Oct 31, 58

Given: fl pt no. in binary

Problem: (1) to convert to decimal using convert instructions

(2) examine no. of significant figures

$(\pm)\ 2^{\pm a} * B = (\pm)\ 10^{\pm c} \cdot D$ $\quad \log_{10} 2^a = \log_{10} 10^b$

$a(\log_{10} 2) = b = c + f$

$2^a B = 10^c D = 10^c (10^f B)$

$\left(\frac{2^a B}{10^c}\right) = D$ or $\frac{2^a B}{10^c} = 10^f D$ fractional part of power of 10.

Straight forward case: repeated div. or mpy by 10, divide by 10

for pos a $\frac{2^a B}{10^n} = R$ Test result vs 1.0, when goes before 1.0 + count up n, convert n + R separately to decimal

for neg a $(10^n)(2^a B)$ Test result vs 1.0 + count n, when goes over 1.0, take last case, convert n + R separately

Test a = 0

pos a set X=0

F LD $\mathcal{L}(2^a B)$

→ F compare $\mathcal{L}(1.0)$
BIN on less
F DIV $\mathcal{L}(10.0)$
Incr Index X by 1
Br

result decimal power c in X
D fraction in acc 48 bits
mpy by 10^{14}
convert (S) A→A B→D. gives D to 15 dec in acc

neg a set X=0

F LD $\mathcal{L}(2^a B)$
→ F compare $\mathcal{L}$ (a.t)
F MPY $\mathcal{L}$ (10)
Incr Index by 1
Br

result decimal power c in X (unsigned)
D fraction in acc 48 bits (16 on last mpy)

binary to decimal

procedure: $2^a B$

1. (Test if no. is 0 & exponent is 0, if so skip.
   Test if no is 0 & exponent isn't convert exponent only (or can go ahead as usual)

2. mpy a by $(\log_{10} 2)$ gives $n.f$ — $\log_{10} 2 \doteq (.30103)_{10} \doteq (.232101)_8$
   (n = integer, f = fraction)
   .0100110100011000

3. { divide normalized $\frac{2^a B}{10^{(n-14)}} = B\,10^{f+14}$ — a mpy or div depending on $(n-14)$ is pos, or neg.
   use n+1 to get value less than 1 (i.e. 0.f)
   or mpy normalized $(10^{14-n})\,2^a B = B\,10^{f+14}$ }

   This gives a number in the accumulator with binary point at 68.

4. − (convert single $B \to D$) (sign OK)
   15 dec. = 60 bits
   1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

5. VFL store T (can select no. of decimals wanted here)

6. (convert $S \to A$ / $B \to D$) exponent (sign carried along)

7. VFL store to T

eg: $1 \times 2^{60} = (60)(.30103) =$ 18.06180

$10^{18}(10^{.06180}) \doteq 10^{18}(1.153)$

actual value) 1.152921×10^{18}

need to use n+1 & 0.115 3

$10^f = 1.0$ to 9.9

$B = 0.1111$ to 0.1000 (1 to 0.5)

$B\,10^f = 0.5$ to 9.9

need to use (10^{f-1})

so $B\,10^{f-1} = 0.05$ to 0.99

may need to normalize

decimal to binary

$10^c \cdot D$ both c + D in decimal.

$\log_2 10^c = \log_2 2^n$

$c(\log_2 10) = n = I + f$

D in 4 bit groups.

| xxxx | xxxx | xxxx |

decimal point = 4c from 0

convert c integer wise to binary (calculate 10^{c-14})

convert D as integer with d.p. at 68 (equiv. to mpy by 10^{14})

so we have $D_2(10^{14} 2^{-48})$ in accumulator

insert exponent +48

normalize mpy by (10^{c-14})

$(D_2 10^{14} 2^0)$

result is normalized fl. point no.