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Comp Arch HW3

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

$91_{10} \Rightarrow 2\overline{)91}$ 45 R1 | $2\overline{)45}$ 22 R1 | $2\overline{)22}$ 11 R0 | $2\overline{)11}$ 5 R1 | $2\overline{)5}$ 2 R1 | $2\overline{)2}$ 1 R0 | $2\overline{)1}$ 0 R1

$91_{10} = 1011011_2$

$C6_{16} \Rightarrow 1100\ \ 0110_2$

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

$2^8 + 2^5 + 2^0 = 256 + 32 + 1 = \boxed{289_{10}}$

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

$11_8 \Rightarrow 001\ \ 001_2 \Rightarrow 01001_2 \quad (= 9_{10})$

$11_{10} \Rightarrow 1011_2 \Rightarrow 01011_2 \quad (= 11_{10})$

$A - B = A + \overline{B} + 1$

$-11_{10} = 10100 + 00001 = 10101_2$

$$\begin{array}{r} A - B = \quad 01001_2 \\ +\ 10101_2 \\ \hline 11110_2 \end{array} \Rightarrow \text{take 2's complement b/c result is neg}$$

$$\begin{array}{r} 00001 \\ +\ 00001 \\ \hline 00010 \end{array} \Rightarrow \boxed{-2_{10}}$$

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

$12.3125_{10} \Rightarrow 2^3 + 2^2 + 2^{-2} + 2^{-4}$

$= 1100\ 0101_{I4Q4}$

$0110_{I2Q2} \Rightarrow 0001\ 1000_{I4Q4}$

$1100\ 0101_{I4Q4}$
$0001\ 1000_{I4Q4}$
$1101\ 1101_{I4Q4}$

$= 2^3 + 2^2 + 2^0 + 2^{-1} + 2^{-2} + 2^{-4}$
$= 8 + 4 + 1 + 0.5 + 0.25 + 0.0625$
$= \boxed{13.8125_{10}}$

0.5000
0.250_0
0.0625
0.8125

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

$101\ 110_{I3Q3} - 111\ 001_{I3Q3}$

$A - B = A + \overline{B} + 1$

$\overline{B} \Rightarrow 000110 + 1$
$= 000111$

101110
$+000111$
110101_2 → 2's comp to find dec neg #

$\Rightarrow 001010 + 1$
$= 001011_{I3Q3}$
$= -(2^0 + 2^{-2} + 2^{-3})$
$= \boxed{-1.375_{10}}$

0.250
$+0.125$
0.375

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

$9_{10} \Rightarrow 1001_{10}$

$3_{10} \Rightarrow 0011_{10}$

$$\begin{array}{r} 1001 \\ \times\ 0011 \\ \hline 1001 \\ 1001 \\ \hline 00011011_2 \end{array}$$

$2^4 + 2^3 + 2^1 + 2^0$

$= 16 + 8 + 2 + 1$

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

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

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

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

$$\begin{array}{r} 1011 \quad I_4 \\ \times\ 1010 \quad I_4 \\ \hline 00000000 \\ 11101110 \\ 00000000 \\ 11011000 \\ \hline 01100110 \quad I8 \end{array}$$

→ 2's comp

00110001 +1

00110010

$= 2^5 + 2^4 + 2^1$

$= 32 + 16 + 2$

$= 48 + 2$

$= 50 \Rightarrow ?$

7. $9.5_{10} + 2.625_{10}$

1001 100 . 0010 101 I4Q3

1001 100
0010 101
1001 100
00000 00
1001100
0000000
1001100
1100 1111 100

⇒ 00011000 111100 I8Q6

$2^4 + 2^3 + 2^{-1} + 2^{-2} + 2^{-3} + 2^{-4}$

16 + 8 + 0.5 + 0.25 + 0.125 + 0.0625

= 24.9375_{10}

0.5000
0.2500
0.1250
0.0625
0.9375

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

1.25_{10} = 001 01 I_3Q_2

-1.25 = 11011 I3Q2

3.5_{10} = 01110 I3Q2

11011 I3Q2
x 01110 I3Q2
0000000000
11111011
11111011
11111011
1111011
1 1 1 0 1 1 1 0 1 0 I6Q4

111 011 1010

↳ 2's comp

⇒ 000100 0101 +1

000100 0110 I6Q4

0.250
0.125
0.375

$-(2^2 + 2^{-2} + 2^{-3})$

-4.375_{10}