Binary Addition

0+0=0, 0+1=1, 1+0=1, 1+1=10; i.e., 0 with a carry of 1.

Binary Subtraction

0-0=0, 1-1=0, 1-0=1, 0-1=1 with a borrow of 1.

Sign-Magnitude Form

In sign-magnitude form, an additional bit called the sign bit is placed in front of the number. If the sign bit is a zero, the number is positive. If it is a 1, the number is negative.

1's complement of a number

1's complement of a no. ~~can be~~ is obtained by complementing each bit of the no., i.e., by changing all ~~0s~~ zeros to ~~1s~~ ones and all 1s to 0s.

It can also be said that 1's complement of a number is obtained by subtracting each bit of the no. from 1.

The major drawback of using 1's complement is its representation of zero. Both 00000000 and its 1's complement 11111111 represent zero.

1) Subtract 45 from 78 using 8-bit 1's complement method.

~~+6 8 4 2 1~~

64	32	16	8	4	2	1	
1	0	0	1	1	1	0	→ 78
0	1	0	1	1	0	1	→ 45
1	1	0	1	0	0	1	0

```
  01001110
  11010010
----------
 (1)00100000
    →     +1
----------
  00100001
```

MSB is zero, so +ve no. +33.

2) Add -25 to +14.

```
  00001110 → +14
  11100110
----------
  11110100
```

No carry. ~~So, result~~ MSB is 1. So, result is -ve & in 1's complement form.
Result is -11.

2's complement of a number

2's complement of a number is obtained by.

i) convert the given no. in 1's complement (by changing all 0s to 1s and 1s to 0s) and then adding 1,

ii) starting at the LSB, copying down each bit up to and including the first 1 bit encountered, and complementing the remaining bits.

2's complement Arithmetic

In 2's complement subtraction, if there is a carry out, ignore it. If the MSB is a 0, the result is +ve and is in true binary form. If the MSB is 1 (whether there is a carry or not) the result is -ve and is in 2's complement form.

1) 46 - 14 using 8-bit 2's complement.

```
  00101110
+ 11110010
-----------
 (1)00100000      +32.
```

2) -75+26.

+26 → binary
-75 → 2's compl.

```
  00011010
+ 10110101
-----------
  11001111      MSB 1  -ve.
```

2's complement -49.