

Complements: Complements are one of the most important aspects of arithmetic operations in digital systems. As we are pretty much familiar with the fact that SUBTRACTION is nothing but a complemented ADDITION, we can carry out a subtraction operation by using the following steps:

- Compute the complement of the SUBTRAHEND.
- Add it with the MINUEND to get the difference.

Complement of any data is needed primarily to perform SUBTRACTION operations. The following example better clarifies the concept:

Suppose we have to calculate: $a = (10 - 6)$

We can do it via any of the two ways stated below:

$$a = (10 - 6) \quad \text{OR} \quad a = (10 + (-6))$$

In Digital Architecture Complements are of following two types:

1. (r-1)'s complement
2. r's complement

Since complements are of two types, they are significantly different for different number systems. Consider the following table:

Number systems	Base (r)	(r-1)'s compliment	r's compliment
Decimal	10	9's	10's
Binary	2	1's	2's
Octal	8	7's	8's
Hexadecimal	16	15's	16's

Basically in a number system, r represents RADIX or simply the BASE.

- Thus r 's complement means to the complement w.r.t. BASE
- Similarly $(r-1)$'s complement means to the complement w.r.t. (BASE-1).

Assignments:

1. What are complements in a Number System? Why do we need them?
2. What are the different complements for different number systems?