

Assignment 1

Date:

Q1(a) - 83

Sol Consider 83

$$\begin{array}{r} 2 \quad 83 \\ 2 \quad 41 \quad 1 \\ 2 \quad 20 \quad 1 \\ 2 \quad 10 \quad 0 \\ 2 \quad 5 \quad 0 \\ 2 \quad 2 \quad 1 \\ 1 \quad 0 \end{array}$$

Ans $(83)_8 = (1010011)_2$

For SMF: $(1.1010011)_2$

Answer

b) +101

$$(101)_8 = (01100101)_2$$

$$\begin{array}{r} 2 \mid 101 \\ 2 \quad 50 \quad 1 \\ 2 \quad 25 \quad 0 \\ 2 \quad 12 \quad 1 \\ 2 \quad 6 \quad 0 \\ 2 \quad 3 \quad 0 \\ 1 \quad 1 \end{array}$$

Q-103

Sol consider +103

$$(103)_8 = (1100111)_2$$

$$\begin{array}{r} 2 \mid 103 \\ 2 \quad 51 \quad 1 \end{array}$$

$$(-103)_8 = (11100111)_2$$

$$\begin{array}{r} 2 \quad 25 \quad 1 \end{array}$$

Ans

$$\begin{array}{r} 2 \quad 12 \quad 1 \\ 2 \quad 6 \quad 0 \\ 2 \quad 3 \quad 0 \\ 1 \quad 1 \end{array}$$

QUESTION 2-

(Q2), (a) -69

Sol Consider +69

$$69 = 1000101$$

$$69 = (01000101)_2$$

$$\begin{array}{r} 2 | 69 \\ 2 \quad 34 \quad 1 \\ 2 \quad 17 \quad 0 \\ 2 \quad 8 \quad 1 \\ 2 \quad 4 \quad 0 \\ \quad \quad 2 \quad 0 \\ \quad \quad \quad 0 \end{array}$$

1's complement form -

$$(10111010)_2$$

Ans

(b) +116

Sol

$$116 = (01110100)_2$$

1's complement - $(01110100)_2$

$$\begin{array}{r} 2 | 116 \\ 2 \quad 58 \quad 0 \\ 2 \quad 29 \quad 0 \\ 2 \quad 14 \quad 1 \\ 2 \quad 7 \quad 0 \\ 2 \quad 3 \quad 1 \\ \quad \quad 1 \end{array}$$

(c) -99

Sol

$$+99 = (01100011)_2$$

1's complement - $(10011100)_2$ Ans

$$\begin{array}{r} 2 | 99 \\ 2 \quad 49 \quad 1 \\ 2 \quad 24 \quad 1 \\ 2 \quad 12 \quad 0 \\ 2 \quad 6 \quad 0 \\ 2 \quad 3 \quad 0 \\ \quad \quad 1 \end{array}$$

QUESTION 3

(Q3) (a) -59

$$\begin{array}{r} 2 \mid 59 \\ 2 \quad 29 \\ \quad 2 \quad 14 \\ \quad \quad 2 \quad 7 \\ \quad \quad \quad 0 \end{array}$$

$$+59 = (00\ 111\ 011)_2$$

$$2^7 \text{ complement} = 11000100$$

$$\begin{array}{r} 2 \quad 3 \quad 1 \\ +1 \\ \hline 11000101 \end{array}$$

Answer

(b) +102

$$102 = (0110\ 0110)_2$$

Answer

$$\begin{array}{r} 2 \mid 102 \\ 2 \quad 51 \quad 0 \\ 2 \quad 25 \quad 1 \\ 2 \quad 12 \quad 1 \\ 2 \quad 6 \quad 0 \\ 2 \quad 3 \quad 0 \\ \quad \quad 1 \quad 1 \end{array}$$

(c) -116

Sol

$$+116 = (0111\ 0100)_2$$

$$\begin{array}{r} 2 \mid 116 \\ 2 \quad 58 \quad 0 \end{array}$$

$$2^7 \text{ complement} = 1000\ 1011$$

$$\begin{array}{r} +1 \\ \hline 10001100 \end{array}$$

$$\begin{array}{r} 2 \quad 29 \quad 0 \\ 2 \quad 14 \quad 1 \\ 2 \quad 7 \quad 0 \\ 2 \quad 3 \quad 1 \\ \quad \quad 1 \quad 1 \end{array}$$

Question 4

(Q4) (a) 10011101

Sol

MSB is 1 then sign is (-)

=>

$$\Rightarrow 2^4 + 2^3 + 2^2 + 2^1 = 16 + 8 + 4 + 1 \Rightarrow 29$$

$\Rightarrow (-29)_{10}$ Ans

(b) 0110100

Sol

MSB is 0 then sign is +ve

$$\Rightarrow 2^6 + 2^5 + 2^4 + 2^2 \Rightarrow 64 + 32 + 16 + 4$$

$\Rightarrow (116)_{10}$ Ans

(c) 10111011

Sol

MSB is 1, then sign is (-ve)

$$\Rightarrow 2^5 + 2^4 + 2^3 + 2^1 + 2^0$$

$$\Rightarrow 32 + 16 + 8 + 2 + 1$$

$\Rightarrow (-59)_{10}$ Answers

QUESTION 5.

(Q.5) a) 10111001

Sol

$$\Rightarrow -2^7 + 2^5 + 2^4 + 2^3 + 2^0$$

$$\Rightarrow -128 + 32 + 16 + 8 + 1$$

$$\Rightarrow -71 + 1$$

$$\Rightarrow (-70)_8 \text{ Answer}$$

(b) 01100100

Sol

$$\Rightarrow 2^6 + 2^5 + 2^2$$

$$\Rightarrow 64 + 32 + 4 \Rightarrow (100)_8 \text{ Answer}$$

(c) 1011101

Sol

$$\Rightarrow -2^7 + 2^5 + 2^4 + 2^3 + 2^2 + 2^0$$

$$\Rightarrow -128 + 32 + 16 + 8 + 4 + 1$$

$$\Rightarrow -67 + 1$$

$$\Rightarrow (-66)_8 \text{ Answer}$$

QUESTION 6

(a) 10111011

Sol~~-128+~~

$$-2^7 + 2^5 + 2^4 + 2^3 + 2^1 + 2^0$$

$$-128 + 32 + 16 + 8 + 2 + 1$$

$$\Rightarrow (-69)_8 \text{ Answer}$$

(b) 01010100

Sol

$$+ 2^6 + 2^4 + 2^2$$

$$\Rightarrow 32 + 16 + 4 \Rightarrow (52)_8 \text{ Answer}$$

$$\Rightarrow 64 + 16 + 4 = (84)_8 \text{ Answer}$$

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(e) 10011000 SolSol

$$= -2^9 + 2^4 + 2^3$$

$$\Rightarrow -128 + 16 + 8.$$

$$\Rightarrow (-104)_{10}$$

Answer

QUESTION 7(a) -38 and -27 Sol

$$(38)_8 = (00100110)_2$$

$$-38 = (11011010)_2$$

$$\begin{array}{r} 2 \mid 38 \\ 2 \quad 19 \quad 0 \end{array}$$

$$\begin{array}{r} 2 \quad 9 \quad 1 \\ 2 \quad 4 \quad 1 \end{array}$$

$$\begin{array}{r} 2 \quad 2 \quad 0 \\ 1 \quad 0 \end{array}$$

$$(27)_8 = (00011011)_2$$

$$(-297) = (111001001)_2$$

Adding

$$\begin{array}{r} 11011010 \\ + 11100101 \\ \hline 10111111 \end{array}$$

$$\begin{array}{r} 2 \mid 27 \\ 2 \quad 13 \quad 1 \end{array}$$

$$\begin{array}{r} 2 \quad 6 \quad 1 \\ 2 \quad 3 \quad 0 \end{array}$$

$$\begin{array}{r} 1 \quad 1 \end{array}$$

$$\Rightarrow \text{Answer} = (10111111)_2$$

$$(b) \ 59 \stackrel{?}{=} 39$$

Sol

$$59 = (00111011)_2$$

$$39 = (00100111)_2$$

$$-39 = (11011001)_2$$

$$\begin{array}{r} 2 | 59 \\ 2 | 29 \quad 1 \end{array}$$

$$\begin{array}{r} 2 | 14 \quad 1 \\ 2 | 7 \quad 0 \end{array}$$

$$\begin{array}{r} 2 | 3 \quad 1 \\ 1 \quad 1 \end{array}$$

Addition... 1 1 1 1 1

$$\begin{array}{r} 00111011 \\ + 11011001 \\ \hline 00010100 \end{array}$$

$$\text{Answer} = (00010100)_2$$

$$\begin{array}{r} 2 | 39 \\ 2 | 19 \quad 1 \\ 2 | 9 \quad 1 \\ 2 | 4 \quad 1 \\ 2 | 2 \quad 0 \\ , 0 \end{array}$$

$$(d) -102 \stackrel{?}{=} -85$$

Sol

$$(-102)_8 = (01100110)_2$$

$$(-102)_2 = (10011010)_2$$

$$85 = 01010101$$

$$-85 = (10101011)_2$$

$$\begin{array}{r} 2 | 102 \\ 2 | 51 \quad 0 \\ 2 | 25 \quad 10 \end{array}$$

$$\begin{array}{r} 2 | 12 \quad 1 \\ 2 | 6 \quad 0 \end{array}$$

$$\begin{array}{r} 2 | 3 \quad 0 \end{array}$$

$$\begin{array}{r} 1 \quad 1 \end{array}$$

$$\begin{array}{r} 10011010 \\ + 10101011 \\ \hline 01000101 \end{array}$$

$$\begin{array}{r} 2 | 85 \\ 2 | 42 \quad 1 \\ 2 | 21 \quad 0 \end{array}$$

$$\begin{array}{r} 2 | 10 \quad 1 \\ 2 | 5 \quad 0 \end{array}$$

$$\begin{array}{r} 2 | 2 \quad 1 \\ 1 \quad 0 \end{array}$$

Overflow error.

c) -58 and 65

Sol:

(considers 58)

$$58 = 0111010$$

$$-58 = (11000110)_2$$

$$\begin{array}{r} 2 | 58 \\ 2 \quad 29 \quad 0 \\ 2 \quad 14 \quad 1 \\ 2 \quad 7 \quad 0 \\ 2 \quad 3 \quad 1 \\ \hline 1 \quad 1 \end{array}$$

$$65 \rightarrow (01000001)_2$$

Add

$$\begin{array}{r} 11000110 \\ + 01000001 \\ \hline 00000111 \end{array}$$

$$\begin{array}{r} 2 | 65 \\ 2 \quad 32 \quad 1 \\ 2 \quad 16 \quad 0 \\ 2 \quad 8 \quad 0 \\ 2 \quad 4 \quad 0 \\ 2 \quad 2 \quad 0. \end{array}$$

$$\text{Answer} = (00000111)_2$$

1 0

c) 29 and -72

Sol:

$$+72 = (01001000)_2$$

$$-72 = (10111000)_2$$

$$29 = (00011101)_2$$

$$\begin{array}{r} 2 | 72 \\ 2 \quad 36 \quad 0 \\ 2 \quad 18 \quad 0 \\ 2 \quad 9 \quad 0 \\ 2 \quad 4 \quad 1 \\ 2 \quad 2 \quad 0. \end{array}$$

Add

$$\begin{array}{r} 10111000 \\ + 00011101 \\ \hline (11010101)_2 \quad \text{Answer} \end{array}$$

$$\begin{array}{r} 2 | 29 \\ 2 \quad 14 \quad 1 \\ 2 \quad 7 \quad 0 \\ 2 \quad 3 \quad 1 \\ \hline 1 \quad 1 \end{array}$$

(QUESTION) 8

a) $(4226)_{10}$

S.O.L

$$\begin{aligned}
 4226 &= (4 \times 16^3) + (2 \times 16^2) + (2 \times 16^1) + (6 \times 16^0) \\
 &= (4 \times 4096) + (2 \times 256) + (32) + (6) \\
 &= 16384 + 512 + 32 + 6 \\
 &= (16934)_{10} \text{ Answer}
 \end{aligned}$$

(b) $(6426)_{10}$

S.O.L

$$\begin{aligned}
 6426 &= (6 \times 16^3) + (4 \times 16^2) + (2 \times 16^1) + (6 \times 16^0) \\
 &= (6 \times 4096) + (4 \times 256) + (2 \times 16) + 6 \\
 &= 24576 + 1024 + 32 + 6 \\
 &= \cancel{25638} \cdot (25638)_{10} \text{ Answer}
 \end{aligned}$$

(c) $2B26$

$$\begin{aligned}
 2B26 &= (2 \times 16^3) + (11 \times 16^2) + (2 \times 16^1) + (6 \times 16^0) \\
 &= 2 \times 4096 + (11 \times 256) + (2 \times 16) + 6 \\
 &= 8192 + 2816 + 32 + 6 \\
 &= (11046)_{10} \text{ Answer}
 \end{aligned}$$

(d) $ABC26$

S.O.L

$$\begin{aligned}
 ABC26 &= (A \times 16^4) + (B \times 16^3) + (C \times 16^2) + (2 \times 16^1) \\
 &\quad + (6 \times 16^0) \\
 \Rightarrow & (10 \times 65536) + (11 \times 4096) + (12 \times 256) + \\
 & (2 \times 16) + 6 \\
 = & 655360 + 45056 + 3072 + 32 + 6 \\
 = & (703526)_{10} \text{ Answer}
 \end{aligned}$$

e) $6F226$

Sol

$$(6F226)_{16} = (6 \times 16^4) + (F \times 16^3) + (2 \times 16^2) + (2 \times 16^1) + (6 \times 16^0)$$

$$= (6 \times 65536) + (15 \times 4096) + (2 \times 256) + (2 \times 16) + 6$$

$$= 393216 + 61440 + 512 + 32 + 6$$

$$= (455206)_10 \quad \underline{\text{Answer}}$$

QUESTION 9

a) ~~(654)~~ $(3654)_{10}$

Sol

16	3654
16	228
16	14
	0

$0.375 \times 16 = 6$
 $0.25 \times 16 = 4$
 $0.875 \times 16 = 14$

$(E46)_{15}$

Answer

b) 7824

Sol

16	7824
16	489
16	36
16	1
	0

$0 \times 16 = 0$
 ~~$0.5625 \times 16 = 9$~~
 $0.875 \times 16 = 14$
 $0.0625 \times 16 = 1$

$(1E90)_{16}$

(a) 8926

SOL

$$\begin{array}{r|rr}
 16 & 8926 \\
 16 & 557 \\
 16 & 34 \\
 16 & 2 \\
 0 &
 \end{array}
 \quad
 \begin{array}{l}
 0.875 \times 16 = 14 \\
 0.8125 \times 16 = 13 \\
 0.125 \times 16 = 2 \\
 0.125 \times 16 = 2
 \end{array}$$

 $\Rightarrow (22\ DE)_{16}$ Answer

(b) 581

$$\begin{array}{r|rr}
 16 & 581 \\
 16 & 34 \\
 16 & 2 \\
 0 &
 \end{array}
 \quad
 \begin{array}{l}
 0.4375 \times 16 = 7 \\
 0.125 \times 16 = 2 \\
 0.125 \times 16 = 2
 \end{array}$$

 $\Rightarrow (227)_{16}$ Answer

(c) 3682

$$\begin{array}{r|rr}
 16 & 3682 \\
 16 & 236 \\
 16 & 14 \\
 0 &
 \end{array}
 \quad
 \begin{array}{l}
 0.125 \times 16 = 2 \\
 0.375 \times 16 = 6 \\
 0.875 \times 16 = 14
 \end{array}$$

 $\Rightarrow (E62)_{16}$ ANSWER

QUESTION 50

a) 11011

Sol

$$\begin{array}{rcl} \text{Binary} & = & 11011 \\ \text{Gray code} & = & 10110 \end{array}$$

Answer

(b) 1001010

Sol

$$\text{Binary} = 1001010$$

$$\text{Gray code} = 1101111 \quad \text{Answer}$$

(c) 1111011101110

Sol

$$\text{Binary} = 1111011101110$$

$$\text{Gray code} = 1000110011001 \quad \text{Answer}$$

g No.

(a)

Question 11

(a) 1010

$$\text{Gray Code} = 1010$$

$$\text{Binary} = 1100 \quad \text{Answer}$$

(b) 00010

Sol

$$\text{Gray Code} = 00010$$

$$\text{Binary} = 00011 \quad \text{Answer}$$

(c) 11000010001

Sol

$$\text{Gray Code} = 11000010001$$

$$\text{Binary} = 10000011010$$

Answer

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QUESTION 12

a) $1001 + 0110$

Sol

$$\begin{array}{r} 1001 \\ + 0110 \\ \hline 1111 \end{array}$$

79 Invalid

$$+ \underline{0110}$$

$$0001 \quad 0101$$

$\Rightarrow 0001 \quad 0101$ Answer

b) $0011 + 1001$

Sol

$$\begin{array}{r} 0011 \\ + 1001 \\ \hline 11100 \\ + 0110 \\ \hline 0001 \quad 0010 \end{array}$$

79

0001 0010 Answer

(c) $1001 + 1001$
Sol

$$\begin{array}{r}
 1 \ 1001 \\
 + 1001 \\
 \hline
 0001 \ 0010 \\
 + 0110 \\
 \hline
 0001 \ 1000
 \end{array}$$

$\Rightarrow 00011000$ Answer

(d) $1001 + 0111$

Sol

$$\begin{array}{r}
 1 \ 1001 \\
 + 0111 \\
 \hline
 0001 \ 0000 \\
 + 0110 \\
 \hline
 0001 \ 0110
 \end{array}$$

Answer

(e) $00110101 + 01100111$

Sol

$$\begin{array}{r}
 00110101 \\
 + 01100111 \\
 \hline
 1001 \ 1100 \\
 + 0110 \\
 \hline
 1 \ 1010 \ 0010 \\
 + 0110 \\
 \hline
 0001 \ 0000 \ 0010
 \end{array}$$

+6 in left bit

$\Rightarrow 00000001 \ 0000 \ 0010$

Answer

Date:

f) $01010011 + 01011000$

Sol:

$$\begin{array}{r} 0101 \\ + 0101 \\ \hline 1010 \\ 0110 \\ \hline 0001 \end{array} \quad \begin{array}{r} 0011 \\ + 1000 \\ \hline 1011 \\ 0110 \\ \hline 0001 \end{array}$$

Add 0110 to both bits

$$\Rightarrow 0000\ 0001\ 0001\ 0001 \text{ Answer.}$$

g) $10010101 + 100111000$

Sol:

$$\begin{array}{r} 0000 \\ + 0001 \\ \hline 0001 \end{array} \quad \begin{array}{r} 1001 \\ + 0011 \\ \hline 1100 \\ 0110 \\ \hline 0010 \end{array} \quad \begin{array}{r} 0101 \\ + 1000 \\ \hline 1101 \\ 0110 \\ \hline 0011 \end{array}$$

Add 0110 to both bits

$$\Rightarrow 0000\ 0010\ 0011\ 0011 \text{ Answer}$$

Date:

b) $010101101001 + 001100161000$

Sol

$$\begin{array}{r} 0101 \quad 0110 \quad 1001 \\ + 0011 \quad 0010 \quad 1000 \\ \hline 1000 \quad 1001 \quad 0001 \\ \hline + 0110 \\ \hline 101001001 \quad 0111 \end{array}$$

Add 6 to right
most byte

$\Rightarrow 00001000 \quad 1001 \quad 0111$ Answer