PDP-4 PROGRAM LIBRARY

(7-52-m)

NUMBER:	Digital-4-15A-M
NAME:	CONTEST II
AUTHOR:	J. M. Graetz
DATE:	1 May 1963
SPECS:	1730 registers: 6000-7727 (4k) 16000-17727 (8k)
	Tapes: AS (3 tapes) RIM, SA 7700 (4k) RIM, SA 17700 (8k) Low Funny Loader, SA 100
NEEDED:	RIM loader (Digital-4-2-I) Low RIM Puncher (in assembling) (Digital-4-11-U)
PURPOSE:	Maintenance program to test the instructions, memory, clock, program interrupt, and reader, punch and teleprinter.

CONTEST (for CONtinuous TEST) is designed to provide a running overall check of a PDP-4 in normal use. It will detect most of the things that may go wrong in executing instructions and will perform a quick checkerboard. For very rigorous testing of memory or I/O equipment, one of the programs listed at the end of this writeup should be used.

METHOD:

CONTEST is made up of a number of small programs, each designed to test one or a group of instructions. These programs are in the form of subroutines called from a dispatch table. Although certain instructions must in fact be working if CONTEST is to be loaded properly, only three are assumed to be operating correctly at the start of the test--hlt, dio, and dac. Starting with jmp, the full set of instructions is tested; at any point, only those previously checked out are assumed to be working. Thus the rotate test makes no use of the add instruction, which is not tested until later.

After all the instructions have been tested, a quick and dirty checkerboard is performed, testing memory up to but not including the space occupied by CONTEST. Each of four patterns is run once. Following checkerboard, the program interrupt and the reader, punch and teleprinter are tested, using the clock interrupt test. An interval of 90 seconds is counted; at 0, 30, and 60 seconds the sequence 1-377 is punched on tape, while the same sequence is being read from another tape; at 0 and 60 seconds a line of gobbledygook corresponding to the teletype codes 1-37 is printed. The whole program then starts over.

In the following discussion, all locations are given for the 4k version. Add 10000_8 to obtain 8k addresses.

CONTEST occupies upper memory as follows:

Instruction tests	6[illegible] to 7241
Clock Interrupt Test	7[illegible] to 7473
Checkerboard	75[illegible] to 7672
Dispatch Table	77[illegible] to 7727

Constants are stored beginning in location 74[illegible]. Some erasable storage at 5[illegible] is also used.

USAGE:

Under normal circumstances, CONTEST will run through the test programs as outlined above. The operator has control over the sequence and the device tests by using the AC switches.

ACS 0 up--repeat the currently running test
down--proceed to the next test in sequence

ACS 17 up--stop with AC = -0 at the end of the clock interrupt test.
down--repeat the whole program from the beginning.

ACS 1 up--do not read test tape during clock interrupt test
down--read the test tape

ACS 2 up--do not punch test tape
down--punch test tape

ACS 16 up--do not print test line
down--print test line

Operating instructions:

1. Read in CONTEST (RIM tape)
2. If I/O devices are to be tested, turn them on; place a loop of tape punched with the sequence 1-377 in the reader; return the teleprinter carriage.
3. Start at 7700 with the AC Switches set as desired.

The tests are logically independent; the program may begin anywhere merely by starting at the proper place in the dispatch table. These addresses are given below, in order as the tests are performed. The symbol associated with each dispatch address is that assigned to the first location of the subroutine. The instructions for which the test is responsible are given also.

Several of the instruction tests were written by Nancy Hurley and Gordon Bell. Gordon Bell also wrote the Clock Interrupt Test and adapted Checkerboard from Leo Gossell's program for the PDP-1.

[illegible]/		/[illegible]
7701/	[illegible]	/[illegible] jmp [illegible]
7702/	[illegible]	/opr [illegible]
7703/	[illegible]	/[illegible], [illegible]
7704/	[illegible]	/[illegible], [illegible], [illegible], [illegible]
7705/	[illegible]	/[illegible], dzm-dac-lac [illegible]
7706/	[illegible]	/dac [illegible]-5777
7707/	dact	/dac [illegible]-5777
7710/	lact	/lac 1-5777
7711/	noise	/cleared AC bits on [illegible]
7712/	rotate	/rar, ral, rtl, rtr
7713/	tand	/and
7714/	addtad	/add, tad
7715/	autoqk	/autoindexing registers 10-17
7716/	salt	/sal, sal 1
7717/	[illegible]	/xct
7720/	[illegible]	/[illegible]
7721/	[illegible]	/clock, program interrupt [illegible], reader, teleprinter

117201

To Assemble CONTEST:

There are three symbolic tapes. The [illegible] tape entitled "[illegible]" is, naturally, assembled [illegible] preceding the second tape [illegible], [illegible] and [illegible] and 3 up. Then assemble the second and third tapes.

The funny format tape [illegible] is [illegible] has no [illegible] put it in core, first read in the [illegible] Loader tape which comes with the CONTEST symbolic tapes. Then place the assembled CONTEST tape in the reader and start in location [illegible].

Finally, to produce a [illegible] tape of CONTEST, read in the [illegible] [illegible] Puncher and punch out the contents of locations [illegible] to [illegible] with a start block to location 7700.

The following library program writeups describe the pertinent sections of CONTEST in greater detail.

Checkerboard (Digital-4-4-M)

The program described here is a more comprehensive one than that included in CONTEST, but the logic and operation are the same.

Clock Interrupt Test (Digital-4-14-M)

Basically the same as in CONTEST.

For thorough testing of the I/O devices, one of the following programs should be used.

Reader and Punch Test (Digital-4-5-M) - These programs allow the user to vary the speed and the patterns read or punched on paper tape.

Teletype I/O Test (Digital-4-6-M) - Allows rigorous testing of teleprinter and keyboard.

Error stops

Except where indicated, pressing CONTINUE will cause the program to proceed.

jumpt — halts are placed at 6003, 6005-7, 6014-17, 6023, [illegible] and 6103. These are non-return stops and the program must be restarted from the dispatch table.

sort	6110	sna failed on +0. If AC≠ +0, cla failed
	6163	AC≠0 ⊃ xor failed. Otherwise, sna failed
	6166	same reasons as previous stop
glocah	6216	sza failed on +0 (did not skip)
	6222	sza failed on -0
	6224	spa did not skip on +AC
	6230	spa skipped on -AC
	6232	sma did not skip on -AC
	6237	sma skipped on +AC
	6243	AC=525252 ⊃ and failed. Otherwise, lac failed
	6247	AC=252525 ⊃ and failed. Otherwise, lac failed
	6253	+AC ⊃ cma failed to complement +0 AC properly
	6256	AC≠0 ⊃ recomplement failed
	6262	+AC ⊃ cma failed to complement 377777 properly
	6265	verification of preceding error
	6270	-AC ⊃ recomplement failed
	6273	verification of preceding error
tlink	6075	(AC-0=1) ∧ (L=0) ⊃ jms failed to save link L=1 ⊃ cll failed
	6056	(AC-0=0) ∧ (L=1) ⊃ jms failed to save link L=0 ⊃ cml failed
	6060	snl failed
	6063	szl failed
lidd	6304	law failed to load itself
	6311	xloc≠0 ⊃ dzm xloc failed
	6316	xloc≠-1 ⊃ dac xloc failed
	6323	AC=+0 ⊃ incorrect indexing. Otherwise, incorrect skip
	6327	AC bits on were cleared by las

	6332	isz failed to skip on +0
	6335	noisy AC
	6340	Xloc≠0 ⊃ incorrect indexing
	6345	AC≠(OV'1) ⊃ incorrect indexing
		AC=1 ⊃ incorrect skip
	6351	noisy AC
damt	6364	AC≠0 ⊃ dam failed
cact	6405	AC≠525252 ⊃ sac failed
iszt	6434	isz skipped on -0
	6446	isz not incrementing properly
noise	6475	AC bit on were cleared during execution of isz
rotate	6557	number did not move right on rar
	6514	link is not the same after rar-ral
	6517	number is not the same after rar-ral
	6563	number did not move left on ral
	6525	link did not survive rar-ral
	6530	number is not the same after rar-ral
	6537	ral failed if AC=0
	6541	link not set after ral
	6546	rar failed if AC≠0
	6550	link not set after rar
tand	6574	AC and mask do not match
	6601	AC and mask do not match
	6613	AC≠0 after completion of test
	6622	failed to change single bit from 1 to 0
addtad	6764	error in sum
	6767	incorrect overflow
	6772	error in sum
	6775	incorrect overflow
	7002	error in sum
	7005	incorrect overflow
	7012	error in sum
	7015	incorrect overflow
	6720	incorrect sum on tad
	6732	" " " "
	6745	" " " "
	6762	" " " "
autogk	7072	register does not contain 545123; automatic indexing did not work
calt	7124	link not set; cal failed
	7127	link saved as 1 on cal
	7132	address saved is incorrect

[illegible]	6[illegible]0	12 [illegible] not failed
[illegible]	7257	failed bit shown as 1 in [illegible] of error. Program can be restarted (7722)
	7256	AC contains failed bit
	7253	AC contains address of register in error
[illegible]	7233	clock flag set--should be clear
	7235	prog interrupt on--should be off
	7241	clock enable on incorrectly
	7245	clon in 7242 did not turn on enable flag
	7252	overflow flag on incorrectly
	7256	ion in 7253 did not turn on prog interrupt
	7310	unexpected break from device not tested
	7313	reader interrupt did not set flag
	7322	wrong character read from tape
	7330	reader flag not cleared by rrb in 7324 or rsa in [illegible]
	7333	punch interrupt did not set flag
	7337	flag not cleared by pcf in 7335
	7347	flag not cleared by pls in 7344
	7352	teleprinter flag not set after interrupt
	7356	flag not cleared by tcf in 7353
	7366	flag not cleared by tls in 7363
	7371	keyboard flag not set after interrupt
	7375	flag not cleared by kcc in 7372
	7415	clock flag not set after overflow interrupt
	7423	flag not cleared by clsa in 7420
	7726	FINAL STOP (when ACS-17 is up)

Error Scope: Numerical Listing

Location	Test	Location	Test	Location	Test
6003	jumpt	6514	rotate	[illegible]	[illegible]
6005-7	"	6517	"	[illegible]	"
6014-17	"	6525	"	[illegible]	"
6023	"	6530	"	[illegible]	"
6030	xort	6537	"	[illegible]	"
6043	jumpt	6541	"	[illegible]	"
6056	tlink	6546	"	[illegible]	"
6060	"	6550	"	[illegible]	"
6063	"	6557	"	[illegible]	"
6073	"	6563	"	[illegible]	"
		6574	tand	[illegible]	"
6103	jumpt			[illegible]	"
6110	xort	6600	tand		
6163	"	6613	"	[illegible]	[illegible]
6166	"	6622	"	[illegible]	"
6216	slotqb	6720	addtad	[illegible]	[illegible]
6222	"	6731	"		
6224	"	6745	"	[illegible]	[illegible]
6230	"	6761	"	[illegible]	[illegible]
6232	"	6764	"		
6237	"	6767	"	[illegible]	FINAL STOP
6243	"	6772	"		
6247	"	6775	"		
6253	"				
6256	"	7002	addtad		
6262	"	7005	"		
6265	"	7010	"		
6270	"	7015	"		
6273	"	7072	aotogx		
6304	lisd	7124	salt		
6311	"	7127	"		
6316	"	7132	"		
6323	"				
6327	"	7133	olink		
6332	"	7136	"		
6335	"	7241	"		
6340	"	7246	"		
6345	"	7252	"		
6351	"	7256	"		
6354	dzmt				
6405	dact				
6424	lszt				
6446	"				
6475	noise				