Comp Arch - HW3 - 10/3/16

1) $91_{10} + C6_{16}$

- Convert to binary:

$91_{10} = 64_{10} + 27_{10} = 64_{10} + 16_{10} + 8_{10} + 2_{10} + 1_{10} = 1011011_2$ (64 32 16 8 4 2 1)

$C6_{16} = \overbrace{1100_2}^{C}\ \overbrace{0110_2}^{6} = 11000110_2 = 198_{10}$

- Arithmetic in binary: (289_{10})

$$\begin{array}{r} {\scriptstyle 1\ \ 1111} \\ 01011011_2 \\ +\ 11000110_2 \\ \hline 100100001_2 \end{array}$$

- Convert to decimal:

(256 128 64 32 16 8 4 2 1)

$100100001_2 = 256_{10} + 32_{10} + 1_{10} = \boxed{289_{10}}$

2) $11_8 - 11_{10}$

$11_8 = \overbrace{001}^{1}\ \overbrace{001}^{1}{}_2 = 1001_2 = 9_{10}$

$11_{10} = 1011_{10} \Rightarrow 10101_2 = -11_{10}$ (8 4 2 1)

$9_{10} - 11_{10} = -2_{10}$

$$\begin{array}{r} {\scriptstyle 1} \\ 001001_2 \\ +\ 110101_2 \\ \hline 111110_2 \end{array} \qquad \begin{array}{r} 000001_2 \\ +\ \ \ \ \ 1_2 \\ \hline 010_2 = 2_{10} \end{array}$$

$111110_2 = \boxed{-2_{10}}$

3) $12.3125_{10} + 0110_{I2Q2}$

$12.3125_{10} = 1100.0101_{I4Q4}$ ($\frac{1}{4}$ $\frac{1}{16}$)

$$\begin{array}{r} 00011000_{I4Q4} \\ +\ 1000101_{I4Q4} \\ \hline 11011101_{I4Q4} \end{array}$$

$11011101_{I4Q4} = \overbrace{1101}^{13}\ \overbrace{1101}^{.875}$

$\boxed{13.875_{10}}$

4) $5.75_{10} - 7.125_{10}$

$5.75_{10} = 10111_{I3Q2}$

$7.125_{10} = 111001_{I3Q3} \Rightarrow 000111_{I3Q3} = -7.125_{10}$

$$\begin{array}{r} 111 \\ 0\,101110_{I4Q3} \\ +\,1\,000111_{I4Q3} \\ \hline 1\,110101_{I4Q3} \end{array} \qquad \begin{array}{r} 0001010_{I4Q} \\ 1 \\ \hline 0001011_{I4Q3} \end{array} = 1.375_{10}$$

$1110101_{I4Q3} = \boxed{-1.375_{10}}$

5) $9_{10} \cdot 3_{10}$

$9_{10} = 1001_2 \qquad 3_{10} = 0011_2 \qquad 9_{10} \times 3_{10} = 27_{10}$

$$\begin{array}{r} 1001_2 \\ \times\,0011_2 \\ \hline 1001 \\ 10010 \\ 000000 \\ +\,0000000 \\ \hline 11011 \end{array}$$

16 8 4 2 1

$11011_2 = \boxed{27_{10}}$

6) $(-5)_{10} \cdot (-6)_{16}$ $\qquad 5 \cdot 6 = 30$

Sign extend to 4x2 places

$5_{10} = 0101_2 \Rightarrow 1011_2 = -5_{10}$

$6_{16} = 0110_2 \Rightarrow 1010_2 = -6_{10}$

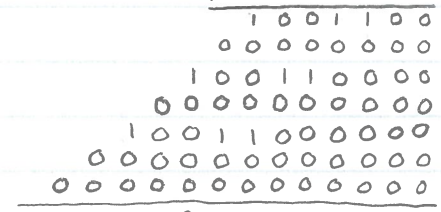
$$\begin{array}{r} 11111011_2 \\ \times\,11111010_2 \\ \hline 00000000 \\ 11111011 \\ 00000000 \\ 11111011 \\ 11111011 \\ 11111011 \\ 11111011 \\ +\,11111011 \\ \hline 0001111102 \end{array} = \boxed{30_{10}}$$

7) $9.5_{10} \cdot 2.625_{10}$

$9.5_{10} = 10011_{I4Q1}$ $\quad 2.625_{10} = 10101_{I2Q3}$

1001100_{I4Q3}

$\times 0010101_{I4Q3}$



$0001100011100_{I8Q6} = \boxed{24.9375_{10}}$

24.9375_{10}

00011000.111100_{I8Q6}

8) $(-1.25)_{10} \cdot 3.5_{10}$

$1.25_{10} = 101_{I1Q2} \Rightarrow 011_{I1Q2} = -1.25_{10}$

$3.5_{10} = 01110_{I2Q2}$

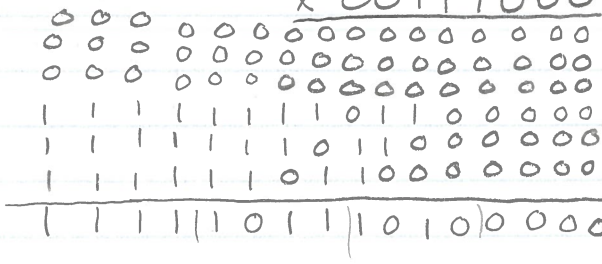
Add 1s to front for negative and zeros for positive

11101100_{I4Q4}

00011000_{I4Q4}

11101100_{I4Q4}

$\times 00011000_{I4Q4}$



$1111101110100000_{I8Q8} = \boxed{-4.375}$

CHECK

$-1.25_{10} \cdot 3.5_{10} = -4.375_{10}$

$4.375_{10} = 00000100.011_2$

$-4.375_{10} = 11111011.101_2$