



```

MM      MM      TTTTTTTTTT  HH      HH      CCCCCCCC  EEEEEEEEEEE  XX      XX  PPPPPPPP
MM      MM      TTTTTTTTTT  HH      HH      CCCCCCCC  EEEEEEEEEEE  XX      XX  PPPPPPPP
MMM     MMM     TT          HH      HH      CC          EE          XX      XX  PP          PP
MMM     MMM     TT          HH      HH      CC          EE          XX      XX  PP          PP
MM      MM      TT          HH      HH      CC          EE          XX      XX  PP          PP
MM      MM      TT          HH      HH      CC          EE          XX      XX  PP          PP
MM      MM      TT          HHHHHHHHHH  CC          EEEEEEEEE  XX      XX  PPPPPPPP
MM      MM      TT          HHHHHHHHHH  CC          EEEEEEEEE  XX      XX  PPPPPPPP
MM      MM      TT          HH      HH      CC          EE          XX      XX  PP          PP
MM      MM      TT          HH      HH      CC          EE          XX      XX  PP          PP
MM      MM      TT          HH      HH      CC          EE          XX      XX  PP          PP
MM      MM      TT          HH      HH      CC          EE          XX      XX  PP          PP
MM      MM      TT          HH      HH      CCCCCCCC  EEEEEEEEEEE  XX      XX  PP          PP
MM      MM      TT          HH      HH      CCCCCCCC  EEEEEEEEEEE  XX      XX  PP          PP

```

```

LL      IIIIII  SSSSSSSS
LL      IIIIII  SSSSSSSS
LL      II     SS
LL      II     SS
LL      II     SS
LL      II     SS
LL      II     SSSSSS
LL      II     SSSSSS
LL      II     SS
LL      II     SS
LL      II     SS
LL      II     SS
LLLLLLLL  IIIIII  SSSSSSSS
LLLLLLLL  IIIIII  SSSSSSSS

```



(2)	49	HISTORY	; Detailed Current Edit History
(3)	58	DECLARATIONS	
(4)	86	MTH\$CEXP	- perform COMPLEX exponentiation

MTH  
Sym  
ARG  
MTH  
MTH  
MTH  
REA  
ZER

PSE

MT

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MAC

```

0000 1 .TITLE MTHSCEXP COMPLEX EXPONENTIATION
0000 2 .IDENT /1-002/ ; File: MTHCEXP.MAR
0000 3
0000 4
0000 5 *****
0000 6 *
0000 7 * COPYRIGHT (c) 1978, 1980, 1982, 1984 BY *
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0000 24 *
0000 25 *
0000 26 *****
0000 27
0000 28
0000 29 FACILITY: MATH LIBRARY
0000 30 ++
0000 31 ABSTRACT:
0000 32 Perform complex exponentiation: e**(r,i)
0000 33
0000 34
0000 35 --
0000 36
0000 37 VERSION: 0
0000 38
0000 39 HISTORY:
0000 40
0000 41 AUTHOR:
0000 42 Jonathan M. Taylor, 19-JUL-77: Version 0
0000 43
0000 44 MODIFIED BY:
0000 45
0000 46
0000 47

```



MTH\$CEXP  
1-002

COMPLEX EXPONENTIATION L 2 16-SEP-1984 01:08:09 VAX/VMS Macro V04-00  
HISTORY ; Detailed Current Edit History 6-SEP-1984 11:20:59 [MTHRTL.SRC]MTH\$CEXP.MAR;1

Page 2  
(2)

```
0000 49      .SBTTL HISTORY      ; Detailed Current Edit History
0000 50
0000 51
0000 52 : Edit History for Version 0 of MTH$CEXP
0000 53 :
0000 54 : 1-001 - Update version number and copyright notice. The last edit
0000 55 :          number for version 0 was 4. JBS 16-NOV-78
0000 56 : 1-002 - Add "_" to the PSECT directive. JBS 21-DEC-78
```

MTH  
Tab

```
0000 58      .SBTTL  DECLARATIONS
0000 59
0000 60  ::
0000 61  :: INCLUDE FILES:
0000 62  ::      OERR.MAR
0000 63  ::
0000 64  ::
0000 65  :: EXTERNAL SYMBOLS:
0000 66      .GLOBL  MTH$SIN_R4
0000 67      .GLOBL  MTH$COS_R4
0000 68      .GLOBL  MTH$EXP_R4
0000 69  ::
0000 70  ::
0000 71  :: MACROS:
0000 72  ::      NONE
0000 73  ::
0000 74  ::
0000 75  :: PSECT DECLARATIONS:
0000 76      .PSECT  _MTH$CODE      PIC, SHR, LONG, EXE, NOWRT
00000000 77  ::
0000 78  ::
0000 79  :: EQUATED SYMBOLS:
00000004 80      argadr =      4      ; offset from AP of arg adr
0000 81  ::
0000 82  ::
0000 83  :: OWN STORAGE:
0000 84  ::      NONE
```

```

0000 86      .SBTTL MTH$CEXP - perform COMPLEX exponentiation
0000 87
0000 88      :++
0000 89      : FUNCTIONAL DESCRIPTION:
0000 90      :
0000 91      :   The result of the operation e ** (r, i) is computed
0000 92      :   by:
0000 93      :
0000 94      :   result = (EXP(r) * COS(i), EXP(r) * SIN(i))
0000 95      :
0000 96      : CALLING SEQUENCE:
0000 97      :   Exponential.wfc.v      = MTH$CEXP(arg.rfc.r)
0000 98      :
0000 99      :
0000 100     : INPUT PARAMETERS:
0000 101     :   The one input parameter is the address of COMPLEX number (r, i),
0000 102     :   where r and i are both single-precision floating point values.
0000 103     :
0000 104     : IMPLICIT INPUTS:
0000 105     :   NONE
0000 106     :
0000 107     : OUTPUT PARAMETERS:
0000 108     :   NONE
0000 109     :
0000 110     : IMPLICIT OUTPUTS:
0000 111     :   NONE
0000 112     :
0000 113     : COMPLETION CODES:
0000 114     :   NONE
0000 115     :
0000 116     : SIDE EFFECTS:
0000 117     :   Signals:      MTH$_SINSIGLOS if |i| > 2*PI*2**31.
0000 118     :                   Floating Overflow if r > 88.028
0000 119     :
0000 120     :--
0000 121
0000 122
00FC 0000 123     .ENTRY MTH$CEXP,      ^M<R2,R3,R4,R5,R6,R7>
0002 124     MTH$FLAG_JACKET      ; resignal
0002 124
6D  00000000'GF  9E 0002 125     MOVAB  G^MTH$$JACKET_HND, (FP)
0009 126     ; set handler address to jacket
0009 126     ; handler
0009 127
50  04 BC  DO 0009 126     MOVL   @argadr(AP), R0      ; R0 = r
00000000'EF  16 000D 127     JSB   MTH$EXP_R4          ; R0 = EXP(r)
55  50  DO 0013 128     MOVL   R0, R5            ; R5 = EXP(r)
0016 129
56  04 AC  DO 0016 130     MOVL   argadr(AP), R6    ; R6 -> (r, i)
001A 131
50  04 A6  DO 001A 132     MOVL   4(R6), R0        ; R0 = i
00000000'EF  16 001E 133     JSB   MTH$SIN_R4        ; R0 = SIN(i)
57  50  DO 0024 134     MOVL   R0, R7          ; R7 = SIN(i)
0027 135
50  04 A6  DO 0027 136     MOVL   4(R6), R0        ; R0 = i
00000000'EF  16 002B 137     JSB   MTH$COS_R4        ; R0 = COS(i)

```



```
51 50 55 44 0031 138  
55 57 45 0031 139  
04 0034 140  
0038 141  
0039 142  
0039 143  
0039 144  
MULF R5, R0 ; R0 = COS(i) * EXP(r)  
MULF3 R7, R5, R1 ; R1 = SIN(i) * EXP(r)  
RET  
.END
```



MTH\$CEXP  
Symbol table

COMPLEX EXPONENTIATION

C 3

16-SEP-1984 01:08:09  
6-SEP-1984 11:20:59

VAX/VMS Macro V04-00  
[MTHRTL.SRC]MTHCEXP.MAR;1

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(4)

```

ARGADR          = 00000004
MTH$$JACKET_HND ***** X 01
MTH$CEXP        00000000 RG 01
MTH$COS_R4      ***** G 00
MTH$EXP_R4      ***** G 00
MTH$$IN_R4      ***** G 00

```

```

+-----+
! Psect synopsis !
+-----+

```

PSECT name	Allocation	PSECT No.	Attributes	CON	ABS	LCL	NOSHR	NOEXE	NORD	NOWRT	NOVEC	BYTE
ABS	00000000 ( 0.)	00 ( 0.)	NOPIC USR	CON	ABS	LCL	NOSHR	NOEXE	NORD	NOWRT	NOVEC	BYTE
_MTH\$CODE	00000039 ( 57.)	01 ( 1.)	PIC USR	CON	REL	LCL	SHR	EXE	RD	NOWRT	NOVEC	LONG

```

+-----+
! Performance indicators !
+-----+

```

Phase	Page faults	CPU Time	Elapsed Time
Initialization	29	00:00:00.10	00:00:00.72
Command processing	133	00:00:00.65	00:00:06.10
Pass 1	78	00:00:00.58	00:00:02.56
Symbol table sort	0	00:00:00.00	00:00:00.00
Pass 2	42	00:00:00.50	00:00:01.93
Symbol table output	2	00:00:00.01	00:00:00.06
Psect synopsis output	2	00:00:00.01	00:00:00.01
Cross-reference output	0	00:00:00.00	00:00:00.00
Assembler run totals	288	00:00:01.87	00:00:11.39

The working set limit was 900 pages.  
2308 bytes (5 pages) of virtual memory were used to buffer the intermediate code.  
There were 10 pages of symbol table space allocated to hold 6 non-local and 0 local symbols.  
204 source lines were read in Pass 1, producing 11 object records in Pass 2.  
1 page of virtual memory was used to define 1 macro.

```

+-----+
! Macro library statistics !
+-----+

```

Macro library name	Macros defined
_\$255\$DUA28:[SYSLIB]STARLET.MLB;2	0

0 GETS were required to define 0 macros.

There were no errors, warnings or information messages.

MACRO/ENABLE=SUPPRESSION/DISABLE=(GLOBAL,TRACEBACK)/LIS=LIS\$:MTHCEXP/OBJ=OBJ\$:MTHCEXP MSRC\$:MTHJACKET/UPDATE=(ENH\$:MTHJACKET)+MSRC\$:



0258 AH-BT13A-SE  
VAX/VMS V4.0

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The image displays a grid of 144 terminal windows, arranged in 12 rows and 12 columns. Each window shows the output of a specific LIS (List Processing) program. The programs are identified by their names, which are centered in the upper portion of each window. The data output is presented in a structured, tabular format with multiple columns and rows of text. The programs shown include:

- MTHCVTDG LIS
- MTHDACOS LIS
- MTHCGABS LIS
- MTHCDSINC LIS
- MTHCLOG LIS
- MTHDASIN LIS
- MTHCGLOG LIS
- MTHCONVER LIS
- MTHCGLG LIS
- MTHCSORT LIS
- MTHCXP LIS
- MTHCGSORT LIS
- MTHCGEXP LIS
- MTHCSINCO LIS
- MTHCONJG LIS
- MTHCDSORT LIS
- MTHCGSINC LIS
- MTHCOSH LIS