	0001	00036	ABIT
	21	01	01040	00	4001	00006	FORM
	22	01	50400	00	0010	00001	
	23	00	45062	06	4000	00017	
	24	01	50400	00	0020	00001	
	25	00	45062	07	4000	00017	
	26	06	02010	00	0000	00007	
	27	01	01000	00	4001	00025	INCOMP
FORM	30	41	40005	44	4004	00000	
	31	01	21700	41	0001	77743	MIMAG
	32	00	40000	42	4400	00135	STEX
	33	01	40000	61	4400	00135	STEX
	34	44	02010	00	4000	00010	USTAR
	35	44	01000	42	4001	00003	COPY1
SW1	36	00	50401	52	0000	00010	USTAR
	37	02	20041	00	0002	00000	
	40	41	21641	20	0004	00000	
COPY1	41	01	40000	20	4401	77731	MCOPY
	42	45	02010	21	4000	00010	USTAR
	43	45	01000	42	4001	00003	COPY2
SW2	44	00	50401	52	0000	00010	USTAR
	45	02	20041	00	0002	00000	
	46	41	21641	20	0004	00000	
COPY2	47	01	40000	20	4401	77723	MCOPY
EXIT	50	01	50470	66	0100	77776	
	51	01	01000	00	4400	00137	UNSAVE
	52	01	01000	00	4200	00000	
EMPTY	53	03	01000	00	4401	77716	ERPR
	54	01	01000	00	4001	77772	EXIT
INCOMP	55	05	01000	00	4401	77714	ERPR
	56	01	01000	00	4001	77770	EXIT
ABIT	57	00	00000	00	0400	00000	

316	ERPR	0	77772	1	2000000000000000	0
317	MCOPY	0	77773	1	2100000000000000	0
320	MREAL	0	77774	3	2200000000000000	0
321	MIMAG	0	77775	1	2300000000000000	0
322	ENTRY	0	77776	1	2400000000000000	0
323	SAVE	0	136	0	1330000000000000	0
324	USTAR	0	10	0	1310000000000000	0
325	EMPTY	0	53	1	1240000000000000	0
326	INCOMP	0	55	1	1260000000000000	0
327	ABIT	0	57	1	1300000000000000	0
330	FORM	0	30	1	5500000000000000	0
331	STEX	0	135	0	1320000000000000	0
332	COPY1	0	41	1	1000000000000000	0
333	SW1	0	36	3	7000000000000000	0
334	COPY2	0	47	1	1200000000000000	0
335	SW2	0	44	3	1100000000000000	0
336	EXIT	0	50	1	1210000000000000	0
337	UNSAVE	0	137	0	1340000000000000	0

VREV

VREV		ORG			1
ERPR		REF	*ERPR		2
ENTRY		REF	*ENTRY		3
		REF	*VREV		4
		TRA	*ENTRY		5
	B1	SUR	T7*U-B1		6
	B2	DRL+2	B7*B6+1		7
	B3	Z0002	B7		10
	B6	RPA	B*SAVE		11
		LDR	B1*B1		12
	P	IF(NUL)TRA	B2		13
		LLS	B15,U-B2		14
		LLS	B15,U-B6		15
	B6	LUR	B*U-B4		16
	B2	LUR	1*U-B3		17
		AB1	B6*B3-1		20
		LDR	B2*B1-1,I-B6		21
RLOOP	P	Z0001	B1*B1+1		22
	S	LDR+2	B6-1,B6-1		23
	B3	IF(PNZ)TRA	RLOOP,B3=1		24
B*SAVE		B*6	(7)		25
		B*3	B*6,B4-1		26
		B*1	*B6,B4-1		27
	PF	B*2	*B6,U-CC		30
ER	03	TRA	*ERPR		31
		TRA	B*SAVE		32
		END			33
					34
					35

ERPR	77775	75	44615	76	1400	00000	
ENTRY	77776	75	44556	26	1400	00000	
	77777	65	61446	52	5400	00000	
	1	01	01000	00	4401	77774	ENTRY
	2	41	53000	41	0000	00007	
	3	42	20006	26	4000	00000	
	4	42	20002	00	4000	00000	
	5	46	21401	00	0001	00013	BSAVE
	6	01	50400	51	0002	00000	
	7	02	01040	00	4001	00015	FR
	10	01	45062	42	4000	00017	
	11	01	45062	46	4000	00017	
	12	46	45010	46	4000	00003	
	13	42	45010	43	4000	00001	
	14	01	41001	43	4100	00000	
	15	01	50400	76	0004	77776	
RLOOP	16	02	20001	21	0002	00000	
	17	02	50402	46	0100	77776	
	20	42	05150	43	4001	77774	RLOOP
BSAVE	21	01	40006	00	4000	00000	
	22	01	40003	46	4500	00000	
	23	01	40001	46	4500	00000	
	24	47	40002	40	4500	00000	
ER	25	03	01000	00	4401	77747	ERPR
	26	01	01000	00	4001	77771	BSAVE

317	ERPR	0	77775	1	2000000000000000	0
320	ENTRY	0	77776	1	3000000000000000	0
321	BSAVE	0	21	1	2500000000000000	0
322	ER	0	25	1	3100000000000000	0
323	RLOOP	0	15	1	2200000000000000	0

CONVL

CONVL		ORG			1
ERPR		REF		*ERPR	2
ENTRY		REF		*ENTRY	3
VREV		REF		*VREV	4
		REF		*CONVL	5
		TRA		*ENTRY	6
		CLA, DBL+2		ML, B6+1	7
		CLA+2		ATTR1, B6+1	10
	-Z	TRA		*SAVE, U+R	11
	E6	RPA		BSAVE	12
GO		LT4, SUR		B6-17, U+B1	13
		LDR		B1, R+B1	14
	R	IF(NUL) TRA		ER	15
		LLS		d15, U+B5	16
		LLS		d15, U+B2	17
	E2	LUR		3, U+B2	20
	E2	ADD		aB1=1, U+B1	21
		LT5, SUR		B6-16, U+B2	22
		LDR		B2, R+B2	23
	R	IF(NUL) TRA		ER	24
		LLS		d15, U+B3	25
	B3	IF(PNZ) SKP		aB3=1, U+B3	26
	T4	TRA		SHJRT, U+R	27
		LLS		d15, U+B4	30
	B4	LUR		3, U+B4	31
	B4	ADD		aB2=1, U+B2	32
		CLA		B6-17, U+T7	33
		TSR		*VREV, CC+1	34
	I	LDR		CODEWD, U+B4	35
		LLS		d15, B4+1	36
	B3	LRS		d15, R+T7	37
		TSR		*XCWD, B4+1	40
		CLA, ST1+		B1+B5, B4+1	41
		STX		aX, B4+1	42
		CLA		USTAR, U+B6	43
	B1	RPA		INST1, I+PF	44
		LT7		INST2, U+T6	45
	B2	RPA		INSTO, U+R	46
	Z	LT5, STF		R, U+B1	47
	FE	STO		ATTR1, B4+1	50
		TLN		ATTCL1, B6+1	51
REPT	I	LT4		aZ, U+B2	52
	B4	MLN		TRMLT, U+CC	53
INST1	*T5	FMP		B2, B2+1	54
		FAD+2		T4, B6+1	55
	B3	IF(NEG) SKP		aB1+1, B2-1	56
		TSR		REPT, B1+1	57
		CLA+		*T5	60
BSAVE		LT5		aZ, I+B6	61
		CLA		B6-17, U+T7	62
		TSR		*VREV, CC+1	63
		TLF		ATTCL1	64
		ILF		ATIL1	65
LV		TRA		*UNSAVE	66
		CLA		B6-1, B6-1	67
		STO		ATTR1, B6-1	70
		TLN		*B6, B6-1	71
		MLN		*B6, B6-1	72
					73

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SHORT	T5	TRA	PF,B6-1	74
		STO,DBL	B6-17	75
		TRA	GO	76
ER	03	TRA	*ERPR	77
		TRA	LV	100
XCWD		EQU	136	101
SAVE		EQU	136	102
UNSAVE		EQU	137	103
USTAR		EQU	10	104
ATTRI		EQU	15	105
TRMLT		EQU	10000	106
ATTLI		EQU	40000	107
ATILI		EQU	40000	110
INST0		NOP	B2+B1	111
INST2		FAD	T4,CC+X	112
CODEWD	Z	00002	USTAR,CC+1	113
		END		114
				115

ERPR	77774	75	44415	76	1400	00000	
ENTRY	77775	75	44556	36	1400	00000	
VREV	77776	65	61446	52	5400	00000	
	77777	42	56556	55	3400	00000	
	1	01	01000	00	4401	77773	ENTRY
	2	01	21706	26	0000	77772	
	3	01	21702	26	0000	00015	ATTR1
	4	10	01000	02	4400	00136	SAVE
	5	46	21601	00	0001	00046	BSAVE
GO	6	01	53440	41	0100	77760	
	7	01	50400	51	0002	00000	
	10	02	01040	00	4001	00060	ER
	11	01	45062	45	4000	00017	
	12	01	45062	42	4000	00017	
	13	42	45010	42	4000	00003	
	14	42	10000	41	4002	77776	
	15	01	53450	42	0100	77761	
	16	01	50400	52	0004	00000	
	17	02	01040	00	4001	00051	ER
	20	01	45062	43	4000	00017	
	21	43	06100	43	4040	77776	
	22	04	01000	02	4001	00044	SHORT
	23	01	45062	44	4000	00017	
	24	44	45010	44	4000	00003	
	25	44	10000	42	4004	77776	
	26	01	21700	07	0100	77760	
	27	01	40000	20	4401	77746	VREV
	30	20	50400	44	0001	00044	CODEWD
	31	01	45062	24	4000	00017	
	32	43	45015	17	4000	00017	
	33	01	40000	24	4400	00126	XCWD
	34	01	21711	24	0042	00000	
	35	01	43005	24	4000	77775	
	36	01	21700	46	0000	00010	USTAR
	37	41	21601	77	0001	00007	INST1
	40	01	50470	06	0001	00033	INST2
	41	42	21601	02	0001	00031	INST0
	42	00	50500	41	0000	00002	
	43	47	20001	24	4000	00015	ATTR1
	44	01	42003	26	4000	40000	ATTL1
REPT	45	20	50440	42	4000	00000	
	46	44	42002	40	4000	10000	TRMLT
INST1	47	05	10600	22	0004	00000	
	50	01	10402	26	0000	00004	
	51	43	02510	62	4002	00001	
	52	01	40000	21	4001	77771	REPT
	53	01	21701	00	0400	00005	
BSAVE	54	01	50450	76	4000	00000	
	55	01	21700	07	0100	77760	
	56	01	40000	20	4401	77717	VREV
	57	01	42007	00	4000	40000	ATTL1
	60	01	42005	00	4000	40000	ATIL1
LV	61	01	01000	00	4400	00137	UNSAVE
	62	01	21700	66	0100	77776	
	63	01	20001	66	4000	00015	ATTR1
	64	01	42003	66	4500	00000	
	65	01	42002	66	4500	00000	
	66	01	01000	66	4200	00000	
SHORT	67	05	20005	00	4100	77760	
	70	01	01000	00	4001	77714	GO
ER	71	03	01000	00	4401	77702	ERPR
	72	01	01000	00	4001	77765	LV
INST0	73	01	30000	00	0006	00000	
INST2	74	01	10401	30	0000	00004	

316	ERPR	0	77774	1	2000000000000000	0
317	ENTRY	0	77775	1	3000000000000000	0
320	VREV	0	77776	1	4000000000000000	0
321	ATTR1	0	15	0	1040000000000000	0
322	SAVE	0	136	0	1010000000000000	0
323	BSAVE	0	54	1	6100000000000000	0
324	GO	0	6	1	1300000000000000	0
325	ER	0	71	1	7600000000000000	0
326	SHORT	0	67	1	7400000000000000	0
327	CODEWD	0	75	1	1120000000000000	0
330	XCWD	0	126	0	1000000000000000	0
331	USTAR	0	10	0	1030000000000000	0
332	INST1	0	47	1	5400000000000000	0
333	INST2	0	74	1	1110000000000000	0
334	INST0	0	73	1	1100000000000000	0
335	ATTL1	0	40000	0	1060000000000000	0
336	REPT	0	45	1	5200000000000000	0
337	TRMLT	0	10000	0	1050000000000000	0
340	ATIL1	0	40000	0	1070000000000000	0
341	LV	0	61	1	6600000000000000	0
342	UNSAVE	0	137	0	1020000000000000	0

RDUP

07/09/68 10.43

PAGE 1

RDUP

ORG

REM

DUP: U - USTAR

REM

FST

USTAR>U>B1

CLA

FUSTAR

BAU-

B1

TRA

ARP2

FUSTAR

OCT

10 00000

USTAR

EQU

10

END

1
2
3
4
5
6
7
10
11
12
13
14
15
16
17
20

1	01	20041	41	0000	00010
2	01	21700	00	0001	00002
3	01	20101	00	0002	00000
4	01	01000	00	4400	77774
5	00	00000	00	0010	00000

USTAR
FUSTAR

FUSTAR

317
320USTAR
FUSTAR

0	10	0
0	5	1

1500000000000000
14000000000000000
0

RSAV

*RSAV

URG

REM

USTAR - B6 LIST

REM

Z

LDR-

USTAR, R-B1

P

20042

a3P2, I-B2

B6

SUR

B1, B6+1

LUR

a415

IF (ZER) TRA

aNODUP

P

LUL

a415

SAU-

B1, CC+1

NODUP

P

RPA

B1

TRA

a32

USTAR

EQU

10

END

1
2
3
4
5
6
7
10
11
12
13
14
15
16
17
20
21
22
23
24

1	00	50401	51	0000	00010
2	02	20042	72	4400	77774
3	44	53000	26	0002	00000
4	01	45010	00	4000	00017
5	01	01010	00	4001	00002
6	02	45020	00	4000	00017
7	01	20101	20	0002	00000
10	02	21601	00	0002	00000
11	01	01000	00	4004	00000

USTAR

NODUP

NODUP

317
320USTAR
NODUP

0	17	0
0	10	1

2000000000000000
1600000000000000

0
0

RSWP

*RSH

ORG

REH

SWAP USTAR TO B1

FF

OBL+2

a7, CC+1

FF

OBL+2

a7, CC+1

Z

TSR

a7, STEX, ULR2

REM

a7, B1

Z

LDR*

USTAR, R+B2

F

PSI

a1

CLA

a2

LUR

a7, 15

IF(ZEP)TRA

a7, NODUP

Z

SAU

a7, 1

LUL

a7, 15

SAU

a7, CC+1

NODUP

F1

RPA

a2

TRA

a7, B6-1, B5-1

USTAR

EQU

10

STEX

EQU

105

END

1
2
3
4
5
6
7
10
11
12
13
14
15
16
17
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21
22
23
24
25
26
27
30
31

1	47	20004	20	4000	00000
2	47	20004	20	4000	00000
3	00	40000	42	4400	00135
4	00	50001	52	0000	00010
5	02	20041	20	0002	00000
6	01	21700	20	0004	00000
7	01	45010	20	4000	00017
10	01	01010	20	4001	00003
11	00	20100	20	4002	00000
12	01	45020	20	4000	00017
13	01	20131	20	0004	00000
14	41	21451	20	0004	00000
15	01	01000	46	4500	77776

STEX
USTAR

NODUP

NODUP

REMARKS

316	STEX	0	176	0	2500000000000000	0
317	USTAR	0	16	0	2400000000000000	0
320	NODUP	0	14	1	2200000000000000	0