

49.1875

$$49 \Rightarrow \begin{array}{r} 128 \quad 64 \quad 32 \quad 16 \quad 8 \quad 4 \quad 2 \quad 1 \\ 0 \quad 0 \quad 0 \quad 0 \quad 0 \quad 0 \quad 0 \quad 0 \\ 0 \quad 0 \quad 1 \quad 1 \quad 0 \quad 0 \quad 0 \quad 1 \end{array} \quad \begin{array}{r} 32 \\ +16 \\ 1 \\ \hline 49 \end{array}$$

$49_{10} = 110001_2$

$$\begin{array}{r} 110001 \\ \downarrow \quad \downarrow \\ 6 \quad 1 \quad 8 \end{array}$$

$49_{10} = 61_8$

$$\begin{array}{r} 0011 \quad 0001 \\ \downarrow \quad \downarrow \\ 3 \quad 1 \quad 16 \end{array}$$

$49_{10} = 31_{16}$

0.1875  $\Rightarrow$   $0.1875 \times 2 = 0.375$   
 $0.375 \times 2 = 0.75$   
 $0.75 \times 2 = 1.5$   
 $0.5 \times 2 = 1.0$

$0.1875_{10} = 0.0011_2$

$$\begin{array}{r} 0.001 \quad 100 \\ \downarrow \quad \downarrow \\ 0.1 \quad 4 \quad 8 \end{array}$$

$0.1875_{10} = 0.14_8$

$$\begin{array}{r} 0.0011 \\ \downarrow \\ 0.3_{16} \end{array}$$

$0.1875_{10} = 0.3_{16}$

$49.1875_{10} = 110001.0011_2 = 61.14_8 = 31.3_{16}$

now use 110001.0011 to get NASA format  $\downarrow$

$0.110001.0011 \leftarrow 2^6$

$\hookrightarrow 0.1100010011$

$$\begin{array}{c|c|c|c} 0.1100010 & 01100000 & 00000000 & 00000110 \\ \hline 6 & 2 & 6 & 0 \end{array} \quad \begin{array}{c|c|c|c} 0000 & 0000 & 0000 & 0110 \\ \hline 0 & 0 & 0 & 6 \end{array} \Rightarrow 62600006 \text{ NASA format}$$

3.07421875

$$3_{10} = \begin{array}{r} 8 \quad 4 \quad 2 \quad 1 \\ 0 \quad 0 \quad 0 \quad 0 \\ 11 \end{array} \quad \begin{array}{r} 2 \\ +1 \\ \hline 3 \end{array} \quad \begin{array}{r} 3 = 11_2 \\ 10 \end{array}$$

$$\begin{array}{r} 0011_2 \\ \downarrow \\ 3_{16} \end{array}$$

$3_{10} = 3_{16}$

$$\begin{array}{r} 011_2 \\ \downarrow \\ 3_8 \end{array}$$

$3_{10} = 3_8$

0.07421875  $\times 2 = 0.1484375$   
 $0.1484375 \times 2 = 0.296875$   
 $0.296875 \times 2 = 0.59375$   
 $0.59375 \times 2 = 1.1875$   
 $0.1875 \times 2 = 0.375$   
 $0.375 \times 2 = 0.75$   
 $0.75 \times 2 = 1.5$   
 $0.5 \times 2 = 1.0$

$3.07421875_{10} =$

$$\begin{array}{c} \downarrow \\ 11.00010011_2 \\ \downarrow \\ 3.13_{16} \\ \downarrow \\ 3.046_8 \end{array}$$

use 11.00010011 to get NASA format  $\downarrow$

$0.1100010011 \leftarrow 2^2$

$$\begin{array}{c|c|c|c} 0.1100010 & 01100000 & 00000000 & 00000010 \\ \hline 6 & 2 & 6 & 0 \end{array} \quad \begin{array}{c|c|c|c} 0000 & 0000 & 0000 & 0010 \\ \hline 0 & 0 & 0 & 2 \end{array}$$

$= 62600002 \text{ NASA format}$

0.00010011  $= 0.13_{16}$

$$\begin{array}{r} 0.000 \quad 100 \quad 110 \\ \downarrow \quad \downarrow \quad \downarrow \\ 0.0 \quad 4 \quad 6 \quad 8 \end{array}$$

$0.046_8$

0.2  $\Rightarrow 0.2 \times 2 = 0.4$   $0.2_{10} = 0.0011_2$

$0.4 \times 2 = 0.8$   
 $0.8 \times 2 = 1.6$   
 $0.6 \times 2 = 1.2$   
 $0.2 \times 2 = 0.4$   
 $0.4 \times 2 = 0.8$   
 $0.8 \times 2 = 1.6$   
 $0.6 \times 2 = 1.2$   
 $0.2 \times 2 = 0.4$

$0.0011 \quad 0011 \quad 0011 \quad 0011$   
 $\downarrow \quad \downarrow \quad \downarrow \quad \downarrow$   
 $0.3 \quad 3 \quad 3 \quad 3$

$0.2_{10} = 0.3_{16}$

$0.0011 \quad 0011 \quad 0011 \quad 0011 \quad 0011 \quad 0011 \quad 011$   
 $\downarrow \quad \downarrow \quad \downarrow \quad \downarrow \quad \downarrow \quad \downarrow \quad \downarrow$   
 $0.1 \quad 4 \quad 6 \quad 3 \quad 1 \quad 4 \quad 6 \quad 3$

$0.2_{10} = 0.1463_8$

Use  $0.0011_2$  to get NASA format

$0.0011 \leftarrow 2^{-2}$

$0.110 \quad 0110 \quad | \quad 0110 \quad 0110 \quad | \quad 0110 \quad 0110 \quad | \quad 1111 \quad 1110$   
 $6 \quad 6 \quad 6 \quad 6 \quad 6 \quad 6 \quad F \quad E$

$2_{10} = 0010 \Rightarrow 0000 \quad 0010$   
 $1111 \quad 1101 \leftarrow 1's \text{ comp}$   
 $+ \quad \quad \quad \downarrow$   
 $1111 \quad 1110 \leftarrow 2's \text{ comp}$

Part b.) Negative Float Representations

$49.1875_{10} = 62600006 \text{ Float}$

$-62600006 = 9DA00006$

$9DA00006 \text{ Float}$

$6 \quad 2 \quad 6 \quad 0 \quad 0 \quad 0 \quad 0 \quad 6$   
 $0.110 \quad 0010 \quad | \quad 0110 \quad 0000 \quad | \quad 0000 \quad 0000 \quad | \quad 0000 \quad 0110$   
 $\downarrow$   
 $1001 \quad 1101 \quad | \quad 1001 \quad 1111 \quad | \quad 1111 \quad 1111 \quad | \quad 1111 \quad 1101$   
 $+ \quad 0000 \quad 0000 \quad 0000 \quad 0000 \quad 0000 \quad 0001$   
 $\downarrow$   
 $1001 \quad 1101 \quad | \quad 1010 \quad 0000 \quad | \quad 0000 \quad 0000 \quad | \quad 0000 \quad 0110$   
 $9 \quad D \quad A \quad 0 \quad 0 \quad 0 \quad 0 \quad 6$

$3.07421875_{10} = 62600002 \text{ Float}$

$-62600002 = 9DA00002$

$9DA00002 \text{ Float}$

$6 \quad 2 \quad 6 \quad 0 \quad 0 \quad 0 \quad 0 \quad 0$   
 $0.110 \quad 0010 \quad | \quad 0110 \quad 0000 \quad | \quad 0000 \quad 0000 \quad | \quad 0000 \quad 0010$   
 $\downarrow$   
 $1001 \quad 1101 \quad | \quad 1001 \quad 1111 \quad | \quad 1111 \quad 1111 \quad | \quad 1111 \quad 1101$   
 $+ \quad 0000 \quad 0000 \quad 0000 \quad 0000 \quad 0000 \quad 0001$   
 $\downarrow$   
 $1001 \quad 1101 \quad | \quad 1010 \quad 0000 \quad | \quad 0000 \quad 0000 \quad | \quad 0000 \quad 0010$   
 $9 \quad D \quad A \quad 0 \quad 0 \quad 0 \quad 0 \quad 2$

$0.2_{10} = 666666FE \text{ Float}$

$-666666FE = 99999AFE$

$99999AFE \text{ Float}$

$6 \quad 6 \quad 6 \quad 6 \quad 6 \quad 6 \quad F \quad E$   
 $0.110 \quad 0110 \quad | \quad 0110 \quad 0110 \quad | \quad 0110 \quad 0110 \quad | \quad 1111 \quad 1110$   
 $\downarrow$   
 $1001 \quad 1001 \quad | \quad 1001 \quad 1001 \quad | \quad 1001 \quad 1001 \quad | \quad 1111 \quad 1101$   
 $+ \quad 0000 \quad 0000 \quad 0000 \quad 0000 \quad 0000 \quad 0001$   
 $\downarrow$   
 $1001 \quad 1001 \quad | \quad 1001 \quad 1001 \quad | \quad 1001 \quad 1010 \quad | \quad 1111 \quad 1110$   
 $9 \quad 9 \quad 9 \quad 9 \quad 9 \quad A \quad F \quad E$

Part C.) Convert Float Rep to decimal

69999902

6 9 9 9 9 9 0 2  
0.110 1001 | 1001 1001 | 1001 1001 | 0000 0010

0.1101001  $\cdot 2^2$

11.01001  $\rightarrow$  0011.01001 1001 1001 1001 1001  
3. 4 C C C C<sub>16</sub>

$$\begin{array}{r} 0.25 \\ + 0.046875 \\ 0.0296875 \\ 0.000183 \\ 0.0000114 \\ \hline = 0.299999 \end{array} \quad \begin{array}{r} 3.4C_{16} \\ = 3.25_{10} \\ + 0.04_{10} \\ \hline = 3.3_{10} \end{array} = 69999902 \text{ float}$$

$$\begin{array}{l} 4 \times 16^{-1} = 0.25 \\ 12 \times 16^{-2} = 0.046875 \\ 12 \times 16^{-3} = 0.00296875 \\ 12 \times 16^{-4} = 0.0001831054 \\ 12 \times 16^{-5} = 0.0000114409 \end{array}$$

69999903

6 9 9 9 9 9 0 3  
0.110 1001 | 1001 1001 | 1001 1001 | 0000 0011

0.1101001  $\times 2^3$

0110.1001  $\rightarrow$  6.999999<sub>16</sub>  
6. 9<sub>16</sub>

$$\begin{array}{r} 0.5625 \\ + 0.0351 \\ 0.002197 \\ 0.0001373 \\ 0.000008583 \\ \hline = 0.59999999_{10} \end{array}$$

$$\begin{array}{r} 6.59999 \\ \rightarrow \\ = 6.6_{10} = 69999903 \text{ float} \end{array}$$

$$\begin{array}{l} 9 \times 16^{-1} = 0.5625 \\ 9 \times 16^{-2} = 0.0351 \\ 9 \times 16^{-3} = 0.002197 \\ 9 \times 16^{-4} = 0.0001373 \\ 9 \times 16^{-5} = 0.000008583 \end{array}$$

966667FF

9 6 6 6 6 7 F F  
1.001 0110 | 0110 0110 | 0110 0110 | 1111 1111

Reverse 2's comp  $\rightarrow$  1001 0110 0110 0110 0110 0110  
- 0000 0000 0000 0000 0000 0001

Reverse 1's comp  $\rightarrow$  0110 1001 1001 1001 1001 1001 | 1111 1111

0.1101001  $\times 2^{-1}$

0.0110 1001

0. 6 9<sub>16</sub>

$$\begin{array}{r} 0.375 \\ + 0.03515 \\ 0.00219 \\ 0.0001373 \\ 0.000008583 \\ \hline = 0.4125 \end{array}$$

$$966667FE \text{ float} = 0.4125_{10}$$

$$\begin{array}{l} 6 \times 16^{-1} = 0.375 \\ 9 \times 16^{-2} = 0.03515 \\ 9 \times 16^{-3} = 0.00219 \\ 9 \times 16^{-4} = 0.0001373 \\ 9 \times 16^{-5} = 0.000008583 \end{array}$$