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IDENTIFICATION

Read Floating Decimal Routine, MU RFD2

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PURPOSE

To read decimal addresses and floating point numbers from cards, convert the floating point decimal numbers to binary floating point numbers and place them in core storage at the indicated locations.

METHOD

Accuracy: Floating Point Numbers, N, are read and converted with a maximum error of $\pm$ 1/2 in the 27th significant bit.

Range: $1.46936795 \times 10^{-39} \leq |N| \leq 1.70141181 \times 10^{38}$

Procedure: The decimal digits x_i of the addresses and numbers are read and decoded from the card row-by-row without the use of a card image. The integer address is converted by the following algorithm:

$$P_i = 10\, P_{i-1} + x_i$$

where P_i is the partially converted integer at the ith stage.

The floating point number is converted as follows:

$$A\, 10^B = \alpha'\, 2^{B \frac{\ln 10}{\ln 2}} = \alpha' 2^{\beta'} 2^r$$

$$= \alpha'\, 2^{\beta'} (e^{r \ln 2}) = \alpha\, 2^{\beta}$$

where α' is A converted as a binary fraction, β' is the integer part of B ln 10/ ln 2, r is the fractional part of B ln 10/ln 2, α is α' times 2^r, and β is β' after adjustment for normalization. A on the card is considered to have the decimal point immediately to the right of the first significant figure. To shift the decimal point to the left hand end of the number, the routine adds one to the exponent, B, before converting it as an integer.

A rounding operatinn is performed on the 28th significant bit so that the conversion will be in error at most by $\pm$ 1/2 in the 27th significant bit.

USAGE

Calling Sequence: The data cards to be read are readied in the reader.

UA SAP

Loc.	Instruction
α	TSX RFD2, 4
$\alpha + 1$	Return

MURASS

Loc.	Instruction
α	BTSX A 4
$\alpha + 1$	Return

Space Required:

	UA SAP	MURASS
164 words program at:	RFD2	A
10 words temporary at:	COMMON	T

Card Format: One loading address and one floating point number may be placed on each card. Starting in column 1 the address (up to 4 decimal digits) is punched followed by a space followed by a sign and up to nine significant figures. Immediately after this, the sign of the exponent is punched, followed by an exponent of up to two decimal digits. If the sign of the number is omitted, the number is regarded as positive. The address (but not the space between address and number) may be omitted, in which case the number is loaded into the address next after that loaded by this program when last used (no matter what computation has elapsed since). A positive exponent sign may be either a blank or a plus sign. Once control is transferred to this subroutine, cards will be read until an END OF FILE or a card with any 12R punch is encountered. Control will then be returned to the main program with 12R of this card in the accumulator as a logical word where it is available for subsequent control purposes. Note that omission means "leaving out and closing up" not "replacing by a space."*

The decimal point is considered to be immediately to the right of the first significant figure.

CODING INFORMATION

Only in exceptional circumstances will the card reader fail to read at full speed while under control of this program. However, no time should be counted on for computation between exit and re-entry to maintain full reader speed.

*An address of five decimal digits may be specified if the total number of card columns used by the above mentioned address, blank, sign, significant figures, and exponent does not exceed eighteen.

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      REM RFD2 MURA READ FLOATING DECIMAL                                  MU   RFD2
.FD2  SXD COMMON,1          SAVE IR1                                      RFD2  0001
      SXD COMMON+1,2        SAVE IR2                                      RFD2  0002
      RCD                   SELECT CARD READER                            RFD2  0003
      CLA RFD2+147          T=10 IN AC                                    RFD2  0004
      STO COMMON+2          STORE T                                       RFD2  0005
      PXD 2,0               CLEAR AC                                      RFD2  0006
      STO COMMON+3          CLEAR CHARACTER WORDS                         RFD2  0007
      STO COMMON+4                                                        RFD2  0008
      STO COMMON+7          CLEAR D                                       RFD2  0009
      CPY COMMON+5          LEFT COPY                                     RFD2  0010
      TRA RFD2+127          TO RIGHT COPY                                 RFD2  0011
      TRA RFD2+95           TO END OF FILE                                RFD2  0012
      CLA RFD2+15           END OF RECORD                                 RFD2  0013
      STA RFD2+33           SET SWITCH TO A                               RFD2  0014
      LXA RFD2+5,2          SET IR2=2                                     RFD2  0015
      PXD RFD2+98,0         CLEAR AC                                      RFD2  0016
      STO COMMON+5          CLEAR F SIGN WORD                             RFD2  0017
      STO COMMON+9          CLEAR I SIGN WORD                             RFD2  0018
      STO COMMON+8          CLEAR CONSTRUCTION WORD                       RFD2  0019
      LXA RFD2+21,1         SET IR1=9                                     RFD2  0020
      LDQ COMMON+5,2        CHARACTER WORD IN MQ                          RFD2  0021
      PXD 9,0               CLEAR AC                                      RFD2  0022
      LGL 4                 X IN AC                                       RFD2  0023
      STQ COMMON+5,2        STORE CHARACTER WORD                          RFD2  0024
      TRA RFD2+26           P                                             RFD2  0025
      TRA RFD2+26           P SUB I                                       RFD2  0026
      TZE RFD2+33           TRANSFER ON BLANK                             RFD2  0027
      SUB RFD2+147          SUB 10                                        RFD2  0028
      TZE RFD2+33           TRANSFER ON PLUS SIGN                         RFD2  0029
      SUB RFD2+146          SUB 1                                         RFD2  0030
      TNZ RFD2+34           TRANSFER ON LESS THAN 10                      RFD2  0031
      SSM                   MINUS SIGN                                    RFD2  0032
      STO COMMON+9          STORE IN I SIGN WORD                          RFD2  0033
      TRA                   SWITCH                                        RFD2  0034
      TMI RFD2+125          TRANSFER ON LESS THAN 10                      RFD2  0035
      PXD RFD2+153,0        X=12 IS A ZERO                                RFD2  0036
      STO COMMON+2          STORE X=0                                     RFD2  0037
      LDQ COMMON+8          CONSTRUCTION WORD IN MQ                       RFD2  0038
      MPY RFD2+147          10                                            RFD2  0039
      LLS 35                                                              RFD2  0040
      ADD COMMON+2          X                                             RFD2  0041
      STO COMMON+8          STORE CONSTRUCTION WORD                       RFD2  0042
      LDQ COMMON+7          D                                             RFD2  0043
      MPY RFD2+147          10                                            RFD2  0044
      STQ COMMON+7          STORE D                                       RFD2  0045
      TIX RFD2+20,1,1       OUT AFTER 9 PASSES                            RFD2  0046
      TIX RFD2+19,2,1       OUT AFTER 2 PASSES                            RFD2  0047
      CLA COMMON+9          SECTION I (EXPONENT)                          RFD2  0048
      ACL COMMON+8          EXPONENT                                      RFD2  0049
      ADD RFD2+146          EXPONENT PLUS 1                               RFD2  0050
      LRS 35                                                              RFD2  0051
      MPY RFD2+149          LN10/LN2                                      RFD2  0052
      LLS 2                                                               RFD2  0053
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ADD RFD2+150        129                                          RFD2  0054
STO COMMON+9        STORE BINARY CHARACTERISTIC B PRIMED         RFD2  0055
MPR RFD2+151        LN2                                          RFD2  0056
STO COMMON+7        STORE AS X FOR EXP X                         RFD2  0057
PXD RFD2+112,0                                                   RFD2  0058
STO COMMON+2        CLEAR INDEX N                                RFD2  0059
STO COMMON+3        CLEAR SUM S                                  RFD2  0060
CLA RFD2+152        1/2                                          RFD2  0061
STO COMMON+4        STORE AS PREVIOUS TERM T                     RFD2  0062
ADD COMMON+3        ADD S                                        RFD2  0063
STO COMMON+3        STORE S                                      RFD2  0064
CLA COMMON+2        N                                            RFD2  0065
ADD RFD2+146        1                                            RFD2  0066
STO COMMON+2        STORE N                                      RFD2  0067
PXD 12,0                                                         RFD2  0068
LDQ COMMON+4        T                                            RFD2  0069
LLS                                                              RFD2  0070
DVH COMMON+2        T/N                                          RFD2  0071
MPR COMMON+7        TX/N=NEW T                                   RFD2  0072
TNZ RFD2+61         IF 0 WE ARE THROUGH                          RFD2  0073
LDQ COMMON+3        FINAL S=P PRIMED                             RFD2  0074
MPR COMMON+5        P TIMES P PRIMED =A PRIMED                   RFD2  0075
ALS 1                                                            RFD2  0076
TZE RFD2+92         IF 0, STORE A 0                              RFD2  0077
TOV RFD2+84         IF NO OVERFLOW ADJUST B PRIMED               RFD2  0078
STO COMMON+5        STORE ADJUSTED A PRIMED                      RFD2  0079
CLA COMMON+9        B PRIMED                                     RFD2  0080
SUB RFD2+146        1                                            RFD2  0081
STO COMMON+9        ADJUSTED B PRIMED                            RFD2  0082
CLA COMMON+5        A PRIMED                                     RFD2  0083
TRA RFD2+75         LOOP TO NORMALIZE                            RFD2  0084
LRS 36              A INTO MQ                                    RFD2  0085
ADD COMMON+9        ADD B                                        RFD2  0086
LLS 27              FORM NUMBER                                  RFD2  0087
RND                 ROUND                                        RFD2  0088
LRS 26              SHIFT FOR ZERO TEST                          RFD2  0089
LBT                                                              RFD2  0090
ACL RFD2+146        ADD 1                                        RFD2  0091
LLS 26              POSITION NUMBER                              RFD2  0092
STO                 STORE COMPLETED NUMBER                       RFD2  0093
CAL COMMON+6        12 RIGHT                                     RFD2  0094
TZE RFD2+2          LOOP BACK IF 0                               RFD2  0095
LXD COMMON,1        RESTORE IR1                                  RFD2  0096
LXD COMMON+1,2      RESTORE IR2                                  RFD2  0097
TRA 1,4             EXIT                                         RFD2  0098
CLA RFD2+57         SECTION A                                    RFD2  0099
STA RFD2+33         SET SWITCH TO B                              RFD2  0100
CLA RFD2+35                                                      RFD2  0101
STA RFD2+24         SET P TO P SUB II                            RFD2  0102
CLA COMMON+8        CONSTRUCTION WORD                            RFD2  0103
TNZ RFD2+106        TRANSFER ON ADDRESS                          RFD2  0104
CLA RFD2+92         IF 0                                         RFD2  0105
ADD RFD2+146        INCREASE OLD ADDRESS                         RFD2  0106
STA RFD2+92         PLANT ADDRESS                                RFD2  0107
PXD RFD2+47,0                                                    RFD2  0108
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STO COMMON+8          CLEAR CONSTRUCTION WORD                RFD2  0109
ADD RFD2+146                                                 RFD2  0110
STO COMMON+7          SET D=1                                RFD2  0111
TRA RFD2+45                                                  RFD2  0112
CLA RFD2+107          SECTION B                              RFD2  0113
STA RFD2+33           SET SWITCH TO I                        RFD2  0114
LDQ COMMON+7          D                                      RFD2  0115
CLA COMMON+5          F SIGN WORD                            RFD2  0116
ACL COMMON+8          CONSTRUCTION WORD                      RFD2  0117
ALS 1                 PLACE D/2 IN MQ                        RFD2  0118
LRS 1                                                        RFD2  0119
DVH COMMON+7          D                                      RFD2  0120
STQ COMMON+5          PARTIALLY COMPLETED FRACTION           RFD2  0121
PXD 0,0                                                      RFD2  0122
STO COMMON+8          CLEAR CONSTRUCTION WORD                RFD2  0123
TOV RFD2+124          RESET OVERFLOW                         RFD2  0124
TRA RFD2+45                                                  RFD2  0125
ADD RFD2+148          11                                     RFD2  0126
TRA RFD2+36                                                  RFD2  0127
CPY COMMON+6          RIGHT COPY                             RFD2  0128
CLA COMMON+2          T                                      RFD2  0129
SUB RFD2+146          T-1                                    RFD2  0130
TNZ RFD2+132          IF NOT 0, STORE                        RFD2  0131
CLA RFD2+67           SET =12                                RFD2  0132
STA COMMON+2          STORE T                                RFD2  0133
LDQ COMMON+5          LEFT COPY WORD IN MQ                   RFD2  0134
LXA RFD2+5,2          IR2=2                                  RFD2  0135
LXA RFD2+21,1         IR1=9                                  RFD2  0136
PXD 0,0               CLEAR AC                               RFD2  0137
ALS 4                                                        RFD2  0138
TQP RFD2+140          IF 0, DO NOT ADD T                     RFD2  0139
ADD COMMON+2          T                                      RFD2  0140
RQL 1                                                        RFD2  0141
TIX RFD2+137,1,1      OUT AFTER 9                            RFD2  0142
ACL COMMON+5,2        ADD CHARACTER WORD SO FAR              RFD2  0143
SLW COMMON+5,2        STORE                                  RFD2  0144
TIX RFD2+135,2,1      REPEAT FOR NEXT CHARACTER WORD         RFD2  0145
TRA RFD2+9            COPY NEXT ROW                          RFD2  0146
HTR 1                 1                                      RFD2  0147
HTR 10                10                                     RFD2  0148
HTR 11                11                                     RFD2  0149
OCT 324464741140      LN10/LN2                               RFD2  0150
HTR 129               129                                    RFD2  0151
OCT 261344137677      LN2                                    RFD2  0152
OCT 200000000000      1/2                                    RFD2  0153
LDQ RFD2+25                                                  RFD2  0154
STQ RFD2+24           SET P TO PI                            RFD2  0155
SUB RFD2+147          10                                     RFD2  0156
TZE RFD2+45           IF ZERO A PLUS SIGN                    RFD2  0157
SUB RFD2+146          1                                      RFD2  0158
TZE RFD2+161          IF ZERO A MINUS SIGN                   RFD2  0159
TPL RFD2+35           IF PLUS A ZERO                         RFD2  0160
TRA RFD2+125          LESS THAN 10                           RFD2  0161
SSM                                                          RFD2  0162
STO COMMON+5          F SIGN WORD                            RFD2  0163
TRA RFD2+45           BACK TO ROUTINE                        RFD2  0164
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