

r 's Complement

Simplify the digital calculation

Complement :- Everything other than the given no

Complement

r 's Complement
(Radix Complement)

$(r-1)$'s Complement
(diminished Radix Complement)

Ex:- Comp of $(7)_{10}$

Everything other than 7

$$\underline{10} - \underline{7} = 3$$

Comp of $(9)_{10}$

$$10 - 9 = 1$$

$$10 - 6 = 4$$

Formula

$N \rightarrow$ given no

$n \rightarrow$ Total no. of digits
in given no

$r \rightarrow$ base

Formula

$$r^n - N$$

$$(10)^1 - 7 = 3$$

$$1) N = 5690$$

determine 10's Comp

$$r^n - N$$

$$r = 10$$

$$N = 5690$$

$$(10)^4 - 5690$$

$$n = 4$$

$$\Rightarrow 10000 - 5690$$

$$\Rightarrow 4310 \text{ Ans}$$

$$2) N = 1101$$

determine 2's Complement

$$0011$$

$$N = 1101, r = 2, n = 4$$

$$r^n - N$$

$$(2)^4 - 1101$$

$$\Rightarrow (16)_{10} - 1101$$

Convert to binary

$$\Rightarrow 10000 - 1101$$

$$= \underline{\underline{00011}} \text{ Ans.}$$

$$\begin{array}{r} \begin{array}{ccccccc} & 1 & & 1 & & 1 & \\ 0 & 1 & 1 & 1 & 1 & 1 & \\ \hline & 1 & 0 & 0 & 0 & 0 & \\ - & 0 & 1 & 1 & 0 & 1 & \\ \hline & 0 & 0 & 0 & 1 & 1 & 0 \end{array} \end{array}$$

$$\begin{array}{l} \leftarrow_{42} \\ 1101 = 13 \\ 8+4+1 \end{array}$$

$$\underline{\underline{16 - 13 = 3 \text{ Ans.}}}$$

Hw

1) $N = 76895$
10's Comp

2) $N = 11011$
2's Comp

$r-1$'s Complement

$r = 10$

r 's Comp
10's Comp

$(r-1)$'s Comp
9's Comp

$r = 2$

2's Comp

1's Comp

$r = 8$

8's Comp

7's Comp

$r = 16$

16's Comp

15's Comp
or
F's Comp

~~Step 1~~ r 's Comp $= r^n - N$

$$(r-1)'s \text{ Comp} = r^n - N - 1$$

$$(r-1)'s \text{ Comp} = r's \text{ Comp} - 1$$

Adding 1 on both side

$$\boxed{(r-1)'s \text{ Comp} + 1 = r's \text{ Comp}}$$

Calculator x 's Comp by $(x-1)$'s Comp + 1

This is needed to avoid borrow concept
while finding complement
(Reduce circuit)

Ex:- 7's Comp of decimal no = 5674

$$r^n - N - 1$$

$$(8)^4 - 5674 - 1$$

$$\Rightarrow (4096)_{10} - 5674 - 1$$

$$\downarrow$$
$$\Rightarrow (10000)_8 - 5674 - 1$$

$$4096 \Rightarrow \underline{7777 - 5674}$$

$$= 2103$$

8's Comp of 5674

$$7's \text{ Comp } 5674 = 2103$$

$$8's \text{ Comp} = (x-1)'s \text{ Comp} + 1$$

$$= 2103 + 1 = 2104$$

$$\begin{array}{r} 7777^8 \\ 10000^8 \\ - \quad 1 \\ \hline 7777 \end{array}$$

Skipped

Ex:- 1's Comp of 1101

$$\begin{array}{r} 1111 \\ - 1101 \\ \hline 0010 \end{array} \rightarrow 1\text{s Comp}$$

2's Comp of 1101

$0010 + 1 \rightarrow 0011 \rightarrow 2^1 \text{ Comp}$

Short cut of 2's Comp.

10111000

$\rightarrow 1's \text{ Comp} \quad 01000'111$

$1 +$

$2's \text{ Comp} \rightarrow \underline{\quad 01001000 \quad}$

Step 1:- write the given no.

10 111 000

Step 2:- Starting from LSB, copy all the zeros till the first 1

10111000 \swarrow LSB
 \downarrow
1000 $\rightarrow 2, 3$

Step 3:- Copy the first 1

Step 4:- Complement all the remaining bits.

$$\begin{array}{r|l} 1011 & 000 \\ \hline 0100 & 1000 \end{array}$$

Ex:-

$$\begin{array}{r|l} 101 & 00 \\ \hline 010 & 100 \end{array}$$

$$\rightarrow \begin{array}{r|l} 101100 & \\ 010011 & + \\ \hline 010100 & \end{array}$$

Ex:- $(1010) \rightarrow 15$ Comp

$$\underline{r^n - N - 1} \rightarrow \underline{r^n - 1 = N}$$

if $r = 10$

9999

$r = 8$

7777

$r = 16$

FFFF

$r = 2$

1111

$$1111 - 1010$$

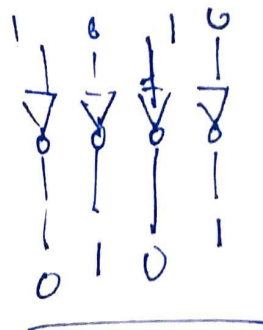
$$\Rightarrow 0101$$

$$2's \text{ Comp} \rightarrow 1's \text{ Comp} + 1$$

$$= 0101 + 1$$

$$= \underline{0110}$$

$$\begin{array}{r} 1010 \\ 0110 \\ \hline \end{array}$$



$$2) \text{ 2's Comp of } (10111010)_2$$

$$\underline{01000110}$$

$$10111010$$

1's Comp

$$01000101$$

$$\begin{array}{r} 01000101 \\ \hline 1+ \\ \hline 01000110 \end{array}$$