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DECUS NO.	8-400a
TITLE	EXECUTE SLOW
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COMPANY	Revised by: G. A. Moyle University of New South Wales Australia
DATE	February 1974
SOURCE LANGUAGE	MACRO-8

ATTENTION

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EXECUTE SLOW

DECUS Program Library Write-up

DECUS NO. 8-400a

ABSTRACT.

Execute Slow will execute the user's program one instruction at a time. Before the instruction is executed the LINK, ACCUMULATOR, PROGRAM COUNTER and INSTRUCTION are printed on the ASR33. The program only occupies one page, in any field, plus locations 0000 to 0003 in field zero, and differs from most trace programs in that the user instructions are actually executed from the user's original location. Subroutine tracing can be turned off.

Minimum Hardware: 4K PDP-8, ASR33

Storage Requirement: Locations 0000 through 0003 in field zero.
6600-6777 (1 page) in any field

Restrictions: User interrupts may not be used.
The 6002 instruction is not allowed.
Instructions with an effective address of .-1
may cause incorrect execution of traced program.

Source Language: MACRO-8

MULTI-FIELD "EXECUTE SLOW"

PURPOSE:-

THE "EXECUTE SLOW" PROGRAM EXECUTES THE USER'S PROGRAM ONE INSTRUCTION AT A TIME. BEFORE EACH INSTRUCTION IS EXECUTED, THE LINK, ACCUMULATOR, PROGRAM COUNTER AND INSTRUCTION ARE PRINTED ON THE TELETYPE. THE PRINTING CAUSES THE SLOW EXECUTION OF THE USER'S PROGRAM. THE MULTI-FIELD "EXECUTE SLOW" PROGRAM NEED NOT BE RESIDENT IN THE FIELD CONTAINING THE PROGRAM TO BE EXECUTED, SINCE MULTI-FIELD LINKAGE IS PROVIDED.

THIS PROGRAM DIFFERS FROM MOST TRACE PROGRAMS IN THAT IT ACTUALLY EXECUTES THE USER'S INSTRUCTIONS FROM THE USER'S ORIGINAL CORE LOCATIONS. THIS IS ACCOMPLISHED BY USING THE INTERRUPT FACILITY AND THE FACT THAT THE "ION" INSTRUCTION DOES NOT TAKE EFFECT UNTIL ONE INSTRUCTION FOLLOWING IT HAS BEEN COMPLETED. SINCE THE TRACE PROGRAM ITSELF REQUIRES THE INTERRUPT, THE USER'S PROGRAM SHOULD NOT USE THE INTERRUPT. THE INSTRUCTION "IOF" (WHEN EXECUTED) WILL TURN THE INTERRUPT OFF AND STOP THE TRACE PROGRAM.

NOTE THAT THIS PROGRAM CANNOT HANDLE INSTRUCTIONS WITH AN EFFECTIVE ADDRESS OF --1, DUE TO THE REPLACEMENT OF THE INSTRUCTION PRIOR TO THAT ABOUT TO BE EXECUTED BY "ION".

ASSEMBLING THE "EXECUTE SLOW" PROGRAM:-

1/. PREPARE A SHORT TAPE CONTAINING:-

N=00XX
M=00YY
W=VV00

WHERE X = FIELD CONTAINING
PROGRAM TO BE
EXECUTED.

Y = FIELD TO CONTAIN
THIS PROGRAM.

VV00 = REQUIRED STARTING
ADDRESS OF THIS
PROGRAM. MUST
BE THE FIRST
LOCATION ON A
PAGE.

2/. USE THIS SHORT TAPE AS THE FIRST INPUT TO THE
ASSEMBLER, WHICH MUST BE MACRO-8 OR PAL-D DUE
TO THE USE OF LITERALS AND BINARY OPERATORS IN
THE SOURCE CODING.

3/. ASSEMBLE THE SOURCE TAPE AS USUAL.

RUNNING THE "EXECUTE SLOW" PROGRAM:-

1/. CHOOSE FIELDS FOR "EXECUTE SLOW" AND PROGRAM
TO BE TRACED.

2/. LOAD PROGRAM TO BE TRACED.

3/. LOAD VERSION OF "EXECUTE SLOW" APPROPRIATE TO
CHOSEN FIELDS.

4/. SET THE SWITCH REGISTER TO THE STARTING ADDRESS
(VV00) OF "EXECUTE SLOW" - 6600 IN BINARY VERSIONS
SUPPLIED.

5/. PRESS LOAD ADDRESS ON COMPUTER.

6/. PRESS START, COMPUTER HALTS AT VV01.

7/. SET THE SWITCH REGISTER TO THE STARTING ADDRESS
OF THE PROGRAM TO BE EXECUTED SLOW.

8/. PRESS CONTINUE.

9/. THE TELETYPE WILL BEGIN TO PRINT THE CONTENTS OF:-

LINK ACCUMULATOR PROGRAM COUNTER INSTRUCTION

10/. THE SWITCH REGISTER SET EQUAL TO ZERO WILL EXECUTE
BUT NOT PRINT SUBROUTINE INSTRUCTIONS. (NOTE:
SUBROUTINES WITH ARGUMENTS WILL NOT TURN PRINT
BACK ON).

11/. A NON-ZERO SWITCH REGISTER WILL ALWAYS PRINT THE
LINE.

12/. ALWAYS STOP THE TRACE BY HITTING ANY TELETYPE KEY.

13/. RESUME THE EXECUTE SLOW BY PRESSING CONTINUE.

"EXECUTE SLOW" STORAGE REQUIREMENTS:-

0001-0003 IN FIELD ZERO
VV00-VV00+0177 (ONE PAGE) IN APPROPRIATE FIELD.

STARTING ADDRESS:-

AS CHOSEN AT ASSEMBLY TIME.

THE BINARY TAPE, SUBMITTED TO DECUS WITH THIS WRITE-UP,
CONTAINS FOUR VERSIONS OF THE MULTI-FIELD "EXECUTE SLOW":-

#1: PROGRAM FIELD 0; "EXECUTE SLOW" FIELD 0
#2: PROGRAM FIELD 1; "EXECUTE SLOW" FIELD 1
#3: PROGRAM FIELD 0; "EXECUTE SLOW" FIELD 1
#4: PROGRAM FIELD 1; "EXECUTE SLOW" FIELD 0

STARTING ADDRESS FOR ALL VERSIONS IS 6600

/MODIFIED "EXECUTE SLOW" - DECUS 8-400.
/ALLOWS MULTI-FIELD OPERATION.

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/ ASSEMBLY INSTRUCTIONS.

/ 1/. PREPARE A SHORT TAPE CONTAINING:-
/ N=00XX
/ M=00YY
/ W=VV00

/ WHERE X = FIELD CONTAINING
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/ Y = FIELD TO CONTAIN
/ THIS PROGRAM.
/ VV00 = REQUIRED STARTING
/ ADDRESS OF THIS
/ PROGRAM. MUST BE
/ FIRST LOCATION ON
/ A PAGE.

/ 2/. USE THIS SHORT TAPE AS FIRST INPUT
/ TO THE ASSEMBLER, WHICH MUST BE
/ EITHER MACRO-8 OR PAL-D DUE TO
/ THE USE OF LITERALS AND BOOLEAN
/ OPERATIONS IN THE SOURCE CODING.

/ 3/. ASSEMBLE THIS SOURCE TAPE AS
/ USUAL.

N=0000
M=0011
W=6600

FIELD 0

*0

00000	0000	INTRPT,	0
00001	6213		CDF CIF M&0070
00002	5403		JMP I .+1
00003	6665		INT

FIELD M&0007

*W

16600	7300	START,	CLA CLL
16601	7402		HLT
16602	3356		DCA IOSW
16603	7604		LAS
16604	3362	RUN,	DCA PC
16605	7240		CLA CMA
16606	1362		TAD PC
16607	3361		DCA PC-1
16610	6201		CDF N&0070
16611	1761		TAD I PC-1
16612	3360		DCA PCINS
16613	1377		TAD (6001
16614	3761		DCA I PC-1
16615	6211		CDF M&0070
16616	7604		LAS
16617	7640		SZA CLA
16620	5245		JMP OUT
16621	1356		TAD IOSW
16622	7640		SZA CLA
16623	5240		JMP INTEST
16624	6201	B,	CDF N&0070
16625	1762		TAD I PC
16626	0376		AND (7000
16627	1375		TAD (4000
16630	6211		CDF M&0070
16631	7640		SZA CLA
16632	5257		JMP PE
16633	2356	XXXX,	ISZ IOSW
16634	1362		TAD PC
16635	7001		IAC
16636	3357		DCA RETRN
16637	5257		JMP PE

16640	1362	INTEST,	TAD PC
16641	7041		CIA
16642	1357		TAD RETRN
16643	7640		SZA CLA
16644	5260		JMP E
16645	3356	OUT,	DCA IOSW
16646	5224		JMP B
16647	7402	CRLFS,	HLT
16650	4341		JMS CRLF
16651	1363		TAD SLINK
16652	1244		TAD INTEST+4
16653	4347		JMS TYPE
16654	1243		TAD INTEST+3
16655	4347		JMS TYPE
16656	5647		JMP I CRLFS
16657	4302	PE,	JMS PSEQ
16660	1363	E,	TAD SLINK
16661	7110		CLL RAR
16662	1364		TAD SAC
16663	6203		CDF CIF N&0070
16664	5761		JMP I PC-1
16665	3364	INT,	DCA SAC
16666	7004		RAL
16667	3363		DCA SLINK
16670	1360		TAD PCINS
16671	6201		CDF N&0070
16672	3761		DCA I PC-1
16673	6031		KSF
16674	5277		JMP .+3
16675	6032		KCC
16676	7402		HLT
16677	6201		CDF 0
16700	1774		TAD I (INTRPT
16701	5204		JMP RUN
16702	7402	PSEQ,	HLT
16703	4247		JMS CRLFS
16704	1364		TAD SAC
16705	4315		JMS PRINT4
16706	1362		TAD PC
16707	4315		JMS PRINT4
16710	6201		CDF N&0070
16711	1762		TAD I PC
16712	6211		CDF M&0070
16713	4315		JMS PRINT4
16714	5702		JMP I PSEQ

06715	7402	PRINT4,	HLT
06716	7004		RAL
06717	3355		DCA WORD
06720	4327		JMS CHARP
06721	4327		JMS CHARP
06722	4327		JMS CHARP
06723	4327		JMS CHARP
06724	1243		TAD INTEST+3
06725	4347		JMS TYPE
06726	5715		JMP I PRINT4
06727	7402	CHARP,	HLT
06730	1355		TAD WORD
06731	7006		RTL
06732	7004		RAL
06733	3355		DCA WORD
06734	1355		TAD WORD
06735	0373		AND (0007
06736	1244		TAD INTEST+4
06737	4347		JMS TYPE
06740	5727		JMP I CHARP
06741	7402	CRLF,	HLT
06742	1372		TAD (215
06743	4347		JMS TYPE
06744	1371		TAD (212
06745	4347		JMS TYPE
06746	5741		JMP I CRLF
06747	7402	TYPE,	HLT
06750	6046		TLS
06751	6041		TSF
06752	5351		JMP --1
06753	7200		CLA
06754	5747		JMP I TYPE
06755	0000	WORD,	0
06756	0000	IOSW,	0
06757	0000	RETRN,	0
06760	0000	PCINS,	0
06761	0000		0
06762	7402	PC,	HLT
06763	0000	SLINK,	0
06764	0000	SAC,	0
06771	0212		
06772	0215		
06773	0007		
06774	0000		
06775	4000		
06776	7000		
06777	6001		

B	6624
CHARP	6727
CRLF	6741
CRLFS	6647
E	6660
INT	6665
INTEST	6640
INTRPT	0000
IOSW	6756
M	0011
N	0000
OUT	6645
PC	6762
PCINS	6760
PE	6657
PRINT4	6715
PSEQ	6702
RETRN	6757
RUN	6604
SAC	6764
SLINK	6763
START	6600
TYPE	6747
W	6600
WORD	6755
XXXX	6633

