CompArc HW 3

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

$91_{10} = 64_{10} + 16_{10} + 8_{10} + 2_{10} + 1_{10} = 1011011_2$

$C6_{16} = \underbrace{1100}_{C}\ \underbrace{0110}_{6} = 11000110$

$$\begin{array}{r} {\scriptstyle 1\ 1\ 1\ 1} \\ 1011011_2 \\ +\ 11000110_2 \\ \hline 100100001_2 \end{array} = 1_{10} + 32_{10} + 256_{10} = \boxed{289_{10}}$$

2) $11_8 - 11_{10} \rightarrow A - B = A + \bar{B} + 1$

$11_8 = \underbrace{001}_{1}\ \underbrace{001}_{1} = 01001_2$ | $11_{10} = 8_{10} + 2_{10} + 1_{10} = 01011_2$ ⇓invert 10100_2

$$\begin{array}{r} {\scriptstyle 1} \\ 01001_2 \\ 10100_2 \\ +\ 00001_2 \\ \hline 11110_2 \end{array}$$

⇓invert

$00001_2 + 00001_2 \Rightarrow 00010_2 = 2_{10}$ ⇑invert $\boxed{-2_{10}}$

interpret 2s complement value

3) $12.3125_{10} + 0110_{12Q2}$

$12.3125_{10} = 8_{10} + 4_{10} + 1/4_{10} + 1/16_{10} = 01100.0101_2 = 11000101$ u4Q4

$0110_{12Q2} = 01.10_2 = 00011000$ u4Q4

$$\begin{array}{r} 1100.0101_2 \\ +\ 0001.1000_2 \\ \hline 1101.1101_2 \end{array} = 8_{10} + 4_{10} + 1_{10} + 1/2_{10} + 1/4_{10} + 1/16_{10} = \boxed{13.8125_{10}}$$

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

$5.75_{10} = 4_{10} + 1_{10} + 1/2_{10} + 1/4_{10} = 101.11_2 = 0101.110$ I4Q3

$7.125_{10} = 4_{10} + 2_{10} + 1_{10} + 1/8_{10} = 111.001_2 = 0111.001$ I4Q3

$$\begin{array}{r} 0101.110 \text{ I4Q3} \\ 1000.110 \text{ I4Q3} \\ 0000.001 \text{ I4Q3} \\ \hline 1110.101 \text{ I4Q3} \end{array}$$

⇓invert

0001.010 I4Q3 $+ 0000.001 = 0001.011$ I4Q3 $= 1.011_2 = 1.375_{10}$

⇓invert

1000110

-1.375_{10}

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

$9_{10} = 8_{10} + 1_{10} = 01001_2$

$3_{10} = 2_{10} + 1_{10} = 00011_2$

$$\begin{array}{r} 1001_2 \\ \times\ 0011_2 \\ \hline 001001 \\ 010010 \\ \hline 011011_2 \end{array} = 1_{10} + 2_{10} + 8_{10} + 16_{10} = \boxed{27_{10}}$$

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

-5_{10}: $5_{10} = 4_{10} + 1_{10} = 0101_2$ convert to 2s complement $\Longrightarrow$ $1010 + 0001 = 1011_2 \rightarrow 1111\ 1011_2$

$-6_{16} = -6_{10}$ $6_{10} = 4_{10} + 2_{10} = 0110_2 \Longrightarrow 1001 + 0001 = 1010_2 \rightarrow 1111\ 1010_2$

$$\begin{array}{r} 1111\ 1011 \\ 1111\ 1010 \\ \hline 00000\ 0000 \\ 11111\ 0110 \\ 00000\ 0000 \\ 11111\ 0110 \\ 11111\ 0110 \\ 11111\ 0110 \\ 11111\ 0110 \\ \hline 00011110 \end{array}$$

only care about these 8 bits

$= \boxed{30_{10}}$

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

$9.5_{10} = 8_{10} + 1_{10} + 1/2_{10} = 1001.1_2 = 01001.100$ U4Q3

$2.625_{10} = 2_{10} + 1/2_{10} + 1/8_{10} = 10.101_2 = 00010.101$ U4Q3

```
        1001.1000    U4Q4
        0010.1010
    -----------------
00000000.00000000
00000001.00110000
00000000.00000000
00000100.11000000
00000000.00000000
00010011.00000000
00000000.00000000
00000000.00000000
-----------------
00011000.11110000   ← U8Q8
```

$= 24.9375_{10}$

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

$-1.25_{10} = -2_{10} + 3/4_{10} = (1101 + 1) + 0.11 = 1110.1100_2$

$3.5_{10} = 1_{10} + 2_{10} + 1/2_{10} = 011.1_2 = 0011.1000_2$

```
          1110.1100        I4Q4
          0011.1000
    -----------------------
0000 0000 . 0000 0000
0000 0000 . 0000 0000
0000 0000 . 0000 0000
1111 1111 . 0110 0000
1111 1110 . 1100 0000
1111 1101 . 1000 0000
0000 0000 . 0000 0000
0000 0000 . 0000 0000
---------------------------
111111 1011 . 1010 0000
```

$1011.1010_2 = -5_{10} + 1/2_{10} + 1/8_{10} = -4.375_{10}$