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TITLE BINREAD (Revised Version)

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SOURCE LANGUAGE PAL III

"BINREAD"
Elementary Disassembler

Requirements: 4 K PDP-8 series computer with ASR-33.

Functions: Disassembles binary object tapes, giving an octal listing of all field and address codes, and of the data/instructions which follow them. Data are arranged in 8-line paragraphs, facilitating address counting. The format is familiar and legible; the execution is rapid. In addition, certain errors are checked for; if found, the computer halts after typing ? . The tape checksum is read and printed out; it is followed by a computed checksum which should agree with it. The routine may be restarted by pressing "Continue" after any halt, whether one caused by an error on the binary tape or one caused by reaching trailer code.

ASCII between rubouts (Pass 2 diagnostics from an assembler) do not cause a halt, but they are printed out in full for the user's information. Since a restart after an erroneous code greater than 300 (e.g., alphabetic letters) gives unpredictable results, such characters are printed before the error halt.

Core Required: Locations 4000 to 4310 in any field, for those using the PDP-8/E. Users of the 8/I, 8/L, etc., should read in the binary patch at the end of the main tape; this will take additional core, namely locations 4311-4321.

Procedure: Load Binread into core (any field) with the binary loader. Place tape to be disassembled into the low speed reader, loading it on its leader code (200); turn reader on (TTY should be on "Line"); load address 4000 and start.

Use in One-Field Machines: This routine does not overlay PAL-III, FOCAL (1969), Symbolic Editor, etc., though it does overlay their storage areas. With Editor and FOCAL it might be advisable to erase this area ("K" and "E A" commands, respectively) before loading Binread.

Execution Time: About 50 sec. to disassemble the binary of the 8/I patch (see last page of listing).

Disadvantages: No attempt is made to give the PAL-III mnemonics for binary tape codes. This is always a bit risky, even for the most elaborate disassembly routines, since 7200 might be (a) CLA (b) the number 7200 = -600 (c) a pointer address (d) several of these at once.

Advantages: Loads quickly, takes little core, executes quickly; checks for a number of errors, including erroneous checksum.

```
/DISASSEMBLY OF A BINARY TAPE (NO BAD PUNCHES):

*0200

F 0                     /FIELD 0 (PS.-OP.)
*0200

*7600

    6201
    7300
    1611
IR XXXX AT YYYY         /ASCII BETWN. RUBOUTS (E.G., DIAGNOSTICS)
    6211
    3611
    2211
    5200
    6203                /8-LINE PARAGRAPHS, HENCE

    7402                /...THIS MUST BE IN LOCN. 7610
    7612
    1351                /TAPE CHECKSUM PUNCH
    1351CK              /COMPUTED CHECKSUM, SHOULD AGREE



/A BAD BINARY TAPE:

*0200

F 0
*0200

*7600

    ?6200           /(COMPUTER HALTED). 1ST FRAME OK, 2ND BAD
    7300
    1611
    6211
?    0011           /1ST FRAME BAD, 2ND OK
    2211
    5200
    6203

    7402
    A?              /CODE 301.  FRAME COUNT FROM HERE ON IS WRONG,
    1213
        1351CK      /...WHICH CAUSES THE EXTRA SPACES HERE.

/TWO ADDRESS CODES IN A ROW CAUSE A DOUBLE ASTERISK ("**"), BUT
/NO HALT.  BOTH FRAME COUNT AND CHECKSUM WILL BE WRONG.

/OTHER ERRORS CAN BE DETECTED ONLY IN THE CHECKSUM.
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```
/       "BINREAD"
/OCTAL DUMP FROM BINARY TAPE;
/CHECKS FOR ILLEGAL CODES
/OR ERRONEOUS CHECKSUM.

/FOR PDP-8/E; PATCH CONVERTS 8/E CODES TO 8/I.

*4000

BSW=7002
MQA=7501
MQL=7421
SPF=6040

4000  6032          KCC
4001  6040          SPF
4002  3255          DCA FLAG
4003  3320          DCA CKSUM
4004  3315          DCA ADRCTR
4005  4342  START,  JMS CRLF
4006  4661  CONTIN, JMS I PROUTIN
4007  7002          BSW
4010  7421          MQL
4011  4322  NEXT,   JMS SPC4
4012  4661          JMS I PROUTIN
4013  7501          MQA
4014  3256          DCA PREV
4015  1256          TAD PREV        /USED FOR CKSUM AT END
4016  4351          JMS OCTP
4017  2315          ISZ ADRCTR
4020  1315          TAD ADRCTR
4021  0260  K260,   AND K7
4022  7650          SNA CLA
4023  4342          JMS CRLF        /8-LINE PARAGRAPHS
4024  5205          JMP START

4025  7421  FLD,    MQL
4026  7501          MQA
4027  0260          AND K7
4030  7650          SNA CLA         /FIELD PS.-OP. MUST END IN 0
4031  5241          JMP OKAY        /IT DOES: SKIP ERROR ROUTINE
4032  7501          MQA             /IT DOESN'T: TYPE ASCII & HLT
4033  1257          TAD K300
4034  4334          JMS TYPE
4035  1262          TAD QUEST
4036  4334          JMS TYPE
4037  7402          HLT             /LET USER MARK BAD FRAME
4040  5205          JMP START
4041  1254  OKAY,   TAD F
4042  4334          JMS TYPE
4043  1332          TAD SPACE
4044  4334          JMS TYPE
4045  7501          MQA
4046  7112          CLL RTR
4047  7010          RAR
4050  0260          AND K7
4051  1221          TAD K260
4052  4334          JMS TYPE
4053  5205          JMP START
```

```
4054  0306  F,       306
4055  0000  FLAG,    0
4056  0000  PREV,    0
4057  0300  K300,    300
4060  0007  K7,      7
4061  4200  PROUTI,  4200
4062  0277  QUEST,   277

4063  2255  TRAILR,  ISZ FLAG          /LEADER OR TRAILER?
4064  5206            JMP CONTIN        /LEADER, IGNORE
4065  4322            JMS SPC4          /TRAILER, DO CHECKSUMS
4066  5716            JMP I PFINIS      /CORRECT CHECKSUM
4067  4351            JMS OCTP
4070  1317            TAD C
4071  4334            JMS TYPE
4072  1307            TAD K
4073  4334            JMS TYPE
4074  4342            JMS CRLF
4075  7402            HLT               /CHECKSUM (COMPUTED) IS LAST LINE
                                        /OF LISTING; CHECKSUM (PUNCHED) IS
                                        /THE LINE ABOVE.
4076  5202            JMP 4002          /RESTART BY "CONTINUE"


4077  1321  ADRS,    TAD K100
4100  7421            MQL
4101  1314            TAD ASTER
4102  4334            JMS TYPE
4103  7501            MQA
4104  1320            TAD CKSUM
4105  3320            DCA CKSUM
4106  7501            MQA
4107  0313  K,        AND K77
4110  7002            BSW
4111  7421            MQL
4112  5212  LF,       JMP NEXT+1

4113  0077  K77,     77
4114  0252  ASTER,   252
4115  0000  ADRCTR,  0
4116  4251  PFINIS,  FINIS
4117  0303  C,       303
4120  0000  CKSUM,   0
4121  0100  K100,    100

4122  0000  SPC4,    0
4123  1333            TAD M4
4124  3342            DCA CRLF          /KEEPS COUNT
4125  1332            TAD SPACE
4126  4334            JMS TYPE
4127  2342            ISZ CRLF
4130  5325            JMP .-3
4131  5722            JMP I SPC4

4132  0240  SPACE,   240
4133  7774  M4,      -4
```

```
4134  0000  TYPE,   0
4135  6041        TSF
4136  5335        JMP .-1
4137  6046        TLS
4140  7200        CLA
4141  5734        JMP I TYPE
4142  0000  CRLF,   0
4143  1350        TAD RETRN
4144  4334        JMS TYPE
4145  1312        TAD LF
4146  4334        JMS TYPE
4147  5742        JMP I CRLF

4150  0215  RETRN,  215

4151  0000  OCTP,   0
4152  7421        MQL
4153  7040        CMA
4154  3255        DCA FLAG
4155  1333        TAD M4
4156  3342        DCA CRLF
4157  7501        MQA
4160  7104        CLL RAL
4161  7004  ROTATE, RAL
4162  7006        RTL
4163  7421        MQL
4164  7501        MQA
4165  0260        AND K7
4166  1221        TAD K260
4167  4334        JMS TYPE
4170  7501        MQA
4171  2342        ISZ CRLF
4172  5361        JMP ROTATE      /NEXT DIGIT
4173  7200        CLA             /ALL DONE; EXIT
4174  5751        JMP I OCTP

            /INPUT ROUTINE; SECOND CORE PAGE OF "BINREAD"

            *4200

4200  0000  ROUTIN, 0
4201  6031        KSF
4202  5201        JMP .-1
4203  6036        KRB
4204  1302        TAD MRBT        /RUBOUT?
4205  7450        SNA
4206  5236        JMP ASCII       /YES, PRBLY. PAL DIAGNOSTICS
4207  1305        TAD NO77        /(AC) NOW = FRAME-300
4210  7500        SMA
4211  5676        JMP I ADFLD
4212  1306        TAD NO100
4213  7450        SNA
4214  5700        JMP I ADTRAILR
4215  7510        SPA
4216  5224        JMP NORMAL
4217  7200        CLA             /200<CODE<300: BAD PUNCH
                                  /BAD HALF OF WORD CLEARED
4220  1307        TAD QUESTN
4221  4701        JMS I ADTYPE
4222  7402        HLT             /EXAMINE TAPE; PRESS CONTINUE
4223  5600        JMP I ROUTIN
```

```
4224  1306  NORMAL, TAD NO100
4225  7500         SMA
4226  5265         JMP ADDRES
4227  1306         TAD NO100        /CODE<100: DATA
4230  3310         DCA TEMP
4231  1310         TAD TEMP
4232  1674         TAD I ADCKSM
4233  3674         DCA I ADCKSM
4234  1310         TAD TEMP
4235  5600         JMP I ROUTIN
4236  6031  ASCII,  KSF
4237  5236         JMP .-1
4240  6036         KRB
4241  1302         TAD MRBT
4242  7440         SZA
4243  5246         JMP .+3
4244  4675         JMS I ADCRLF
4245  5201         JMP ROUTIN+1
4246  1304         TAD RBT
4247  4701         JMS I ADTYPE     /ASCII BETWEEN RUBOUTS TYPED OUT
4250  5236         JMP ASCII        /LOOP UNTIL NEXT RUBOUT

4251  1677  FINIS,  TAD I ADPREV    /TAPE CKSUM
4252  7002         BSW
4253  0305         AND NO77
4254  7041         CIA
4255  1674         TAD I ADCKSM
4256  3674         DCA I ADCKSM
4257  1677         TAD I ADPREV
4260  0305         AND NO77
4261  7041         CIA
4262  1674         TAD I ADCKSM
4263  5664         JMP I .+1        /CKSUM NOW CORRECTED
4264  4067         TRAILR+4

4265  3310  ADDRES, DCA TEMP
4266  1303         TAD M11
4267  3672         DCA I ADADCT
4270  1310         TAD TEMP
4271  5673         JMP I ADADRS     /ADRCTR NOW = -9

4272  4115  ADADCT, ADRCTR
4273  4077  ADADRS, ADRS
4274  4120  ADCKSM, CKSUM
4275  4142  ADCRLF, CRLF
4276  4025  ADFLD,  FLD
4277  4056  ADPREV, PREV
4300  4063  ADTRAI, TRAILR
4301  4134  ADTYPE, TYPE
4302  7401  MRBT,   -377
4303  7767  M11,    -11
4304  0377  RBT,    377
4305  0077  NO77,   77
4306  0100  NO100,  100
4307  0277  QUESTN, 277
4310  0000  TEMP,   0
```

ADADCT	4272
ADADRS	4273
ADCKSM	4274
ADCRLF	4275
ADDRES	4265
ADFLD	4276
ADPREV	4277
ADRCTR	4115
ADRS	4077
ADTRAI	4300
ADTYPE	4301
ASCII	4236
ASTER	4114
BSW	7002
C	4117
CKSUM	4120
CONTIN	4006
CRLF	4142
F	4054
FINIS	4251
FLAG	4055
FLD	4025
K	4107
K100	4121
K260	4021
K300	4057
K7	4060
K77	4113
LF	4112
MQA	7501
MQL	7421
MRBT	4302
M11	4303
M4	4133
NEXT	4011
NORMAL	4224
NO100	4306
NO77	4305
OCTP	4151
OKAY	4041
PFINIS	4116
PREV	4056
PROUTI	4061
QUEST	4062
QUESTN	4307
RBT	4304
RETRN	4150
ROTATE	4161
ROUTIN	4200
SPACE	4132
SPC4	4122
SPF	6040
START	4005
TEMP	4310
TRAILR	4063
TYPE	4134

```
                /PATCH TO BINREAD FOR PDP-8/I, -8/L, ETC.

                *4001

                BSW=JMS I 4175
                MQA=TAD 4176
                MQL=DCA 4176

4001  6046              TLS
                *4007
4007  4775              BSW
4010  3376              MQL
                *4013
4013  1376              MQA
                *4025
4025  3376              MQL
4026  1376              MQA
                *4032
4032  1376              MQA
                *4045
4045  1376              MQA
                *4100
4100  3376              MQL
                *4103
4103  1376              MQA
                *4106
4106  1376              MQA
                *4110
4110  4775              BSW
4111  3376              MQL
                *4152
4152  3376              MQL
                *4157
4157  1376              MQA,
                *4163
4163  3376              MQL
4164  1376              MQA
                *4170
4170  1376              MQA
                *4175
4175  4311              BYTE
                *4252
4252  5316              JMP R6R
                *4311
4311  0000  BYTE,       0
4312  7106              CLL RTL
4313  7006              RTL
4314  7006              RTL
4315  5711              JMP I BYTE
4316  7112  R6R,        CLL RTR
4317  7012              RTR
4320  7012              RTR
4321  5253              JMP 4253


BSW     4775
BYTE    4311
MQA     1376
MQL     3376
R6R     4316
```