UNIVERSITY OF ZAMBIA

SCHOOL OF ENGINEERING

DEPARTMENT OF ELECTRICAL ENGINEERING.

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COURSE : EEE 3131

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Question 1 :

(a) 13.375

2 | 13	
6	1
3	0
1	1
0	1

$0.375 \times 2 = 0.75 \quad 0$

$0.75 \times 2 = 1.50 \quad 1$

$0.5 \times 2 = 1.0 \quad 1$

⇒ 1101.011

(b) 74.25

2 | 74	
37	0
18	1
9	0
4	1
2	0
1	0
0	1

$0.25 \times 2 = 0.5 \quad 0$

$0.5 \times 2 = 1.0 \quad 1$

⇒ 1001010.01

= 01 001 010.010

1 1 2 . 2

⇒ 112.2$_8$

(c) Excess 3 code. (287).

287 = 5 6 10

2 | 5	
2	1
1	0
0	1

0101

2 | 6	
3	0
1	1
0	1

0110

2 | 10	
5	0
2	1
1	0
0	1

1010

⇒ 0101 0110 1010

#

Question 2.

(a) 165F

1	6	5	F
0001	0110	0101	1111

⇒ 0001011001011111

(b) 0001011001011111

= 0001110101110000 = Gray code

(c) 0001011001011111

$0\,0\,0\,2^{12}\,0\,2^{10}\,2^{9}\,0\,0\,2^{6}\,0\,2^{4}\,2^{3}\,2^{2}\,2^{1}\,2^{0}$

5727 ⇒ Decimal equivalent.

(d) 5727_{10}

0101 0111 0010 0111

Question 3.

(a) 25

2	25
	12 1
	6 0
	3 0
	1 1
	0 1

= 11001

= 00011001

= 11100110 + 1 = 11100111 -2's compliment

-17

2	17
	8 1
	4 0
	2 0
	1 0
	0 1

= -10001 => -00010001

= 11101110 + 1

=> 11101111 - 2's compliment.

(b) 25 - 17.

= 00011001

+ 11101111

100001000

= 00001000 ans.

(c) $-(2^{n-1}) \leq x \leq 2^{n-1} - 1$

Range = $-32\,768 \leq x \leq 32\,767$ ans.

Question 4.

(a) $(13.5)_{10} \times (2.5)_{10}$

$$\begin{array}{r} 13.5 \\ \times\ 2.5 \\ \hline 675 \\ 270 \\ \hline 33.75 \end{array}$$

2 | 13	$0.5 \times 2 = 1.0$ ↑
6 1	
3 0	
1 1	
0 1	

$\Rightarrow 1101.1$

2 | 2	$0.5 \times 2 = 1.0$
1 0	
0 1	

10.1

Binary Multiplication.

$$\begin{array}{r} 1101.1 \\ \times\ 10.1 \\ \hline 11011 \\ 00000\ 0 \\ +\ 11011\ 1 \\ \hline 100001.11 \end{array}$$ ans.

$$\begin{array}{r|l} 10.1 & 1.101 \\ \hline 100.0001 & \\ -\ 101 & \\ \hline 110 & \\ -\ 101 & \\ \hline 101 & \\ -\ 101 & \\ \hline 0 & \end{array}$$

$\Rightarrow 1.101_2$

Question 5.

(a) $11100_2 + 10011_2 = 101111_2$

(b) $101_2 - 11_2 = 010_2$

(c)
$$\begin{array}{r} 111 \\ \times\ 101 \\ \hline 111 \\ 000 \\ +\ 111 \\ \hline 10011_2 \end{array}$$

Question 6.

(a) (i) 1111_2

Binary = 1010

(ii) 1000_2

Binary = 1111

(iii) 1110_2

Binary = 1011

(iv) 1101_2

Binary = 1001

(v) 1001_2

Binary = 1110