

# Homework #1

1) 16 bit FP representation of -5.375

$$\begin{array}{l} .375 \times 2 = 0 + .75 \\ .75 \times 2 = 1 + .5 \\ .5 \times 2 = 1 + 0 \end{array} \quad \begin{array}{r} 2 \\ \sqrt{5} \\ \underline{4} \\ 1 \end{array} \quad \begin{array}{r} 101 \\ 2 \\ \sqrt{2} \\ \underline{2} \\ 0 \end{array}$$

$$\begin{array}{l} 101.011 = 1.01011 \times 2^2 \\ 2+7=9 = \text{biased exponent} \\ 1.01011 \times 10^9 = 1.01011 \times 2^{1001} \end{array} \quad \begin{array}{r} 4 \\ \sqrt{9} \\ \underline{9} \\ 0 \end{array} \quad \begin{array}{r} 2 \\ \sqrt{4} \\ \underline{4} \\ 0 \end{array} \quad \begin{array}{r} 2 \\ \sqrt{2} \\ \underline{2} \\ 0 \end{array} \quad \begin{array}{r} 2 \\ \sqrt{2} \\ \underline{2} \\ 0 \end{array}$$

$$\begin{array}{cccc} 1 & 1001 & 01011 & 000000 \\ 0xc & 0a & 0c & 0 \end{array}$$

DxCACD

2) real number equivalent of 0x3400, bias offset = 7

$$\underline{0011010000000000}$$

$$\begin{array}{l} .1 \times 2^{0110} = .1 \times 2^6 \quad 6-7=-1 \\ .1 \times 2^{-1} = (.1 \times 1) \times 2^{-1} = .1 \times 2^{-1} \end{array}$$

$$(.11)_2 = 2^{-1} + 2^{-2} = \underline{.75}$$

3) real # equivalent to FP of  $0 \times 3400$ , bias offset = 8

$0 \times 3400$

$\begin{array}{cc} 3 & 4 \\ 0011010000000000 \end{array}$

$$.1 \times 2^6 = .1 \times 2^{6-8} = .1 \times 2^{-2}$$

$$1.1 \times 2^{-2} = (.011)_2 = 2^{-2} + 2^{-5} = \boxed{.375}$$

4) Von Neumann architecture bottleneck is when we have a CPU that is really fast but we have really slow memory. Memory holds the CPU back due to how slow it is.