ESC 201 Assignment 9 Solutions

Ans 1. (a) $(1010.011)_2$

$= (1 \times 2^3) + (0 \times 2^2) + (1 \times 2^1) + (0 \times 2^0) + (0 \times 2^{-1}) + (1 \times 2^{-2}) + (1 \times 2^{-3})$

$= 8 + 0 + 2 + 0 + 0.25 + 0.125$

$= 10.375$

(b) $(FA)_{16}$

$= (15 \times 16^1) + (10 \times 16^0)$

$= 240 + 10$

$= 250$

(c) $(101110101101)_2$

$= (1011)(1010)(1101)$

$= (BAD)_{Hex}$

(d) $(FA)_{16}$

$= (1111)(1010)$

$= 11111010$

Ans 2.

	27	remainder
2	13	1
2	6	1
2	3	0
2	1	1
2	0	1

$\therefore 27 = 11011$

0.25		
0.	5	x2
1.	0	x2

$\therefore 0.25 = (.01)_2$

$\therefore (27.25)_{10} = (11011.01)_2$

Ans 3. Largest binary number that can be represented using 8 bits is $(11111111)_2 = 255$

Let the number of bits be n. The largest binary number using these 8 bits is

$$2^{n-1} + 2^{n-2} + 2^{n-3} + \ldots + 2^1 + 1$$

$$= 2^n - 1$$

From the given condition,

$$2^n - 1 \geq 10^6$$

$$\therefore n \geq \log_2(10^6 + 1)$$

$$\therefore n = 20.$$

Ans 4. (a) $24 + 17 = 40$

Let the number system be x.

$$\therefore 2x^1 + 4x^0 + 1x^1 + 7x^0 = 4x^1 + 0$$

$$\Rightarrow 2x + 4 + x + 7 = 4x$$

$$\Rightarrow 11 = 4x - 3x$$

or $x = 11$

(b) $22 \times 5 = 132$

Let the number system be x.

$$\therefore (2x^1 + 2x^0)(5x^0) = (1x^2 + 3x^1 + 2x^0)$$

$$\Rightarrow (2x+2)(5) = (x^2 + 3x + 2)$$

$$\Rightarrow 10x + 10 = x^2 + 3x + 2$$

$$\Rightarrow x^2 - 7x - 8 = 0$$

$$\Rightarrow x^2 - 8x + x - 8 = 0$$

$\Rightarrow x(x-8)+1(x-8)=0$

$\Rightarrow (x+1)(x-8)=0$

$x=-1$ is inadmissible.

$\therefore x=8$

Ans 5. (a) 10000000

1's complement : 01111111

2's complement : 10000000

(b) 10101010

1's complement : 01010101

2's complement : 01010110

(c) 01110101

1's complement : 10001010

2's complement : 10001011

(d) 10011100

1's complement : 01100011

2's complement : 01100100

Ans 6. (a) $(32)_{10} = (100000)_2 = (0100000)_2$

↳ for sign.

For -32, take 2's complement of +32

$(-32)_{10} = (1100000)_2$

(b) Since the sign bit is 1, the number is negative. 2's complement of 11011111 is 00100001.

$(00100001)_2 = (33)_{10}$

Ans 7. $(+32)_{10} = (00100000)_2$

$(-32)_{10} = (11100000)_2$

$(+24)_{10} = (00011000)_2$

$(-24)_{10} = (1110\,1000)_2$

+32 +24:

$$\begin{array}{r} 00100000 \\ +\ 00011000 \\ \hline 00111000 \end{array}$$

= 56

-32 +24

$$\begin{array}{r} 11100000 \\ +\ 00011000 \\ \hline 11111000 \end{array}$$

This is a negative number.
2's complement of 11111000
= 00001000 = 8

-32 -24

$$\begin{array}{r} 11100000 \\ +\ 11101000 \\ \hline 111001000 \end{array}$$

This is a negative number.
2's complement of 111001000
= 00011000 = 56

+32 -24

$$\begin{array}{r} 00100000 \\ +\ 11101000 \\ \hline 100001000 \end{array}$$

= 8

Ans 8. $x + \bar{x}y$

$= (x+\bar{x}).(x+y)$ [P3: $x(y+z) = xy + xz$]

$= 1 \cdot (x+y)$ [P4: $x + \bar{x} = 1$]

$= x + y$

Ans 9. (a) $f=(x+y).(x\bar{y}+\bar{x})$

$\Rightarrow f = x\bar{y} + x.\bar{x} + y.\bar{y} + y.\bar{x}$

$\Rightarrow f = x\bar{y} + y\bar{x}$

(b) $f = ABCD + \bar{A}BD + AB\bar{C}D$

$\Rightarrow f = ABD(C+\bar{C}) + \bar{A}BD$

$\Rightarrow f = ABD + \bar{A}BD$

$\Rightarrow f = BD(A+\bar{A})$

$\Rightarrow f = BD$

Ans 10. $f = (x.y+z)(y+x.z)$

x	y	z	$x.y+z$	$y+x.z$	f
0	0	0	0	0	0
0	0	1	1	0	0
0	1	0	0	1	0
0	1	1	1	1	1
1	0	0	0	0	0
1	0	1	1	1	1
1	1	0	1	1	1
1	1	1	1	1	1

SOP : $f = \bar{x}.y.z + x.\bar{y}.z + x.y.\bar{z} + xyz$

POS : $f = (\bar{x}+y+z).(x+\bar{y}+z).(x+y+\bar{z}).(x+y+z)$