

(r)'s complement: (r)'s complement can be calculated by the following formula:

$$\begin{aligned} & \left( \left( (r^n - 1) - N \right) + 1 \right) \\ = & (r^n - N) \end{aligned}$$

Here again,

r is Radix or Base

n is number of digits in the actual number and

N is the actual number itself.

In this formula we see that we have added 1 to the formula of (r-1)'s complement. Now, -1 and +1 cancelled each other and the formula became:  $(r^n - N)$

Examples:

Ex. 5) Find the r's or 10's compliment of decimal number  $(27)_{10}$ .

here,  $n = 2$ ,  $r = 10$ ,  $N = 27$

$$\begin{aligned} \text{thus, } r\text{'s compliment} &= (10^2 - 27) \\ &= (100 - 27) \\ &= 73 \end{aligned}$$

**Recall from Ex 1. that the (r-1)'s complement of  $(27)_{10}$  was  $(72)_{10}$**

Ex. 6) Find the r's or 8's compliment of Octal number  $(253)_8$ .

here,  $n = 3$ ,  $r = 8$ ,  $N = 253$

$$\begin{aligned} \text{thus, } r\text{'s compliment} &= (8^3 - 253) \\ &= (512 - 253) \\ &= (512 - 171) \\ &= (341)_{10} = (525)_8 \end{aligned}$$

Since  $(253)$  is in octal and  $(511)$  is in decimal, we need to convert  $(253)$  to decimal first.

**Recall from Ex 2. that the (r-1)'s complement of  $(253)_8$  was  $(524)_8$**

**Ex. 7)** Find the  $r$ 's or  $16$ 's complement of Hexadecimal number  $(A9)_{16}$ .

here,  $n = 2$ ,  $r = 16$ ,  $N = A9$

thus,  $r$ 's complement =  $(16^2 - A9)$

=  $(256 - A9)$

=  $(256 - A9)$

=  $(256 - 169)$

=  $(87)_{10} = (57)_{16}$

Since  $(A9)$  is in Hexadecimal and  $(256)$  is in decimal, we need to convert  $(A9)$  to decimal first.

**Recall from Ex 3. that the  $(r-1)$ 's complement of  $(A9)_{16}$  was  $(56)_{16}$**

**Ex. 8)** Find the  $r$ 's or  $2$ 's complement of Binary number  $(11011)_2$ .

here,  $n = 5$ ,  $r = 2$ ,  $N = 11011$

thus,  $r$ 's complement =  $(2^5 - 11011)$

=  $(32 - 11011)$

=  $(32 - 27)$

=  $(5)_{10} = (00101)_2$

Since  $(11011)$  is in binary and  $(32)$  is in decimal, we need to convert  $(11011)$  to decimal first.

**Recall from Ex 4. that the  $(r-1)$ 's complement of  $(11011)_2$  was  $(00100)_2$**

Here again in examples 6, 7 and 8; we see that the non-decimal numbers i.e.  $(253)_8$ ,  $(A9)_{16}$  and  $(11011)_2$  are converted to decimal numbers- 171, 169 and 27 respectively for ease of calculations.

After finding the final results (which are in decimal), we converted them back into their own number systems.

**Assignments:**

- 1.** Calculate the  $(r)$ 's complements for the following-
  - a.** Decimal number  $(36)_{10}$
  - b.** Octal number  $(62)_8$
  - c.** Hexadecimal number  $(4D)_{16}$
  - d.** Binary number  $(101110)_2$