EIE2050 Assignment 1

1

(a)

$$(100001)_2 = 2^5 + 2^0 = (33)_{10}$$

(b)

$$(100111)_2 = 2^5 + 2^2 + 2^1 + 2^0 = (39)_{10}$$

(c)

$$(101010)_2 = 2^5 + 2^3 + 2^1 = (42)_{10}$$

(d)

$$(111001)_2 = 2^5 + 2^4 + 2^3 + 2^1 = (57)_{10}$$

(e)

$$(1100000)_2 = 2^6 + 2^5 = (96)_{10}$$

(f)

$$(11111101)_2 = (100000000 - 1 - 10)_2 = 2^8 - 1 - 2^1 = (253)_{10}$$

(g)

$$(11110010)_2 = (100000000 - 1 - 1101)_2 = 2^8 - 1 - 2^3 - 2^2 - 2^0 = (242)_{10}$$

(h)

$$(11111111)_2 = (100000000 - 1)_2 = 2^8 - 1 = (255)_{10}$$

2

(a)

$$
\begin{array}{c|l}
 & .76 \\
1 & .52 \\
1 & .04 \\
0 & .08 \\
0 & .16 \\
0 & .32 \\
\vdots & \vdots
\end{array}
\qquad (0.76)_{10} \approx (0.11000)_2
$$

(b)

$$
\begin{array}{c|l}
 & .456 \\
0 & .912 \\
1 & .824 \\
1 & .648 \\
1 & .296 \\
0 & .592 \\
\vdots & \vdots
\end{array}
\qquad (0.456)_{10} \approx (0.01110)_2
$$

(c)

$$
\begin{array}{c|l}
 & .8732 \\
1 & .7464 \\
1 & .4928 \\
0 & .9856 \\
1 & .9712 \\
1 & .9424 \\
\vdots & \vdots
\end{array}
\qquad (0.8732)_{10} \approx (0.11011)_2
$$

3

(in binary arithmetic)

(a)

$$
\begin{array}{r}
11 \div 11 = 1 \cdots 0 \\
(0 \times 10 + 0) \div 11 = 0
\end{array}
\implies 110 \div 11 = \boxed{10}
$$

(b)

$$
\begin{array}{r}
10 \div 10 = 1 \cdots 0 \\
(0 \times 10 + 1) \div 10 = 0 \cdots 1 \\
(1 \times 10 + 0) \div 10 = 1
\end{array}
\implies 1010 \div 10 = \boxed{101}
$$

(c)

$$
\begin{array}{r}
111 \div 101 = 1 \cdots 10 \\
(10 \times 10 + 1) \div 101 = 1
\end{array}
\implies 1111 \div 101 = \boxed{11}
$$

4

(a)

With 8-bits, the additive inverse of $(10011001)_2$ is

$$(100000000 - 10011001)_2 = (01100111)_2 = (103)_{10}$$

Therefore the decimal value of 10011001 (in 2's complement) is $\boxed{-103.}$

(b)

Sign bit is 0. Positive number has itself as 2's complement:

$$(01110100)_2 = (116)_{10}$$

Therefore the decimal value of 01110100 (in 2's complement) is $\boxed{116.}$

(c)

The additive inverse of $(10111111)_2$ in 8-bits is

$$(100000000 - 10111111)_2 = (01000001)_2 = (65)_{10}$$

Therefore the decimal value of 10111111 (in 2's complement) is $\boxed{-65.}$

5

(in binary arithmetic)

(a)

$$\begin{aligned} &(-1)^1 \times 1.01001001110001 \times 10^{(10000001-01111111)} \\ = &\boxed{-1.01001001110001 \times 10^2} \end{aligned}$$

(b)

$$\begin{aligned} &(-1)^0 \times 1.100001111101001 \times 10^{(11001100-01111111)} \\ = &\boxed{1.100001111101001 \times 10^{77}} \end{aligned}$$

6

(in binary arithmetic)

(a)

$$\begin{array}{rr} \text{Bor} & 0\,0000\,000 \\ & 0011\,0011 \\ - & 0001\,0000 \\ \hline & \boxed{0010\,0011} \end{array}$$

(b)

$$\begin{array}{rr} \text{Bor} & 1\,1111\,000 \\ & 0110\,0101 \\ - & 1110\,1000 \\ \hline & \boxed{0111\,1101} \end{array}$$

7

(in hexadecimal arithmetic)

(a)

$$\begin{array}{rr} \text{Bor} & 1 \\ & 60 \\ - & 39 \\ \hline & \boxed{27} \end{array}$$

(b)

$$\begin{array}{rr} \text{Bor} & 1 \\ & A5 \\ - & 98 \\ \hline & \boxed{D} \end{array}$$

(c)

$$\begin{array}{rr} \text{Bor} & 1 \\ & F1 \\ - & A6 \\ \hline & \boxed{4B} \end{array}$$

(d)

$$\begin{array}{rr} \text{Bor} & 0 \\ & AC \\ - & 1\,0 \\ \hline & \boxed{9C} \end{array}$$

8

(a)

$$4 = (0100)_{\text{BCD}}; 3 = (0011)_{\text{BCD}}$$
$$4 + 3 = (0111)_{\text{BCD}}$$

(b)

$$5 = (0101)_{\text{BCD}}; 2 = (0010)_{\text{BCD}}$$
$$5 + 2 = (0111)_{\text{BCD}}$$

(c)

$$6 = (0000\ 0110)_{\text{BCD}}; 4 = (0000\ 0100)_{\text{BCD}}$$
$$6 + 4 = (0000\ 1010)_2 \overset{+0110}{=} (0001\ 0000)_{\text{BCD}}$$

(d)

$$17 = (0001\ 0111)_{\text{BCD}}; 12 = (0001\ 0010)_{\text{BCD}}$$
$$17 + 12 = (0010\ 1001)_{\text{BCD}}$$

(e)

$$28 = (0010\ 1000)_{\text{BCD}}; 23 = (0010\ 0011)_{\text{BCD}}$$
$$28 + 23 = (0100\ 1011)_2 \overset{+0110}{=} (0101\ 0001)_{\text{BCD}}$$

(f)

$$65 = (0110\ 0101)_{\text{BCD}}; 58 = (0101\ 1000)_{\text{BCD}}$$
$$65 + 58 = (1011\ 1101)_2 \overset{+0110\ 0110}{=} (0001\ 0010\ 0011)_{\text{BCD}}$$

(g)

$$113 = (0001\ 0001\ 0011)_{\text{BCD}}; 101 = (0001\ 0000\ 0001)_{\text{BCD}}$$
$$113 + 101 = (0010\ 0001\ 0100)_{\text{BCD}}$$

(h)

$$295 = (0010\ 1001\ 0101)_{\text{BCD}}; 157 = (0001\ 0101\ 0111)_{\text{BCD}}$$
$$295 + 157 = (0011\ 1110\ 1100)_2 \overset{+0110\ 0110}{=} (0100\ 0101\ 0010)_{\text{BCD}}$$

9

Hello. How are you?

10

(a) and **(c)** are in error because parity is even (6 and 8).