* —— o —— Problems —— o ——

⇒ Using 1's, 2's, 9's, 10's Complement perform the following.

(a) 23 − 56.

23 in Binary ⇒ $(010111)_2$

56 in Binary ⇒ $(111000)_2$.

1's Complement:

$M = (010111)_2$ $N = (111000)_2$

1's Complement of N $= (000111)_2$

Add M with 1's Complement of N.

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

⇒ M < N,

$M - N \Rightarrow -[\text{1's Complement of } (011110)_2]$

$\Rightarrow -(100001)_2$.

2's Complement:

2's Complement of $N = (001000)_2$

Add M with 2's Complement of N

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

∴ M < N;

$\Rightarrow (010111)_2 - (1110000)_2$

$\Rightarrow -[\text{2's complement of } (011111)_2]$

$\Rightarrow -(100001)_2$.

* 9's Complement:

~~M = (010111)₂ & N = (111000)₂~~ M = 23, N = 56

9's Complement of N = ~~(999999)₂ − (111000)₂~~ 99 − 56

N = ~~(888999)~~ 43

Add M with 9's Complement of N.

$$\begin{array}{r} 010111 \\ +\ 888999 \\ \hline 899110 \end{array} \qquad \begin{array}{r} 23 \Rightarrow M \\ +\ 43 \Rightarrow N \\ \hline 66 \end{array}$$

$M < N$,

$= -[(999999) - (899110)] \Rightarrow -((99) - (66))$

$\Rightarrow -(100889)_2 = \quad \Rightarrow -(33).$

10's Complement:-

Here $M = 23$, $N = 56$

10's Complement of $N = (99 - 56) + 1$

$= 43 + 1$

$N = 44$

Step ①:- Add M with 10's Complement of N

$$\begin{array}{r} 23 \\ +\ 44 \\ \hline 67 \end{array}$$

Step ②:- Here $M < N$, Hence the result is obtained by taking the 10's Complement of Sum with a negative sign in front

$\Rightarrow 23 - 56$

$\Rightarrow -($10's Complement of 67$)$

$\Rightarrow -[(99 - 67) + 1]$

$\Rightarrow -[33],$

(b) 98 - 34

98 in Binary = 1100010

34 in Binary = 0100010

1's Complement -

$M = (1100010)_2$ & $N = (0100010)_2$

1's Complement of $N = (1011101)_2$

Add M with 1's Complement of N

$$\begin{array}{r} 1100010 \\ +\ 1011101 \\ \hline 1\,0011111 \\ +\ \ \ \ \ \ \ \ 1 \\ \hline 1000000 \\ \hline \end{array}$$

$\therefore (1100010)_2 - (0100010)_2 \Rightarrow (1000000)_2$

2's Complement -

2's Complement of $N = (1011110)_2$

Add M with 2's Complement of N

Discarded

$$\begin{array}{r} 1\ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \\ 1100010 \\ +\ 1011110 \\ \hline 1000000 \\ \hline \end{array}$$

$M > N \Rightarrow$ (2's Complement of $(1000000)_2$)

$\Rightarrow (1000000)_2$.

9's Complement:

~~$M = (1100010)_2$ & $N = (0100010)_2$~~

~~9's Complement of $N \Rightarrow (9999999 - 0100010) +$~~

$M = 98$, $N = 34$

9's Complement of $N = 99 - 34$

$\boxed{N = 65}$

Add M with 9's Complement of N

$$\begin{array}{r} \overset{1}{9}\,8 \\ +\ 6\,5 \\ \hline 1\quad 6\,3 \\ +\quad 1 \\ \hline 6\,4 \end{array}$$

Here, $M > N$, hence result is $98 - 34 = 64$

10's Complement:

$M = 98$ & $N = 34$

10's Complement of $M \Rightarrow (99 - 34) + 1$

$\Rightarrow 65 + 1$

$\boxed{N \Rightarrow 66}$

Add M with 10's Complement of N

$$\begin{array}{r} 1\ \overset{1}{9}\,8 \\ 6\,6 \\ \hline 6\,4 \end{array}$$

Discard

$M > N$,

$M - N \Rightarrow 98 - 34 \Rightarrow 64$