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6/6/2021

CIS 17A Problem #6 Scratch Work

given A.) 3.75 B.) 0.7 C.) 89.9

#1 Convert to binary, octal, and hex

A.) $3.75_{10} \rightarrow$ 3 . C $_{16}$ hex

10 | 3 (0) : 0.75 × 16 = 12
20
3

$3.C_{16} \rightarrow$ 11 . 1100 $_2$ binary

$11.1100_2 \rightarrow$ 3 . 6 $_8$ octal

B.) $0.7_{10} \rightarrow$ 0 . B$\bar{3}$ $_{16}$ hex

$0.7_{10} \times 16 = 11.2 \Rightarrow B_{16}$
$0.2_{10} \times 16 = 3.2 \Rightarrow 3_{16}$
$0.2_{10} \times 16 = 3.2 \Rightarrow 3_{16}$ ...

$0.B\bar{3}_{16} \rightarrow$ 0 . 1011 0011 $_2$ binary

$0.1011\,0011\,0011\,0011\,0011\,0011_2 \rightarrow 0.54631_8$ octal

C.) $89.9_{10} \rightarrow$ 59 . E$\bar{6}$ $_{16}$ hex

16 | 89 (5) 80 9
16 | 5 (0) 0 5

$0.9_{10} \times 16 = 14.4 \Rightarrow E_{16}$
$0.4_{10} \times 16 = 6.4 \Rightarrow 6_{16}$
$0.4_{10} \times 16 = 6.4 \Rightarrow 6_{16}$ ...

$59.E\bar{6}_{16} \rightarrow$ 1011001 . 1110 0110 $_2$ binary

$1011001.1110\,0110\,0110\,0110_2 \rightarrow 131.71463146_3$

$\Rightarrow 131.71463_8$ octal

#2. Convert to NASA Hex Float w/ first 24 bits representing the signed fraction and the last bits representing the signed exponent.
Scaled as 0. Fraction x 2^ exponent

A.) 3.75_{10}
→ $11.1100_2 \times 2^0$
$0.111100_2 \times 2^2$

0.1 1 1 1000 | 0 0000000 | 00000002 | 00000010
= 78000002

B.) 0.7_{10}
→ $0.1011\overline{0011}_2 \times 2^0$

0.1011001 | 10011001 | 10011001 | 00000000
= 59999900

C.) 89.9_{10}
→ $1011001.\overline{1110011}_2 \times 2^0$
$0.1011001\overline{1110011}_2 \times 2^7$

0.1011001 | 11100110 | 01100110 | 00000111
= 59E66607

is initialized with the feet and inches values

#5) Convert to IEEE 754 format

A) $3.75_{10} \rightarrow 0.1111 \times 2^{2}$

$\rightarrow \underset{\text{ignore}}{1}.111_2 \times 2^{1}$

power = 1 + 127 = 128

0 (10000000) 11100000 00000000 00000000

sign | power

$\Rightarrow$ 40700000

B.) $0.7_{10} \rightarrow 0.1011\overline{0011}_2 \times 2^{0}$

$\rightarrow 1.0110011_2 \times 2^{-1}$

power = -1 + 127 = 126

0 (01111110) 01100110 01100110

$\Rightarrow$ 3F333333

C) $89.9_{10} \rightarrow 1011001.1110\overline{0110}_2 \times 2^{0}$

$\Rightarrow 1.011001111001\overline{10}_2 \times 2^{6}$

power = 6 + 127 = 133

11001 rounded up

0 (10000101) 01100111 10011001 10011101

$\Rightarrow$ 42B3CCCD