

Course: CIS-17A

Section: 48593

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- Exercise #6: (Convert to Nasa Float point Format IEEE 754)

$$a) +49.1875_{10} \rightarrow 0.1875 \times 16 = (3)$$

$$49_{10} \rightarrow 49 \overline{)16}$$

$$\begin{array}{l} 3.0625 \\ \downarrow \\ (3) \end{array} \quad \begin{array}{l} 0.0625 \times 16 = (1) \end{array}$$

$$\Rightarrow 49_{10} = 31_{16} \Rightarrow 49.1875_{10} = 31.3_{16}$$
$$0.1875_{10} = 3_{16}$$

$$31.3_{16} \Rightarrow$$
$$\begin{array}{r} 110001.0011 \\ \hline 2^5 \text{ exp.} \end{array}$$

$$49_{10} = 49 \overline{)8}$$
$$\begin{array}{l} 6.125 \\ \downarrow \\ (6) \end{array} \quad \begin{array}{l} 0.125 \times 8 = (1) \end{array}$$

$$= 61_8 \Rightarrow 0.1875 \times 8 = 1.5$$
$$0.5 \times 8 = (4)$$

$$\Rightarrow 49.1875_{10} = 61.14_8$$

Single Precision Bias: $127 + 5 = (132)$

$$\begin{array}{r} 12 \\ \hline 66 \rightarrow 0 \\ 33 \rightarrow 0 \\ 16.5 \rightarrow 1 \\ 8.0 \rightarrow 0 \\ 4.0 \rightarrow 0 \\ 2.0 \rightarrow 0 \\ 1.0 \rightarrow 0 \\ 0.5 \rightarrow 1 \end{array} = \underbrace{10000100}_{\text{Exp}}$$

$$+49.1875_{10} = 0 \overbrace{10000100}^{2^5 \text{ 132}} \overbrace{100010011000000000000000}^{\text{mantissa}} \rightarrow 4244C000_{16}$$

Nasa

$$-49.1875_{10} = 1 \overbrace{10000100}^{2^5 \text{ 132}} \overbrace{000100110000000000000000}^{\text{mantissa}} \rightarrow C244C000_{16}$$

Nasa

$$b) \pm 3.07421875_{10}$$

↓
(3)

$$\begin{aligned} 0.07421875 \times 16 &= 1.1875 \Rightarrow 0.07421875 \times 8 = 0.59375 \\ 0.1875 \times 16 &= 3 \Rightarrow 0.59375 \times 8 = 4.75 \\ & \quad 0.75 \times 8 = 6 \end{aligned}$$

$$3.07421875_{10} = 3.13_{16} = 3.0468_{16}$$

$$\begin{array}{c} \text{0011} \quad \text{0001} \quad \text{0011} \end{array} \boxed{2'}_{\text{exp.}}$$

$$1.100010011 \times 2'$$

Single Precision Bias: $127 + 1 = 128$ | 2

64 → 0
32 → 0
16 → 0
8 → 0
4 → 0
2 → 0
1 → 0
0.5 → 1

↑

Mantissa.

$$\begin{aligned} 3.07421875_{10} &= 0 \overbrace{10000000}^{2'_{128}} \overbrace{100010011000000000000000}^{\text{Mantissa}} \\ -3.07421875_{10} &= 1 \overbrace{10000000}^{2'_{128}} \overbrace{100010011000000000000000}^{\text{Mantissa}} \end{aligned}$$

↓

4044C000₁₆ NASA
C044C000₁₆ NASA

$$c) \pm 0.2_{10}$$

0

$$0.2 \times 16 = 3.2$$

$$0.2 \times 16 = 3.2 \Rightarrow$$

$$0.2 \times 16 = 3.2$$

3.2

$$0.2 \times 8 = 1.6$$

$$0.6 \times 8 = 4.8$$

$$0.8 \times 8 = 6.4$$

$$0.4 \times 8 = 3.2$$

$$0.2 \times 8 = 1.6$$

will repeat always.

$$0.2_{10} = 0.33333...3_{16} = 0.14631463...1463_8 \Rightarrow 1.1001100110011001...0011 \times 2^{-3} \text{ exp}$$

Single Precision Bias: $127 + (-3) = 124$ / 2

$$\begin{array}{l} 62 \rightarrow 0 \\ 31 \rightarrow 0 \\ 15.5 \rightarrow 1 \\ 7.5 \rightarrow 1 \\ 3.5 \rightarrow 1 \\ 1.5 \rightarrow 1 \\ 0.5 \rightarrow 1 \end{array}$$

$$\begin{array}{l} + \\ \uparrow \\ +0.2_{10} = 0 \quad \overbrace{01111100}^{2^{-3} \quad 124} \quad \overbrace{10011001100110011001100}^{\text{Mantissa}} \quad (0)1111100 \rightarrow 3E4CCCCD_{16} \\ - \\ \downarrow \\ -0.2_{10} = 1 \quad \overbrace{01111100}^{2^{-3} \quad 124} \quad \overbrace{10011001100110011001100}^{\text{Mantissa}} \rightarrow BE4CCCCD_{16} \end{array}$$

$$d) 69999902_{16} = \underbrace{0110}_{\text{Nasa}} \underbrace{1001}_2 \underbrace{1001}_3 \underbrace{1001}_4 \underbrace{1001}_6 \underbrace{1001}_3 \underbrace{0000}_{2^2} \underbrace{0010}_{2^2}$$

$$3.4cccccc$$

$$3.2314631_8$$

To decimal: $2^1 + 2^0 = 3$

$$2^2 + 2^{-5} + 2^{-6} + 2^{-9} + 2^{-10} + 2^{-13} + 2^{-14} + 2^{-17} + 2^{-18} + 2^{-21} = 29999971389_{10}$$

$$\approx 3.29999971389_{10}$$

e) $69999903_{16} \Rightarrow$ Same as before with exp = $\underbrace{0000}_{2^3} \underbrace{0011}_{2^3}$

$$0110. \underbrace{1001}_{4} \underbrace{1001}_{6} \underbrace{1001}_{3} \underbrace{1001}_{1} \underbrace{1001}_{4} \underbrace{1001}_{6} \underbrace{0}_{3}$$

To Decimal: $0110 = 6_{10}$

$$6.999999$$

$$2^1 + 2^{-4} + 2^{-5} + 2^{-8} + 2^{-9} + 2^{-12} + 2^{-13} + 2^{-16} + 2^{-17} + 2^{-20} = 5999999$$

$$6.4631463_8$$

$$6.5999999_{10}$$

f) $966667FF_{16} = \underbrace{0100}_{\text{Nasa}} \underbrace{0110}_4 \underbrace{0110}_B \underbrace{0110}_3 \underbrace{0110}_3 \underbrace{0110}_3 \underbrace{0111}_{2^{15}} \underbrace{1111}_{2^{15}} \underbrace{1111}_{2^{15}}$

4B33.33FF₁₆ To Decimal:

$$45463.147776_8$$

$$2^0 + 2^1 + 2^4 + 2^5 + 2^8 + 2^9 + 2^{12} + 2^{14} = 19251_{10}$$

$$2^{-3} + 2^{-4} + 2^{-7} + 2^{-8} + 2^{-9} + 2^{-10} + 2^{-11} + \dots + 2^{-17} = 20311737060546875_{10}$$

Decimal: 19251.203117370605_{10}