Saad Bin Khalid   20K-0161

ASSIGNMENT 01

CHAPTER - 2

Question # 1

(a)

```
    1 0 0 1
+   1 1 1 0
-----------
  1 0 1 1 1
```

(b)

```
    1 0 1 1 1
+   1 1 1 0 1
-------------
  1 1 0 1 0 0
```

Question # 2

a)
```
    1 1 0 1
-   0 1 0 1
-----------
    1 0 0 0
```

b)
```
    1 0 1 1
-   0 1 0 1
-----------
    0 1 1 0
```

Question # 3

a)
```
      1 1 1 0
  ×   1 0 1
-------------
      1 1 1 0
    1 1 1 0
  1 1 1 0
-------------
1 0 0 0 0 1 1 0
```

Given :

    Dividend : $1111 \rightarrow 00001111$

    Divisor : $\quad 0101 \rightarrow 00000101$

2's complement of: $1011 \rightarrow 11111011$

    divisor

Let the counter be initialized as: 00000000

The divisions proceeds as :

$$
\begin{array}{c}
11111 \\
\cancel{1\ 1\ 1\ 1\ 1} \\
+\ \cancel{0\ 1\ 0\ 1} \\
+\ \cancel{1\ 0\ 1\ 1} \\
\hline
1\ 0\ 1\ 0
\end{array}
$$

$$
\begin{array}{c}
1\ 1\ 1\ 1\ 1\ 1\ 1 \\
0\ 0\ 0\ 0\ 1\ 1\ 1\ 1 \\
+\ 1\ 1\ 1\ 1\ 1\ 0\ 1\ 1 \\
\hline
0\ 0\ 0\ 0\ 1\ 0\ 1\ 0
\end{array}
$$

Counter : $00000000 + 00000001 = 00000001$

$$
\begin{array}{c}
1\ 1\ 1\ 1\ 1\ 1 \\
0\ 0\ 0\ 0\ 1\ 0\ 1\ 0 \\
+\ 1\ 1\ 1\ 1\ 1\ 0\ 1\ 1 \\
\hline
0\ 0\ 0\ 0\ 0\ 1\ 0\ 1
\end{array}
$$

Counter : $00000001 + 00000001 = 00000010$

$$\begin{array}{r} \overset{1\ 1\ 1\ 1\ 1\ 1\ 1}{0\ 0\ 0\ 0\ 0\ 1\ 0\ 1} \\ +\ 1\ 1\ 1\ 1\ 1\ 0\ 1\ 1 \\ \hline 0\ 0\ 0\ 0\ 0\ 0\ 0\ 0 \end{array}$$

Counter : 00000010 + 00000001 = 00000011

Hence, the answer is : 00000011 i.e. 3

Question # 4

a) 11010101 &

b) 01100100

c) 11110001

Question # 5

a) ∴ +65 : 01000001
    ∴ −65 : 10111110

b) +128 : ~~10000000~~
    +126 : 01111110

c) ∴ +98 : 01100010
    ∴ −98 : 10011101

Question # 6

a)   ∵ 58 : 00111010
     ∴ -58 : 11000110

b)   ~~+88~~   112 : 01110000

c)   ∵   +136 : 10001000
     ∴ -136 :   0111 1000 ⟹ Out of range

Question # 7

a)

$$\frac{S}{1} \quad \frac{Mag}{0011\,0101}$$

$$- \quad 16 + 8 + 1 + 1 = 29$$

$$\Rightarrow -29$$

b)

$$\begin{array}{cc} Sign & Mag \\ 0 & 1110100 \\ + & \cancel{118} \; 64+32+16+4 = 116 \end{array}$$

$$\Rightarrow +116$$

c)

$$\begin{array}{cc} Sign & - & Mag \\ 1 & & 0111011 \\ - & & 32+16+8+2+1 = 59 \end{array}$$

$$\Rightarrow -59$$

Question # 8

a)
$$\frac{S}{1} \quad \frac{Mag}{0111001}$$
1's: 101000110

b)
sign – Mag:
0   1100100

1's: 01100100

c)
$$\frac{Sign}{1} \quad \frac{Mag:}{0011000}$$
1's: 1011100111

Question # 9

a)
1 – 0111011

In binary:
– 00111011

2's : 11000101

b)
0 – 1010100

2's : 01010100

c)
1 – 0011000

In binary:
– 0011000

2's : 11101000

Question # 10

The largest decimal number for 'n' bits is:

$$D_L: 2^n - 1$$

∴ For n = 8

$$D_L: 2^8 - 1 = 256 - 1 = 255$$

Question # 11

Since, the number of bits is 5; Therefore, the weight is distributed as:

2^4	2^3	2^2	2^1	2^0
16	8	2	1	0
				0

Binary: 1   0   0   0   0

⇒ 1 has a weight of 16 or 2^4

Question # 12

a) ∵ +38 → 00101110

∴ -38 → 11010010

Also, ∵ 27 → 00011011

∴ -27 → 11100101

∴
```
  -38  →    1 1 0 1 0 0 1 0
  -27  →  + 1 1 1 0 0 1 0 1
           1 0 1 1 0 1 1 1
```

b) $\because 39 \rightarrow 00100111$

$\therefore -39 \rightarrow 11011001$

$$\Rightarrow 59 \rightarrow 00111011$$
$$-39 \rightarrow +11011001$$
$$\overline{00010100}$$

c) $\because 58 \rightarrow 00111010$

$\therefore -58 \rightarrow 11000110$

$$-58 \rightarrow 11000110$$
$$65 \rightarrow +01000001$$
$$\overline{00000111}$$

d) $+102 \rightarrow 01100110$

$-102 \rightarrow 10011010$

$$+85 \rightarrow 01010101$$
$$-85 \rightarrow 10101011$$

$$-102 \rightarrow 01010101$$
$$-85 \rightarrow +10101011$$
$$\overline{00000000}$$

$$-102 \rightarrow 10011010$$
$$-85 \rightarrow +10101011$$
$$\overline{101000101}$$

$\because$ ~~Number is out of range~~, we will have ~~to include one extra bit~~

$\therefore$ ~~Ans = 101000101~~

e) +72 → 01001000
   -72 → 10110 1000

   -72 → 10111000
   29 → + 00011101
        11010101

f) +49 → 00110001
    -49 → 11001111

   111 → 01101111
   -49 → +10010001
         000000

   111 → 01101111
   -49 → + 11001111
         00111110