

IDENTIFICATION

PRODUCT CODE: MAINDEC 12-DØBA

PRODUCT NAME: INSTRUCTION TEST PART I

DATE CREATED: OCTOBER 1, 1969

MAINTAINER: DIAGNOSTIC GROUP

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1. ABSTRACT

Instruction Test Part I is a maintenance program designed as a confidence check of most of the L mode instructions available on the PDP-12. All operations with the exception of relays, display, A-D conversion, and tape instructions are checked in a variety of configurations. The program runs continuously, stopping only in the event of an error; it will ring the teletype bell once every 4096 passes.

2. REQUIREMENTS

2.1 Equipment

- a. Any PDP-12 computer.
- b. ASR-33 Teletype or equivalent.

2.2 Preliminary Programs

All 8 mode memory diagnostics must have been successfully run prior to attempting to check the L mode instructions.

3. LOADING PROCEDURES

3.1 Method

This program must be loaded with the binary loader. If you are unfamiliar with the proper binary loading procedures refer to "Appendix A" of this program, otherwise proceed with the following:

- a) Set the teletype reader switch to FREE.
- b) Open the teletype reader and insert the program tape so that the arrows on the tape are visible to and pointing toward the operator.
- c) Close the reader and set the reader switch to START.
- d) Set the teletype front panel switch to ON LINE.
- e) Set the LEFT switches to 7777.
- f) Set the RIGHT switches to 4000.
- g) Set the MODE switch to 8 mode.
- h) Depress I/O preset.
- i) Depress START LS.
- j) When the program tape has been read the ACCUMULATOR must be 0000; if it is not, a read-in error has occurred and one might try reloading the binary loader.
- k) Remove the program tape from the reader.

4. STARTING PROCEDURE

4.1 Starting Address

- a. Set the LEFT and RIGHT switches to 7777, SENSE switches to 77.
- b. Set the MODE switch to L MODE.
- c. Depress I/O PRESET.
- d. Depress START 20.
- e. The program will halt at address 4022.
The AC must = 0000; if not, it is a hardware error and must be corrected.
- f. Depress CONTINUE.

5. ERRORS

The program is initialized to perform various operations with the number 0001 as the argument. When the program cycle is complete, the number is incremented and the test resumes. When the number being tested is = 7777, it is reset to 0001. The computer will halt on an error. Consult program listing for an explanation of each halt. Depress continue to continue testing.

When properly running, the AC and MB will appear to be counting up at a high rate; the teletype bell will ring once every 8 seconds. If these conditions do not exist, manually examine the program in core for proper loading, correct the error, or reload the program, and single step it while monitoring the IR and MA; this should give an indication of any problem areas that may exist.

/INSTRUCTION TEST PART I PDP-12 MAINDEC 12-D0BA-L-(D)
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 /PDP-12 INSTRUCTION DEFINITIONS (PARTIAL)

/MISCELLANEOUS

0000	HLT=0000	/HALT
0002	PDP=0002	/CHANGE TO PDP-8 MODE
6141	LINC=6141	/CHANGE TO LINC MODE
0005	QAC=0005	/Z1 TO A[-J](11 BITS) I EQUALS 1 TO 11
0011	CLR=0011	/CLEAR ACCUMULATOR LINK, AND Z REGISTER
0014	ATR=0014	/(A6-A11)>R REGISTER
0015	RTA=0015	/R REGISTER>(A6-A11)
0016	NOP=0016	/NO OPERATION
0017	COM=0017	/C(AC)>C(A)
0040	SET=0040	/C(P+1)>BETA REGISTER (OR INDIRECT)
0200	XSK=0200	/SKIP ON 1777
/SHIFT		
0240	ROL=0240	/ROTATE LEFT
0300	ROR=0300	/ROTATE RIGHT ALSO SHIFT RIGHT INTO MQ REGISTER
0340	SCR=0340	/SCALE RIGHT ALSO SHIFT RIGHT INTO MQ REGISTER
/SKIP		
0400	SXL=0400	/SKIP IF EXTERNAL LEVEL IS -3
0415	KST=0415	/SKIP IS KEY HAS BEEN STRUCK
0440	SNS=0440	/SKIP IS SENSE SWITCH IS UP
0456	SKP=0456	/SKIP UNCONDITIONALLY
0450	AZE=0450	/SKIP IF ACCUMULATOR ZERO
0451	AP0=0451	/SKIP IS ACCUMULATOR POSITIVE
0452	LZE=0452	/SKIP IF LINK ZERO
0454	FLO=0454	/SKIP IF ADD OVERFLOW FLAG IS SET
0455	QLZ=0455	/SKIP IS BIT 11 OF MQ REGISTER IS 0
/OPERATE		
0500	IOB=0500	/EXECUTE THE FOLLOWING IOT INSTRUCTION IN PDP-8 MODE
0517	LSW=0517	/READ THE CONTENTS OF THE LEFT SWITCHES INTO THE AC
0516	RSW=0516	/READ THE CONTENTS OF THE RIGHT SWITCHES INTO THE AC
/ARITHMETIC		
1000	LDA=1000	/LOAD ACCUMULATOR
1040	STA=1040	/STORE CONTENTS OF ACCUMULATOR
1100	ADA=1100	/ADD TO CONTENTS OF ACCUMULATOR
1140	ADM=1140	/ADD TO CONTENTS OF MEMORY REGISTER
1200	LAM=1200	/ADD CONTENTS OF LINK AND ACCUMULATOR
		/TO CONTENTS OF MEMORY REGISTER
1240	MUL=1240	/MULTIPLY

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    /HALF WORD OPERATIONS
1300 LDH=1300 /TRANSFER HALF WORD FROM MEMORY INTO
           /THE RIGHT HALF OF ACCUMULATOR
1340 STH=1340 /TRANSFER THE HALF WORD FROM THE RIGHT
           /SIDE OF ACCUMULATOR REGISTER INTO THE
           /DESIGNED HALF OF A MEMORY REGISTER
1400 SHD=1400 /SKIP IF THE HALF WORD IN ACCUMULATOR
           /REGISTER AND THE MEMORY REGISTER DIFFER

    /MEMORY REFERENCE OPERATIONS
1440 SAE=1440 /SKIP IF THE CONTENTS OF THE ACCUMULATOR
           /EQUAL THE CONTENTS OF THE DESIGNATED
           /MEMORY REGISTER
1500 SRO=1500 /SKIP IF THE RIGHTMOST BIT IN THE
           /DESIGNATED MEMORY REGISTER IS 0;
           /AFTER TESTING, ROTATE THE CONTENTS
           /ONE PLACE TO THE RIGHT.
1540 BCL=1540 /FOR EACH BIT POSITION OF MEMORY REGISTER
           /Y THAT CONTAINS A 1, CLEAR THE
           /CORRESPONDING BIT POSITION OF THE
           /ACCUMULATOR (LOGICAL AND)
1600 BSE=1600 /FOR EACH BIT POSITION OF MEMORY
           /REGISTER Y THAT CONTAINS A 1, SET THE
           /CORRESPONDING BIT POSITION OF THE ACCUMULATOR
           / (INCLUSIVE OR)
1640 BCO=1640 /FOR EACH BIT POSITION OF MEMORY
           /REGISTER Y THAT CONTAINS A 1, COMPLEMENT
           /THE CORRESPONDING BIT POSITION OF THE
           /ACCUMULATOR (EXCLUSIVE OR)
0020 I=0020 /I BIT ADDRESS REFERENCE

    /FULL ADDRESS
2000 ADD=2000 /ADD THE CONTENTS OF THE DESIGNATED
           /MEMORY REGISTER TO ACCUMULATOR
4000 STC=4000 /STORE THE CONTENTS OF ACCUMULATOR
           /IN THE DESIGNATED MEMORY REGISTER
           /THEN CLEAR ACCUMULATOR
6000 JMP=6000 /JUMP TO ANOTHER DESIGNATED MEMORY
           /REGISTER FOR THE NEXT INSTRUCTION;

    /INPUT - OUTPUT
6046 TLS=6046 /LOAD PRINTER/PUNCH BUFFER,
           /PRINT, CLEAR FLAG
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/THIS TEST IS DESIGNED AS A QUICK CONFIDENCE CHECK
 /OF MOST OF THE PDP-12 L MODE INSTRUCTIONS.
 /SET LEFT AND RIGHT SWITCHES TO ONE'S, SENSE SWITCHES TO ONE'S,
 /I/O PRESET L MODE, START 20
 /PROGRAM WILL HALT AT REL 0022; AC MUST = 0
 /THIS TEST WILL RUN IN ANY 1K MEMORY SEGMENT

4001 4001
 4002 0001
 4003 0000
 4004 0000
 4005 0000
 4006 0000
 4007 0000
 4010 0010
 4011 0000
 4012 0000
 4013 0000
 0004
 0006
 0010
 0012
 0013

*4001
 0001
 0001
 0000
 0000
 0000
 0000
 0010
 0000
 0000
 0000
 B=0004
 B2=0006
 NUM=0010
 TEM=0012
 CNT=0013

/TAGS AND INITIAL CONSTANTS CALLED
 /THIS WAY TO AVOID ADDRESSING PROBLEMS.
 /B REG
 /B2 REG
 /NUM REG
 /TEM REG
 /CNT REG

```

      4020      *4020
4020 0011 S1,   CLR
4021 0013      STC      CNT
4022 0000      HLT
4023 0064 S2,   SET I   B
4024 0010      NUM
4025 0066      SET I   B2
4026 0012      TEM
4027 0070      SET I   NUM
4030 0001      0001
      /MAJOR RESTART FROM END OF PASS
4031 1020 LS1,  LDA      I
4032 0000      HLT
4033 1460      SAE      I
4034 0000      HLT
4035 0000      HLT
4036 1004      LDA      B
4037 1444      SAE      B
4040 0000      HLT
4041 1444      SAE      B
4042 0000      HLT
4043 1046      STA      B2
4044 1444      SAE      B
4045 0000      HLT
4046 1446      SAE      B2
4047 0000      HLT
4050 0470 LS2,  AZE      I
4051 0000      HLT
4052 0017      COM
4053 0470      AZE      I
4054 0000      HLT
4055 0017      COM
4056 1446      SAE      B2
4057 0000      HLT
4060 0451      APO
4061 0017      COM
4062 0451      APO
4063 0000      HLT
4064 0011      CLR
4065 0450      AZE
4066 0000      HLT
4067 0017      COM
4070 0450      AZE
4071 0000      HLT
4072 0471      APO      I
4073 0000      HLT
4074 0011 LS3,  CLR
4075 0452      LZE
4076 0000      HLT
4077 1444      SAE      B
4100 0452      LZE
4101 0000      HLT
4102 0471      APO      I
4103 0452      LZE
4104 0000      HLT

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/MAJOR START L MODE 4020

/SET COUNTER = 0

/LEGAL HALT, AC=0'S

/INITIALIZE B

/(B)=10

/INITIALIZE B2

/(B2)=0

/NUMBER TO BE TESTED

/(NUM)=1

/MAJOR RESTART FROM END OF PASS

/TEST MODE OF

/INDEX, LDA, LOAD AC

/WITH HLT, DOES AC

/CONTAIN HLT?

/LDA I OR SAE I FAILED

/SET (AC) = (B)

/SHOULD SKIP

/LDA, SAE FAILED

/TRY IT AGAIN

/SAE MODIFIED AC

/STORE IN C(B2);

/STA MODIFIED AC

/CHECK STA

/STA FAILED

/AC = B

/AZE I FAILED

/THE NUMBERS + & = 0 ARE NEVER USED

/

/AZE I FAILED OR COM FAILED

/

/AZE, MODIFIED AC OR COM FAILED

/SHOULD SKIP

/COMP IF NEG (APO FAILED)

/SHOULD SKIP

/APO FAILED

/AZE FAILED

/AZE FAILED

/APO I FAILED

/CLEAR AC, LINK

/CLR OR LZE FAILED

/AC = 0, B + 0

/SAE SKIPPED IN ERROR

/AC IS POSITIVE

/APO SKIPPED IN ERROR

4105	0011	LS4,	CLR		/CLEAR AC, LINK
4106	1024		LDA	B	
4107	0017		COM		/COMP AC
4110	1444		SAE	B	
4111	0452		LZE		
4112	0000		HLT		/COM, SAE FAILED
4113	0017		COM		
4114	1444		SAE	B	
4115	0000		HLT		/COM OR SAE FAILED
4116	0016		NOP		
4117	1444		SAE	B	
4120	0000		HLT		/NOP SKIPPED IN ERROR OR CHANGED AC
4121	0452		LZE		
4122	0000		HLT		/NOP CHANGED LINK
4123	1004	SC1,	LDA	B	/NUMBER TO AC
4124	0240		ROL		/ROTATE NO PLACES
4125	1444		SAE	B	/CHECK THE NUMBER
4126	0000		HLT		/ROL ROTATED IN ERROR
4127	0254		ROL	14	/ROTATE 12 PLACES
4130	1444		SAE	B	/GIVES SAME NUMBER
4131	0000		HLT		/ROL FAILED
4132	0011	SC2,	CLR		/CLEAR AC AND LINK
4133	1004		LDA	B	/LOAD NUMBER
4134	0300		ROR		/ROTATE NO PLACES
4135	1444		SAE	B	/NUMBER CHANGED?
4136	0000		HLT		/ROR ROTATED IN ERROR
4137	0314		ROR	14	/ROTATE 12 PLACES
4140	1444		SAE	B	/GIVES SAME NUMBER
4141	0000		HLT		/ROR FAILED
4142	0452		LZE		/LINK WAS CLEARED AT SC2
4143	0000		HLT		/ROTATE SET LINK IN ERROR
4144	0011	SC3,	CLR		/CLEAR AC
4145	0017		COM		/COMP AC
4146	0261		ROL I	1	/SET THE LINK
4147	1004		LDA	B	/GET NUMBER
4150	0317		ROR	17	/GO LEFT AND
4151	0257		ROL	17	/RIGHT ON EQUAL
4152	1444		SAE	B	/NUMBER OF PLACES
4153	0000		HLT		/ROL, ROR FAILED
4154	0472		LZE	I	/TEST LINK
4155	0000		HLT		/LZE, CLR, ETC
4156	0011	SC4,	CLR		/CLEAR AC AND LINK
4157	1004		LDA	B	/LOAD AC
4160	0335		ROR I	15	
4161	1444		SAE	B	/ROTATE 13 DECIMAL
4162	0000		HLT		/TIMES
4163	0452		LZE		/LINK MODIFIED?
4164	0000		HLT		/ROR 13 SET LINK IN ERROR
4165	1004	SC5,	LDA	B	/LOAD AC
4166	0275		ROL I	15	
4167	1444		SAE	B	/ROTATE 13 GIVES SAME NUMBER
4170	0000		HLT		/ROL I 13 CHANGED AC

4171	1204	SC6,	LDA	B	/LOAD AC
4172	0354		SCR	14	/SCALE RIGHT; THIS SHOULD
4173	0450		AZE		/EXTEND THE SIGN
4174	0220		HLT		/AC = +/-0 IN ERROR
4175	1204		LDA	B	
4176	0017		COM		/LOAD COMP
4177	0354		SCR	14	/AC SHOULD EQUAL
4200	0450		AZE		/+/- ZERO
4201	0000		HLT		/NOT = +/-ZERO
4202	1204	SC7,	LDA	B	
4203	0261		ROL I	1	/HIGH ORDER BIT TO AC
4204	1204		LDA	B	/SIMULATE SCALE
4205	0321		ROR I	1	/VIA ROR, ROL
4206	1046		STA	B2	/SAVE IN TEMPORARY REGISTER
4207	0011		CLR		/CLEAR LINK
4210	1204		LDA	B	
4211	0341		SCR	1	/SCALE RIGHT
4212	1446		SAE	B2	/CHECK WITH SIMULATE
4213	0000		HLT		/SCR FAILED
4214	0452		LZE		/CONTENTS OF LINK
4215	0000		HLT		/MODIFIED
4216	1204	SC8,	LDA	B	
4217	1046		STA	B2	/STORE IN TEMPORARY
4220	1506		SRO	B2	/ROTATE TEMPORARY
4221	0016		NOP		
4222	0301		ROR	1	/ROTATE AC
4223	1446		SAE	B2	/C(Y) C(AC) SHOULD BE THE SAME
4224	0000		HLT		/SRO CHANGED C(Y) OR C(AC)
4225	1204	SC9,	LDA	B	
4226	1046		STA	B2	/STORE IN TEMPORARY
4227	0301		ROR	1	/ROTATE RIGHT MOST
4230	1506		SRO	B2	/TO AC SIGN, SRO,
4231	0017		COM		/SKIP IF SIGN ZERO
4232	0451		APO		/TEST THE BIT
4233	0000		HLT		/SRO CHANGED SIGN
4234	1204	SCA,	LDA	B	/TEST SCR I 1
4235	1046		STA	B2	/WILL THE LAST
4236	0361		SCR I	1	/BIT GO TO
4237	1506		SRO	B2	/THE LINK?
4240	6244		JMP	,+4	/USE SRO TO
4241	0452		LZE		/FIND THE LAST
4242	0000		HLT		/BIT & SCR I
4243	6246		JMP	,+3	
4244	0472		LZE	I	/SRO SAYS BIT A
4245	0000		HLT		/ONE SCR I
4246	1204	AAI,	LDA	B	/ADD VALUES THE
4247	0017		COM		/RESULT SHOULD EQUAL ZERO
4250	1100		ADA		/
4251	0010		NUM		
4252	0450		AZE		
4253	0000		HLT		/ADA FAILED

4254	0011	AA2,	CLR			
4255	0017		COM			/SET TO ALL ONES
4256	1104		ADA	B		
4257	1444		SAE	B		/CHECK END CARRY
4260	0000		HLT			/END CARRY FAILED
4261	0011	AA3,	CLR			/CLEAR AC AND LINK
4262	0017		COM			
4263	1104		ADA	B		
4264	1104		ADA	B		/MULTIPLY VIA ADD
4265	0301		ROR	1		/DIVIDE BY 2, VIA ROR
4266	1444		SAE	B		
4267	0000		HLT			/ADDITION FAILED
4270	1004	AA4,	LDA	B		
4271	1120		ADA	I		
4272	7777		7777			/AC = -ZERO
4273	1444		SAE	B		
4274	0000		HLT			/ADDITION OF -0 FAILED
4275	1004	AA5,	LDA	B		/USE ADD AND ADA
4276	2306		ROR	6		/ADD ALL THE NUMBERS
4277	2010		ADD	NUM		/C(B) = NUM
4300	0017		COM			
4301	1104		ADA	B		
4302	0246		ROL	6		
4303	0017		COM			
4304	1444		SAE	B		
4305	0000		HLT			/ADDITION, ADD OR ADA
4306	0452	AA6,	LZE			/LINK SET, SEE
4307	0000		HLT			/AA3 TO AA6
4310	4012		STC	TEM		/STORE RESULT IN TEM
4311	0450		AZE			
4312	0000		HLT			/STC FAILED TO CLEAR AC
4313	1006		LDA	B2		/C(B2) = TEM
4314	1444		SAE	B		/
4315	0000		HLT			/STC FAILED TO STORE
4316	1004	AA7,	LDA	B		/PUT NUMBER IN
4317	1046		STA	B2		/AC AND C(TEM)
4320	1146		ADM	B2		/ADD TO MEM AND AC
4321	0301		ROR	1		
4322	1444		SAE	B		/IS AC CORRECT
4323	0000		HLT			/ADM FAILED
4324	0241		ROL	1		/IS MEMORY SAME AS AC
4325	1446		SAE	B2		/
4326	0000		HLT			/ADM FAILED
4327	0452		LZE			
4330	0000		HLT			/SEE AA6, AA7
4331	0011	AA8,	CLR			/CLEAR AC, LINK
4332	1046		STA	B2		/CLEAR TEMPORARY
4333	1004		LDA	B		/LOAD NUMBER
4334	1046		LAM	B2		/AC + (-0) = AC
4335	1444		SAE	B		/LINK WAS ZERO
4336	0000		HLT			/LAM CHANGED AC IN ERROR
4337	0452		LZE			/LINK SHOULD BE CLEAR
4340	0000		HLT			/LAM SET LINK
4341	0011		CLR			
4342	1046		STA	B2		/CLEAR AC, LINK, TEMPORARY

4343	0017	COM	/SET AC
4344	2261	ROL I 1	/SET LINK =1, AC =7776
4345	1276	LAM 82	/AC = 7777
4346	0452	LZE	
4347	0200	HLT	/0 TO LINK, LAM FAILED
4350	0450	AZE	
4351	0000	HLT	/+1 AC, LAM FAILED

4352	2211	AA9,	CLR		/CLEAR LINK
4353	4362		STC	.+7	
4354	1224		LDA	B	/TEST LAM
4355	4212		STC	TEM	/STORE IN TEMPORARY
4356	1226		LAM	B2	
4357	1446		SAE	B2	
4360	2220		HLT		/AC+C(Y); LAM FAILED
4361	1222		LAM	I	
4362	2220		0		/ADD IN THE LINK
4363	2216		NOP		
4364	1444		SAE	B	
4365	2220		HLT		/LAM FAILED
4366	1224	BT,	LDA	B	/LOAD AC
4367	1544		BCL	B	/CLEAR SELECTED BITS
4370	2450		AZE		/BCL FAILED TO CLEAR
4371	2220		HLT		
4372	1224		LDA	B	
4373	2217		COM		
4374	1544		BCL	B	
4375	2217		COM		/BITS OTHER THAN
4376	1444		SAE	B	/SELECTED BITS CLEARED?
4377	2220		HLT		/BCL CLEARED IN ERROR
4400	1224	BT1,	LDA	B	
4401	2306		ROR	6	
4422	1644		BCO	B	/COMP BITS
4423	1644		BCO	B	/RE COMP BITS
4424	2246		ROL	6	
4425	1444		SAE	B	
4426	2300		HLT		/BCO FAILED
4427	1224	BT2,	LDA	B	
4410	1620		BSE	I	/SET NO BITS
4411	2220		0		
4412	1444		SAE	B	
4413	2220		HLT		/BSE SET BITS IN ERROR
4414	1620		BSE	I	/SET ALL BITS
4415	7777		7777		
4416	1124		ADA	B	/-0 + C(B) = C(B)
4417	1444		SAE	B	
4420	2220		HLT		/BSE FAILED TO SET BITS
4421	2211		CLR		
4422	1624		BSE	B	
4423	1444		SAE	B	
4424	2220		HLT		/BSE FAILED
4425	2211	BT3,	CLR		
4426	1644		BCO	B	/LOAD VIA COMP
4427	2217		COM		/COMP
4430	1644		BCO	B	/COMP THE ZERO
4431	2450		AZE		
4432	2220		HLT		/BCO FAILED
4433	1644		BCO	B	/ONES TO ZEROS
4434	2217		COM		/COMP
4435	1444		SAE	B	
4436	2220		HLT		/BCO FAILED

4437	0011	HW1,	CLR		
4440	1046		STA	B2	/CLEAR TEMPORARY
4441	1020		LDA	I	
4442	4011		TEM-1+4000		
4443	4006		STC	B2	/FULL ADDRESS TORE
4444	1004		LDA	B	/NUMER TO AC
4445	0306		ROR	6	
4446	1366		STH 20	B2	/PUT IN LEFT HALF
4447	0306		ROR	6	
4450	1366		STH 20	B2	/PUT IN RIGHT HALF
4451	1444		SAE	B	
4452	0000		HLT		/STH MODIFIED AC
4453	1446		SAE	B2	
4454	0000		HLT		/STH, STORED INCORRECTLY
4455	0011	HW2,	CLR		
4456	0017		COM		
4457	1306		LDH	B2	/TEST LDH, RIGHT HALF
4460	0451		APD		
4461	0000		HLT		/LEFT AC NOT CLEAR
4462	1406		SHD	B2	
4463	0451		APD		
4464	0000		HLT		/SHD, RIGHT HALF
4465	0017		COM		
4466	1406		SHD	B2	/LINK SHOULD BE ZERO
4467	0000		HLT		/SHD, SKIPPED
4470	0011	HW3,	CLR		
4471	1420		SHD	I	/SKP HALF DIFFERENT
4472	7700		7700		
4473	0000		HLT		/SHD FAILED TO SKIP
4474	1004		LDA	B	
4475	1046		STA	B2	/C(B) TO C(B2), IE TEM
4476	1020		LDA	I	
4477	4011		TEM-1+4000		
4500	4006		STC	B2	
4501	0450		AZE		
4502	0000		HLT		/STC SCALE!
4503	1004		LDA	B	
4504	0306		ROR	6	
4505	1426		SHD I	B2	/INCREMENT
4506	0452		LZE		
4507	0000		HLT		/SHD I SKIPPED IN ERROR
4510	1406		SHD	B2	/NO INCREMENT
4511	0452		LZE		
4512	0000		HLT		/SHD FAILED TO SKIP
4513	0306		ROR	6	
4514	1426		SHD I	B2	
4515	0452		LZE		
4516	0000		HLT		/SHD I SKIPPED IN ERROR
4517	1406		SHD	B2	
4520	0452		LZE		
4521	0000		HLT		/NO INCREMENT SHD
4522	1444		SAE	B	
4523	0000		HLT		/GOOD GRIEF, AGAIN!
4524	0011	HW4,	CLR		
4525	1420		SHD	I	

/INSTRUCTION TEST PART I POP-12 MAINDEC 12-00

PAL10

V141

18-NOV-69

2148

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4526	2077	0077	
4527	2452	LZE	
4530	0000	HLT	
4531	1004	LDA	B
4532	2326	ROR	6
4533	1400	SHD	
4534	0012	TEM	
4535	0452	LZE	
4536	0000	HLT	

/SHD I

/SHD

4537	1004	ST,	LDA	B	/TEST SET
4540	0017		COM		
4541	0046		SET	B2	
4542	0004		B		
4543	0017		COM		
4544	1444		SAE	B	
4545	0000		HLT		/SET DIDN'T WORK
4546	0011		CLR		
4547	2004		ADD	B	/SET MODIFIED AC
4550	1440		SAE		
4551	0006		B2		
4552	0000		HLT		/SET FAILED
4553	1004		LDA	B	
4554	4556		STC	,+2	
4555	0066		SET I	B2	
4556	0000		?		
4557	0450		AZE		
4560	0000		HLT		/AC MODIFIED, SET
4561	1000		LDA		
4562	0006		B2		
4563	1444		SAE	B	
4564	0000		HLT		/SET I FAILED
4565	1004	XS1,	LDA	B	
4566	4006		STC	B2	/STORE IN B2
4567	0206		XSK	B2	
4570	0016		NOP		
4571	0450		AZE		
4572	0000		HLT		/AAC ALTERED, XSK
4573	1000		LDA		
4574	0006		B2		
4575	1444		SAE	B	
4576	0000		HLT		
4577	0066		SET I	B2	/TEST FOR NOT INCREMENT
4600	0012		TEM		

4601	1004	XS2,	LDA	B	
4622	1046		STA	B2	/CONSTANT+1
4623	2002		ADD	2	
4624	0232		XSK I	TEM	
4625	1446		SAE	B2	
4626	6610		JMP	,+2	
4627	6614		JMP	,+5	
4610	0242		RCL	2	
4611	0342		SCR	2	
4612	0450		AZE		
4613	0000		HLT		/XSK, INCREMENT
4614	0066		SET I	B2	
4615	1777		1777		
4616	0011		CLR		/CLEAR LINK
4617	0206		XSK	B2	
4620	0000		HLT		/XSK
4621	0066		SET I	B2	
4622	1776		1776		
4623	0226		XSK I	B2	
4624	0000		HLT		/XSK
4625	0226		XSK I	B2	
4626	0452		LZE		
4627	0000		HLT		/XSK
4630	0450		AZE		
4631	0000		HLT		/AC MODIFIED
4632	0011		CLR		
4633	0017		COM		
4634	4006		STC	B2	
4635	0226		XSK I	B2	
4636	0016		NOP		
4637	2006		ADD	B2	
4640	1460		SAE	I	
4641	6000		6000		
4642	0200		HLT		/XSK I FAILED
4643	0066		SET I	B2	
4644	0010		10		

4645	1204	MSA,	LDA	B	
4646	0306		ROR	6	
4647	1644		BCD	B	
4650	1040		STA		/STORE SIGNS
4651	0012		TEM		/IN TEM
4652	1644		BCD	B	/RESTORE AC
4653	0451		APD		/STORE OPERAND
4654	0017		COM		/AS + NUMBER
4655	4005		STC	B+1	
4656	1004		LDA	B	
4657	0451		APD		
4660	0017		COM		/STORE SECOND
4661	4673		STC	MSB+3	/OPERAND
4662	4006		STC	B2	/CLEAR AC
4663	4007		STC	B2+1	
4664	1020		LDA	I	
4665	3777		3777		
4666	4702		STC	MS	/COUNTER
4667	0011		CLR		
4670	2006	MSB,	ADD	B2	/MULTIPLY SUBROUTINE
4671	0321		ROR I	1	/SCALE RIGHT LINK IS ZERO
4672	1520		SRO	I	
4673	0000		0		/SECOND OPERAND
4674	2005		ADD	B+1	/ADD IV ,~1--
4675	4006		STC	B2	/STORE TEMPORARY RESULT
4676	2007		ADD	B2+1	
4677	0321		ROR I	1	/BRING IN LINK
4700	4007		STC	B2+1	
4701	1520		SRO	I	
4702	0000	MS,	0		
4703	6670		JMP	MSB	
4704	1000		LDA		
4705	0012		TEM		
4706	0374		SCR I	14	/SIGN TO LINK +/-1 TO AC
4707	2006		ADD	B2	
4710	0452		LZE		
4711	0017		COM		/IF SIGNS UNLIKE
4712	0016		NJP		
4713	4006		STC	B2	
4714	2007		ADD	B2+1	/TEM HAS SIGNS
4715	0452		LZE		/ANS IN B2
4716	0017		COM		/AND B2+1
4717	0301		ROR	1	
4720	4007		STC	B2+1	/END OF SIMULATE
4721	1004	MSD,	LDA	B	/ORIGINAL NUMBERS
4722	0306		ROR	6	/C(B) AND C(B)=6
4723	1244		MUL	B	/SIMULATE RESULTS
4724	1440		SAE		/B2 AND B2+1
4725	0007		B2+1		/MUL, INTEGER
4726	0000		HLT		/LOW ORDER PRODUCT WRONG
4727	0452		LZE		
4730	0017		COM		
4731	0451		APD		
4732	0000		HLT		/SIG LINK, MUL FAILED

4733	1224	MSE,	LDA	B	
4734	2326		ROR	6	/ORIGINAL NUMBERS
4735	1240		MUL		/C(B) NO C(B)=5
4736	4010		4000+10		/SIMULATE RESULTS
4737	1440		SAE		/B2 + B2+1
4740	2026		B2		
4741	2020		HLT		/MUL, FRACTIONAL FAILED
4742	2452		LZE		
4743	2017		COM		
4744	2451		APD		
4745	2020		HLT		/SIGN + LINK MUL FAILED
4746	1220	JM1,	LDA	I	/JMP 0 RETURN
4747	6020		JMP		
4750	5777		STC	1777	/JMP OUT AND BACK
4751	7777		JMP	1777	
4752	0064		SET I	B	/RESTORE POINTER
4753	0010		NUM		
4754	0066		SET I	B2	
4755	2007		NUM	-1	
4756	1004		LDA	B	
4757	1466		SAE I	B2	
4762	0000		HLT		/INDEX 1, B, MODE
4761	0066		SET I	B2	
4762	0012		TEM		
4763	1020	QL1,	LDA I		
4764	7777		7777		
4765	2314		ROR	14	/LOAD MQ TO ONE'S
4766	2455		QLZ		
4767	2456		SKP		
4770	0000		HLT		/QLZ MQ11=1 FAILED
4771	0475		QLZ I		
4772	0000		HLT		/QLZ I FAILED TO SKIP
4773	0011		CLR		
4774	2455		QLZ		
4775	0000		HLT		/QLZ FAILED MQ11=0
4776	0475		QLZ I		
4777	2456		SKP		
5000	0000		HLT		/QLZ I SKIPPED IN ERROR
5001	1220	QC1,	LDA I		
5002	7777		7777		
5003	0314		ROR	14	/LOAD MQ TO ONE'S
5004	1020		LDA I		
5005	0000		0000		/CLEAR AC
5006	0205		QAC		/MQ TO AC 1-11
5007	0451		APD		
5008	0000		HLT		/QAC LOADED AC0
5011	0011		CLR		/CLEAR MQ
5012	1020		LDA I		
5013	4000		4000		/SET AC0
5014	2005		QAC		/MQ TO AC 1-11
5015	0451		APD		
5016	0000		HLT		/QAC FAILED TO CLEAR AC0
5017	0017	SW1,	LSW		/READ THE LEFT SWITCHES
5020	1460		SAE	I	/EQUAL TO 7777?
5021	7777		7777		

5022	0000		HLT
5023	0516	Sw2,	RSW
5024	1462		SAE I
5025	7777		7777
5026	0000		HLT

/LSW FAILED
/READ THE RIGHT SWITCHES
/EQUAL TO 7777?
/RSW FAILED

5027	0440	SW3,	SNS	0	
5030	0441		HLT		/SW0 FAILED
5031	0441		SNS	1	
5032	0442		HLT		/SW1 FAILED
5033	0442		SNS	2	
5034	0442		HLT		/SW2 FAILED
5035	0443		SNS	3	
5036	0443		HLT		/SW3 FAILED
5037	0444		SNS	4	
5040	0444		HLT		/SW4 FAILED
5041	0445		SNS	5	
5042	0445		HLT		/SW5 FAILED
5043	0460	SW4,	SNS I	0	
5044	0456		SKP		
5045	0000		HLT		/SW0 SKIPPED IN ERROR
5046	0461		SNS I	1	
5047	0456		SKP		
5050	0000		HLT		/SW1 SKIPPED IN ERROR
5051	0462		SNS I	2	
5052	0456		SKP		
5053	0000		HLT		/SW2 SKIPPED IN ERROR
5054	0463		SNS I	3	
5055	0456		SKP		
5056	0000		HLT		/SW3 SKIPPED IN ERROR
5057	0464		SNS I	4	
5060	0456		SKP		
5061	0000		HLT		/SW4 SKIPPED IN ERROR
5062	0465		SNS I	5	
5063	0456		SKP		
5064	0000		HLT		/SW5 SKIPPED IN ERROR

5065	1001	F1,	LDA	1	/END OF TEST
5066	1144		ADD	B	/INCREMENT B
5067	1004		LDA	B	/TEST FOR LAST TEST VAL
5070	1460		SAE	I	
5071	7777		7777		
5072	6031		JMP	LS1	/KEEP GOING
5073	0450		APE		
5074	0000		HLT		/SAE I SKIPPED IN ERROR
5075	0070		SET I	NUM	/RESET POINTER-DON'T USE ZERO
5076	0001		0001		/CYCLE APPROXIMATELY 8 SECONDS
5077	1020		LDA	I	
5100	0207		0207		/BELL CODE
5101	0500		ICR		
5102	6046		TLS		/RING IT
5103	6031		JMP	LS1	

\$

0000
0100

0200
0300

0400
0500

0600
0700

1000
1100

1200
1300

1400
1500

1600
1700

2000
2100

2200
2300

2400
2500

2600
2700

3000
3100

3200
3300

3400
3500

3600
3700

4000	11111111	11111000	11111111	11111111	11111111	11111111	11111111	11111111
4100	11111111	11111111	11111111	11111111	11111111	11111111	11111111	11111111
4200	11111111	11111111	11111111	11111111	11111111	11111111	11111111	11111111
4300	11111111	11111111	11111111	11111111	11111111	11111111	11111111	11111111
4400	11111111	11111111	11111111	11111111	11111111	11111111	11111111	11111111
4500	11111111	11111111	11111111	11111111	11111111	11111111	11111111	11111111
4600	11111111	11111111	11111111	11111111	11111111	11111111	11111111	11111111
4700	11111111	11111111	11111111	11111111	11111111	11111111	11111111	11111111

5000	11111111	11111111	11111111	11111111	11111111	11111111	11111111	11111111
5100	11110000	00000000	00000000	00000000	00000000	00000000	00000000	00000000

5200
5300

5400
5500

5600
5700

6000
6100

6200
6300

6400
6500

6600
6700

7000
7100

7200
7300

7400
7500

7600
7700

AA2	4254	MSD	4721
AA3	4261	MSE	4733
AA4	4270	MUL	1240
AA5	4275	NOP	0016
AA6	4306	NUM	0010
AA7	4316	PDP	0002
AA8	4331	QAC	0005
AA9	4352	QC1	5001
AAI	4246	QL1	4763
ADA	1122	QLZ	0455
ADD	2002	ROL	0240
ADM	1142	ROR	0300
APC	2451	RSW	0516
ATR	0014	RTA	0015
AZE	2450	S1	4020
B	0004	S2	4023
B2	0006	SAE	1440
BCL	1540	SC1	4123
BCO	1640	SC2	4132
BSE	1600	SC3	4144
BT	4366	SC4	4156
BT1	4420	SC5	4165
BT2	4427	SC6	4171
BT3	4425	SC7	4202
CLR	0011	SC8	4216
CNT	0013	SC9	4225
COM	0017	SCA	4234
F1	5065	SCR	0340
FLO	2454	SET	0040
HLT	0000	SHD	1400
HW1	4437	SKP	0456
HW2	4455	SNS	0440
HW3	4470	SRO	1500
HW4	4524	ST	4537
I	0000	STA	1040
IOB	0500	STC	4000
JM1	4746	STH	1340
JMP	6000	SW1	5017
KST	0415	SW2	5023
LAM	1200	SW3	5027
LDA	1000	SW4	5043
LDH	1300	SXL	0400
LINC	6141	TEM	0012
LS1	4031	TLS	6046
LS2	4050	XS1	4565
LS3	4074	XS2	4601
LS4	4105	XSK	0200
LSW	0517		
LZE	2452		
MS	4702		
MSA	4645		
MSB	4672		

ERRORS DETECTED: 0
LINKS GENERATED: 0
RUN-TIME: 6 SECONDS
2K CORE USED