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MINITRACE 1

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PURPOSE

Minitrace 1 is a trace program for IBM 1401 computers with 4,000 or fewer digits of core storage. It is designed to furnish the information normally provided by a full trace program while using a minimum of core space and requiring almost no set-up work. A trace program is used in testing and debugging other programs, its output consisting of information about the execution of the program being traced. Minitrace 1 monitors each instruction of the program being traced, and except for fully-chained instructions prints one line for each such instruction after it is executed. The contents of this line are as follows:

Print positions	Information printed
1- 3	Address of the instruction being traced.
4	The letter "C" if one or more fully-chained instructions follow the instruction being traced.
6	OP-code of the instruction being traced.
8-10	A-operand of the instruction being traced.
12-14	B-operand of the instruction being traced.
16	d-character of the instruction being traced.
18-20	Contents of Index 1.
22-24	Contents of Index 2.
26-28	Contents of Index 3.
30-43	Up to 14 digits of the contents, after execution, of the field addressed by the A-operand of the instruction being traced. An asterisk indicates the length of the field.
45-58	Up to 14 digits of the contents, after execution, of the field addressed by the B-operand of the instruction being traced. An asterisk indicates the length of the field.
59	Always a blank.
60	Always a record-mark.

MACHINE REQUIREMENTS

Minitrace 1 uses 981 digits of core memory and may be assembled anywhere in core except the print area. For example, it may be assembled with origin at 3019 to use positions 3019-3999.

Other machine requirements are:

4,000 or fewer digits of core memory
Advanced programming feature
  Index registers
  Store address register instructions
  Move record instruction
1403 Printer

PROCEDURE

Minitrace 1 has been designed to avoid almost all "setting-up" of the program deck to be traced. In most cases, it is merely necessary to remove the "END" card from the deck to be traced, place Minitrace 1 behind the remainder of the deck, place any data cards used behind Minitrace 1, and load and run the combined deck, following exactly the procedures specified for the program being traced.

EXECUTION TIME

With the print storage feature, the trace runs at maximum printer speed with double-spacing, i.e., about 500 instructions will be traced per minute. Input and output operations executed by the program being traced will use their normal additional time.

SOURCE LANGUAGE

SPS

LIMITATIONS

Minitrace 1 will trace all generally known 1401 instructions. There are several minor limitations and requirements, fully described in the Write-Up, that are imposed in order to reduce the core space used by Minitrace 1.

CHECK-OUT STATUS

Minitrace 1 has been used to trace a variety of programs on systems that include tape, Ramac, and 1407 console equipment. The nature of the program is such, however, that it may still contain bugs or may be unable to handle some instruction or sequence of instructions that was not anticipated by the author. The author therefore requests that each user, as a service to other users, inform him of all difficulties encountered in order that the program may be modified or that a description of the limitation may be added to the Write-Up.

OPERATING PROCEDURES

A. Standard trace

1. Remove the last card (END card) from the assembled program to be traced.

2. Place the Minitrace 1 deck behind the program deck to be traced.

3. Place data cards, if any, behind the Minitrace 1 deck.

4. Load and run the combined deck.

   Follow the procedures specified for the program being traced. (Check for switches, carriage control tape, etc.)

Precaution--If not altered, Minitrace 1 will expect to find the first instruction of the program being traced in core location 333. To begin tracing at a different address, that address should be inserted as the contents of FX, the constant that occupies the first 3 digits of Minitrace 1. For example, if Minitrace 1 is assembled with origin at 3019 and a program is to be traced starting at R28, then R28 should be inserted into 3019-3021. Use a condensed Minitrace 1 deck to trace a condensed program deck.

B. Trace of particular part of program

1. Remove "End" card from program to be traced.

2. Replace 1st card of Minitrace 1 with a card which is identical except that the address at which tracing is to begin is punched into columns 24-26.

3. Put the Minitrace 1 deck behind the program to be traced.

4. Replace the last card of Minitrace 1 with the "End" card from the program to be traced.

5. Place data cards, if any, behind the combined decks.

6. Set address stop to the address at which tracing is to begin.

7. Load and run the program to the address stop. The Start button must be pressed twice at address stops during loading.

8. Set the I-address register to 3022, the address of the first instruction of Minitrace 1.

9. Press Start to begin tracing.

To stop tracing before the execution of a given instruction, set address stop to the address of the instruction which follows that instruction. A portion or the remainder of the program being traced may then be properly executed by restarting at the address of the given instruction. Tracing may be resumed later in the program by the following procedure:

1. Set address stop to the address of the instruction at which tracing is to be resumed.

2. Press Start and run the program to the address stop.

3. Put the address of the instruction at which tracing is to be resumed into core locations 3019-3021.

4. Reset the I-address register to 3022.

5. Press Start to resume tracing.

REQUIREMENTS, LIMITATIONS, AND FURTHER EXPLANATION

A. Fully-chained instructions

Minitrace 1 can accommodate up to 27 full-chain instructions in a row in the circumstances which place the most severe limitation on the number that can be handled. In other words, if the program being traced does not contain a string of more than 27 consecutive fully-chained instructions, it can be traced and the next paragraph can be ignored.

If the chain follows an instruction which is less than 8 digits long, the number of consecutive fully-chained instructions that can be traced is increased by one for each digit by which the instruction preceeding the chain is shorter than 8. If the chain is not followed by a 4-digit instruction whose op-code is either M, L, Q, or H, or be a 4-digit constant whose first character is M, L, Q, or H, the number of consecutive fully-chained instructions that can be traced is increased by 4.

B. Incorrect indication of presence of full-chain

If, in the program being traced, it happens that one-digit constants that contain characters that are op-codes that can be chained follow an unconditional branch instruction in core storage layout, Minitrace 1 will be fooled into thinking that a chain will be executed, and will print "C" after the address of the branch instruction. This incorrect notation does not otherwise affect the trace, and is mentioned here only because it might be confusing in the rare occasions when it is encountered.

C. Explanation of use of asterisks to indicate length of fields

When the contents of the fields addressed by the A-operand and B-operand are moved prior to being printed, the move is stopped either by the word-mark of the field addressed or when the 14th digit of the field is moved. An asterisk is then printed in the position immediately to the left of the last digit moved. The asterisk thus indicates the length of the field addressed, provided it is less than 14 digits long.

D. Minitrace 1 sets word marks in 001, 087, and 092

Word marks are set in core locations 001, 087, and 092, and remain set during execution of the program being traced. The latter must therefore be able to function under these conditions.

E. Stacker and printer skip instructions

A Skip After Print instruction is executed directly after the trace of that instruction is printed rather than after the next Print instruction in the program being traced. An Immediate Skip instruction is executed directly before the trace of that instruction is printed.

A Select Stacker instruction given after a Read instruction will not be effective because it will not be executed within the necessary time limit. All cards read should be expected to fall into the normal read pocket.

F. A- and B-operands of 000

Minitrace 1 does not print the contents of location 000 if this position is addressed by the program being traced.

The instruction with this operand (e.g., N 000 or H 089 000) will be correctly executed.

G. Word marks must follow all instructions

It is recommended that programs that may be traced be written with word marks in the location following each instruction, thus extending the general requirement to the three instructions that do not ordinarily require such a word mark (the 4-digit unconditional Branch, the 7-digit Set Word Mark, and the 7-digit Clear Storage and Branch).

However, Minitrace 1 will usually be able to trace the above instructions if a word mark occurs in core within 32 digits after the last digit of the instruction (within 35 digits of the 4-digit unconditional Branch).

The author's experience has shown that this requirement must especially be kept in mind when writing the last instruction of the program (the instruction preceeding the END card) and when patching assembled decks (also remember not to put a patch into locations used by Minitrace 1).

H. Partial logic of Minitrace 1

The following statement of the principal logic employed by Minitrace 1 may be useful in determining whether programs which make unusual use of particular instructions can be traced:

1. The contents of the B-address register after execution of an instruction being traced are stored and returned to the register before execution of the next instruction if the latter is a 4-digit Move, Load, or Store B-address Register instruction. The contents of the A-address register are similarly handled if the next instruction to be traced is a 4-digit Store A-address Register instruction. These are the only cases in which the contents of the registers are stored for use by the next instruction. When a branch occurs, the address of the next sequential instruction following the Branch instruction is introduced into the B-address register prior to execution of the next instruction to be traced.

2. Minitrace 1 recognizes the following 1-digit instructions as fully-chained instructions and causes them to be executed without tracing at the same time that the preceding unchained instruction is executed and traced:

C	□
X	!
W	?
%	L
Q	M
H	/
Z	#
@	E
P	V
D	B
Y	S
,	A

3. Minitrace 1 recognizes that branches may occur to the A-address of instructions with the following op-codes:

B	3
V	5
W	6
.	7
1	K
4	F
2	/ (7-digit instruction only).

Sample Output of Minitrace 1

Trace of Richmond Program 064
Inquiry into account of Transit Department
on Ramac, using 1407 Console

333	, 087 092	*	*	‡
340	, 024 040	*	*	‡
347	, -01 -04	*	*	‡
354	, -15	*		‡
358	B 530 Q	*M		‡
363	B 347	*,		‡
347	, -01 -04	*	*	‡
354	, -15	*		‡
358	B 530 Q	*M		‡
363	B 347	*,		‡
347	, -01 -04	*	*	‡
354	, -15	*		‡
358	B 530 Q	*M		‡
363	B 347	*,		‡
347	, -01 -04	*	*	‡
354	, -15	*		‡
358	B 530 Q	*M		‡
363	B 347	*,		‡
347	, -01 -04	*	*	‡
354	, -15	*		‡
358	B 530 Q	*M		‡
363	B 347	*,		‡
347	, -01 -04	*	*	‡
354	, -15	*		‡
358	B 530 Q	*M		‡
363	B 347	*,		‡
347	, -01 -04	*	*	‡
354	, -15	*		‡

358	B 530 Q		*M	‡
530	M %T0 S77 R			*2 ‡
538	C S79 Y/3		*218	*218 ‡
545	B 701 /		*A	‡
550	M UW1 Z98		*880	*0008880 ‡
557	B 501		*H	‡
501	H 500		*B561	‡
505	B 385		*NB	‡
509	B 371		*M	‡
371	M %F0 Z92 R			*0 ‡
379	B 406 N		*B	‡
384	N 848 3		*B	‡
389	N			‡
390	B 434		*M	‡
434	M %E2 Z92 R			*0 ‡
442	B 478		*B	‡
478	B 406 Y		*B	‡
483	M 529 528		*1	*1 ‡
490	, 385 390		*B	*B ‡
497	B 561		*C	‡
561	C S79 -03		*218	*218 ‡
568	B 696 /		*N	‡
573	B 738 B		*M	‡
738	M S79 213		*218*	218 ‡
745	M VKS 237	*IT	*IT	‡
	218 TRANSIT			
752	2			‡
753	/ 299	*		‡
757	F K			‡
759	M S92 222		*TOTAL DEBITS*	TOTAL DEBITS ‡
766	L T19 241	* , , .0	* , , .0	‡
773	E -14 241		*08741587913*	87,415,879.13 ‡

6331

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                 TOTAL DEBITS      87,415,879.13
     780  2                                                       ‡
     781  / 299                     *                             ‡
     785  M T05 223                  *TOTAL CREDITS* TOTAL CREDITS ‡
     792  L T19 241                  *  ,   ,   .0 *   ,   ,   .0  ‡
     799  E -25 241                    *02231850889* 22,318,508.89 ‡
                 TOTAL CREDITS     22,318,508.89
     806  2                                                       ‡
     807  / 299                     *                             ‡


     811  F L                                                     ‡
     813  H 089 000                                *000           ‡
     820  H 094 000    000                        *000            ‡
     827  M T34 224    000 000                 *DEBITS*     DEBITS ‡
     834  M T41 241    000 000               *CREDITS*     CREDITS ‡
                       DEBITS              CREDITS
     841  2            000 000                                    ‡
     842  / 299        000 000    *                               ‡

     846  F J          000 000                                    ‡
     848  M -14 T52    000 000       *08741587913   *08741587913  ‡
     855  M -25 T63    000 000       *02231850889   *02231850889  ‡
     862  B 951 -T5    000 000                 *L*08890000002750  ‡
     870  , -S6        000 000                 *0                 ‡
     874  V ‡73 -T5 2  000 000                 *L    *0000002750  ‡
     ‡73  L T19 224    000 000    *  ,   ,   .0 *   ,   ,   .0    ‡
     ‡80  A -T5 T76    000 000      *0000002750    *0000002750    ‡
     ‡87  E -T5 224    000 000      *0000002750*         27.50    ‡
     ‡94  B 903        000 000                 *2                 ‡
                         27.50
     903  2            000 000                                    ‡
     904  / 299        000 000    *                               ‡
     908  ¤ -S6        000 000     *022318508890                  ‡
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```
912  B #98 -T6 # 000 000                    *□*88900000027500 ≠
920  B /27 -T6 @ 000 000                    *C*88900000027500 ≠
928  A T65 089   000 000                *10            *010 ≠
935  C 089 S40   010 000                *010           *00E ≠
942  B S27 S     010 000                  *Y                 ≠
947  B 862       010 000                  *B                 ≠
862  B 951 -T5   010 000                  *L*2750000063212M  ≠
870  , -S6       010 000                  *0                 ≠
874  V #73 -T5 2 010 000                  *L    *000063212M  ≠
882  L T19 241   010 000  *   ,   ,  .0 *   ,   ,  .0       ≠
889  A -T5 T87   010 000       *000063212M   *0000063212M   ≠
896  E -T5 241   010 000       *000063212M*      6,321.24   ≠
                                 6,321.24
903  2           010 000                                     ≠
904  / 299       010 000  *                                  ≠
908  □ -S6       010 000  *88900000027500                    ≠
912  B #98 -T6 # 010 000                  *□*750000063212M0  ≠
```

NO BOOTSTRAP CARD

PG	LIN	CT	LABEL	OP	A OPERAND	B OPERAND	D	LOC	INSTRUCTION COMMENTS	MITR1
1	030	3	FX	DCW	*		333	3021		
1	040	7	E2	MCW	TA &058	TA &057		3022	M H27 H26	
1	050	1		MCW				3029	M	
1	060	1		MCW				3030	M	
1	070	1		MCW				3031	M	
1	080	1		MCW				3032	M	
1	090	1		MCW				3033	M	
1	100	1		MCW				3034	M	
1	110	1		MCW				3035	M	
1	120	1		MCW				3036	M	
1	130	1		MCW				3037	M	
1	140	1		MCW				3038	M	
1	150	1		MCW				3039	M	
1	160	1		MCW				3040	M	
1	170	7		LCA	TA &058	ENDEX		3041	L H27 G47	
1	180	1		LCA				3048	L	
1	190	7		LCA	TA &013	A &013		3049	L G82 G18	
1	200	4		SW	0001			3056	, 001	
1	210	4		CW	ENDEX -014			3060	¤ G33	
1	220	7		MCW	FX	TA &002		3064	M &21 G71	
1	230	7		MCW	0089	TA &019		3071	M 089 G88	
1	240	7		MCW	0094	TA &023		3078	M 094 G92	
1	250	7		MCW	0099	TA &027		3085	M 099 G96	
1	260	7		LCA	B &001	0089		3092	L G07 089	
1	270	7		LCA	FX	0094		3099	L &21 094	
1	280	7	E10	SBR	0094	0001	2	3106	H 094 0-1	
1	290	8		BWZ	E15	0000	2 1	3113	V A32 0-0 1	
1	300	7		SBR	0089	0001	1	3121	H 089 0#1	
1	310	4		B	E10			3128	B A06	
1	320	7	E15	MCW	0000 2	B	1	3132	M 0-0 G#6	
1	330	1		MCW				3139	M	
1	340	7		MCW	BLANKS	B	1	3140	M F97 G#6	
1	350	7		MCW	F8X -001	BFAD		3147	M G11 G54	

PG	LIN	CT	LABEL	OP	A OPERAND	B OPERAND	D	LOC	INSTRUCTION COMMENTS	MITRI
1	360	1		MCW				3154	M	
1	370	7		MCW	F8X	TA &015		3155	M G12 G84	
1	380	7		MCW	A	TA &005		3162	M G05 G74	
1	390	7	E22A	MCW	0000 2	TOP		3169	M 0-0 G48	
1	400	7		SBR	0094	0001	2	3176	H 094 0-1	
1	410	8		BWZ	TEST	0000	2 1	3183	V H29 0-0 1	
1	420	7	WW	A	I9I	0094		3191	A I99 094	
1	430	7	ZZ	SBR	0094	0004	2	3198	H 094 0-4	
1	440	8		BWZ	MOD2	0000	2 1	3205	V 824 0-0 1	
1	450	7	E26AA	A	I9F	0094		3213	A I96 094	
1	460	4		B	E26			3220	B 878	
1	470	8	MOD2	B	E24	TOP	M	3224	B B60 G48 M	
1	480	8		B	E24	TOP	L	3232	B B60 G48 L	
1	490	8		B	E24	TOP	H	3240	B B60 G48 H	
1	500	8		B	E22A45	TOP	Q	3248	B 116 G48 Q	
1	510	4		B	E26AA			3256	B B13	
1	520	7	E24	LCA	HXXX &003	C	1	3260	L G62 G#9	
1	530	7	E26AB	SBR	0089	0004	1	3267	H 089 0#4	
1	540	4		B	E26AA			3274	B B13	
1	550	7	E26	LCA	BXXX &003	C	1	3278	L G66 G#9	
1	560	7		MCW	0094	FX		3285	M 094 &21	
1	570	7		MCW	TA &019	0089		3292	M G88 089	
1	580	7		MCW	TA &023	0094		3299	M G92 094	
1	590	8		B	EXCUTE	AFAD		3306	B F98 G51	
1	600	7		SBR	TXY1 &003	TABLE1		3314	H C24 C64	
1	610	7	TXY1	MCW	TABLE1	LOOK2 &007		3321	M C64 C39	
1	620	4		SAR	TXY1 &003			3328	Q C24	
1	630	8	LOOK2	B	E60	A	F	3332	B I35 G05 F	
1	640	8		B	TEST2	LOOK2 &007	B	3340	B C65 C39 B	
1	650	4		B	TXY1			3348	B C21	
1	660	1		DCW	*		B	3352		
1	670	1		DCW	*		V	3353		
1	680	1		DCW	*		W	3354		
1	690	1	HALT	DCW	*		.	3355		
1	700	1		DCW	*		1	3356		
1	710	1		DCW	*		4	3357		

PG	LIN	CT	LABEL	OP	A OPERAND	B OPERAND	D	LOC	INSTRUCTION COMMENTS	MITR1
1	720	1		DCW	*		2	3358		
1	730	1		DCW	*		3	3359		
1	740	1		DCW	*		5	3360		
1	750	1		DCW	*		6	3361		
1	760	1		DCW	*		7	3362		
1	770	1		DCW	*		K	3363		
1	780	1	TABLE1	DCW	*		F	3364		
1	790	8	TEST2	B	E59	A	/	3365	B I27 G05 /	
1	800	4		B	EXCUTE			3373	B F98	
1	810	7	E62	MCW	FX	BREG		3377	M &21 G04	
1	820	7		MCW	AFAD	NOPX &003		3384	M G51 C94	
1	830	4	NOPX	NOP	0000			3391	N 000	
1	840	4		SBR	FX			3395	H &21	
1	850	7	E65	MCW	AFAD	TA &009		3399	M G51 G78	
1	860	8		B	XY	AFAD		3406	B D56 G51	
1	870	8		B	XY	AFAD -002	%	3414	B D56 G49 %	
1	880	7		MCW	AFAD	NOPY &003		3422	M G51 D32	
1	890	4	NOPY	NOP	0000			3429	N 000	
1	900	4		SBR	E66 &003			3433	H D48	
1	910	8		B	DONT	E66 &003	0	3437	B I46 D48 0	
1	920	7	E66	MCW	0000	TA &042		3445	M 000 H11	
1	930	4		MCW	AST			3452	M G68	
1	940	7	XY	MCW	BFAD	TA &013		3456	M G54 G82	
1	950	8		B	COMP	BFAD		3463	B E05 G54	
1	960	7		MCW	BFAD	NOPZ &003		3471	M G54 D81	
1	970	4	NOPZ	NOP	0000			3478	N 000	
1	980	4		SBR	E67 &003			3482	H D97	
1	990	8		B	DONT2	E67 &003	0	3486	B I70 D97 0	
2	000	7	E67	MCW	0000	TA &057		3494	M 000 H26	
2	010	4		MCW	AST			3501	M G68	
2	020	7	COMP	MCW	0260	STORE2		3505	M 260 G67	
2	030	7		MCW	RM	0260		3512	M F96 260	
2	040	7		MCW	0089	AFAD		3519	M 089 G51	
2	050	7		SBR	0089	0201		3526	H 089 201	
2	060	7	CHA	MCM	0000 1	WR -201 1		3533	P 0+0 DT6	
2	070	4		SAR	0089			3540	Q 089	

PG	LIN	CT	LABEL	OP	A OPERAND	B OPERAND	D	LOC	INSTRUCTION COMMENTS MITR1
2	080	8		B	DONE	0088	6	3544	B E56 088 6
2	090	4		B	CHA			3552	B E33
2	100	7	DONE	SBR	0089	0201		3556	H 089 201
2	110	7	CHAR	MCM	TA -201 1	0000 1		3563	P EW8 0≠0
2	120	4		SBR	0089			3570	H 089
2	130	8		B	DONE3	0088	6	3574	B E86 088 6
2	140	4		B	CHAR			3582	B E63
2	150	2	DONE3	CC			S	3586	F S
2	160	1		W				3588	2
2	170	7		SBR	0089	0201 -		3589	H 089 201
2	180	7	CHARL	MCM	WR -201 1	0000 1		3596	P DT6 0≠0
2	190	4		SBR	0089			3603	H 089
2	200	8		B	DONE6	0088	6	3607	B F19 088 6
2	210	4		B	CHARL			3615	B E96
2	220	7	DONE6	MCW	STORE2	0260		3619	M G67 260
2	230	7		MCW	AFAD	0089		3626	M G51 089
2	240	4		B	E2			3633	B &22
2	250	1	WR	DCW	*			3637	
2	260	29		DC	*			3666	
2	270	29		DC	*			3695	
2	280	1	RM	DCW	*		≠	3696	
2	290	1	BLANKS	DCW	*			3697	
2	300	1	EXCUTE	DCW	*		N	3698	
2	310	3	AREG	DC	*		000	3701	
2	320	3	BREG	DC	*		000	3704	
2	330	1	A	DCW	*			3705	
2	340	1	B	DC	*			3706	
2	350	3	C	DC	*			3709	
2	360	3	F8X	DC	*			3712	
2	370	1	D	DC	*			3713	
2	380	4		DC	*			3717	
2	390	30	ENDEX	DC	*			3747	
2	400	1	TOP	DCW	*			3748	
2	410	3	AFAD	DCW	*			3751	
2	420	3	BFAD	DCW	*			3754	
2	430	4	QXXX	SAR	AREG			3755	Q G01

PG	LIN	CT	LABEL	OP	A OPERAND	B OPERAND	D	LOC	INSTRUCTION COMMENTS	MITR1
2	440	4	HXXX	SBR	BREG			3759	H G04	
2	450	4	BXXX	B	E65			3763	B C99	
2	460	1	STORE2	DCW	*			3767		
2	470	1	AST	DCW	*		*	3768		
2	480	1	TA	DCW	*			3769		
2	490	14		DC	*			3783		
2	500	2		DCW	*			3785		
2	510	4		DCW	*			3789		
2	520	4		DCW	*			3793		
2	530	4		DCW	*			3797		
2	540	15		DCW	*			3812		
2	550	15		DCW	*			3827		
2	560	1		DCW	*		≠	3828		
2	570	7	TEST	SBR	TXY &003	TABLE		3829	H H39 H90	
2	580	7	TXY	MCW	TABLE	LOOK1 &007		3836	M H90 H54	
2	590	4		SAR	TXY &003			3843	Q H39	
2	600	8	LOOK1	B	E22A34	TOP	A	3847	B H91 G48 A	
2	610	8		B	WW	LOOK1 &007	C	3855	B A91 H54 C	
2	620	4		B	TXY			3863	B H36	
2	630	1	CH	DCW	*		C	3867		
2	640	1		DCW	*		X	3868		
2	650	1		DCW	*		W	3869		
2	660	1		DCW	*		%	3870		
2	670	1		DCW	*		Q	3871		
2	680	1		DCW	*		H	3872		
2	690	1		DCW	*		Z	3873		
2	700	1		DCW	*		@	3874		
2	710	1		DCW	*		P	3875		
2	720	1		DCW	*		D	3876		
2	730	1		DCW	*		Y	3877		
2	740	1		DCW	*		,	3878		
2	750	1		DCW	*		□	3879		
2	760	1		DCW	*		-	3880		
2	770	1		DCW	*		&	3881		
2	780	1		DCW	*		L	3882		
2	790	1		DCW	*		M	3883		

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PG LIN  CT  LABEL    OP    A OPERAND          B OPERAND          D     LOC   INSTRUCTION COMMENTS    MITR1
 2 800   1          DCW   *                                     /    3884
 2 810   1          DCW   *                                     #    3885
 2 820   1          DCW   *                                     E    3886
 2 830   1          DCW   *                                     V    3887
 2 840   1          DCW   *                                     B    3888
 2 850   1          DCW   *                                     S    3889
 2 860   1  TABLE   DCW   *                                     A    3890
 2 870   7  E22A34  MCW   CH                 TA    &003               3891  M H67 G72
 2 880   7          LCA   TOP                B          1            3898  L G48 G≠6
 2 890   7          SBR   0089               0001       1            3905  H 089 0≠1
 2 900   4          B     E22A                                       3912  B A69
 2 910   7  E22A45  LCA   QXXX  &003        C          1            3916  L G58 G≠9
 2 920   4          B     E26AB                                      3923  B B67
 2 930   8  E59     B     EXCUTE             BFAD                    3927  B F98 G54
 2 940   7  E60     SBR   F8X   -004        E62                     3935  H G08 C77
 2 950   4          B     EXCUTE                                     3942  B F98
 2 960   8  DONT    B     DONT1              E66   &002         0    3946  B I58 D47 0
 2 970   4          B     E66                                        3954  B D45
 2 980   8  DONT1   B     XY                 E66   &001         0    3958  B D56 D46 0
 2 990   4          B     E66                                        3966  B D45
 3 000   8  DONT2   B     DONT3              E67   &002         0    3970  B I82 D96 0
 3 010   4          B     E67                                        3978  B D94
 3 020   8  DONT3   B     COMP               E67   &001         0    3982  B E05 D95 0
 3 030   4          B     E67                                        3990  B D94
 3 040   3  I9F     DCW   *                                   I9F  3996
 3 050   3  I9I     DCW   *                                   I9I  3999
 3 060              END   E2                                         /  &22 080

          204 CARDS
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