# BIT Manipulation

1. A bit is a basic unit of computation . It can either be 1 or 0.
2. 1 Byte is equal to 8 BITS.
3. The range of value a 3 bit message can store is 2^3= 8 and n bit message can store value ranging from 2^n

| 3-bit message | | |
|---|---|---|
| A | B | C |
| 0 | 0 | 0 |
| 0 | 0 | 1 |
| 0 | 1 | 0 |
| 0 | 1 | 1 |
| 1 | 0 | 0 |
| 1 | 0 | 1 |
| 1 | 1 | 0 |
| 1 | 1 | 1 |

462 × 326

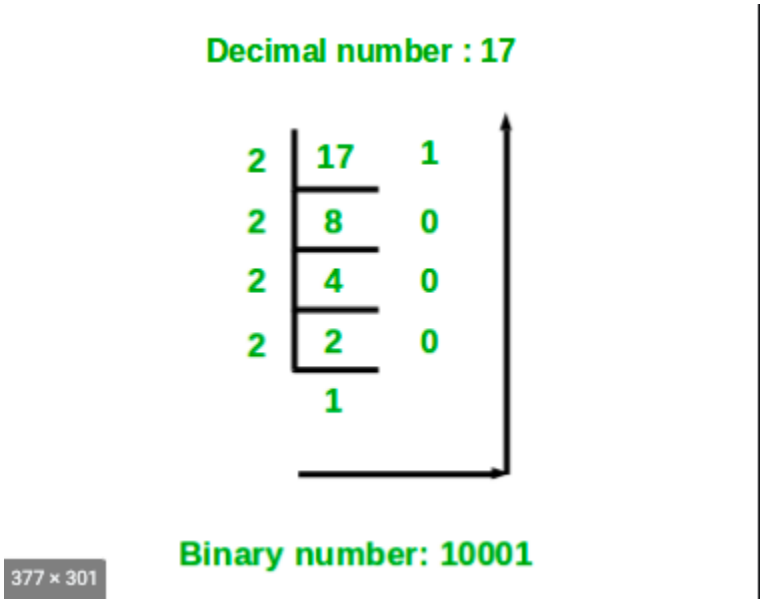
4. Size of int is 4 bytes .
   Int = 4 bytes = 4*8 bits .
   Therefore the range of values it can store is 2^32.
   Signed int can store value ranging from -2,147,483,648 to 2,147,483,647
   Unsigned int can store value ranging from 0 to 4,294,967,295

5. Any number that we see in real life is a decimal number.
   Example 55 is a decimal number. It has a base 10.

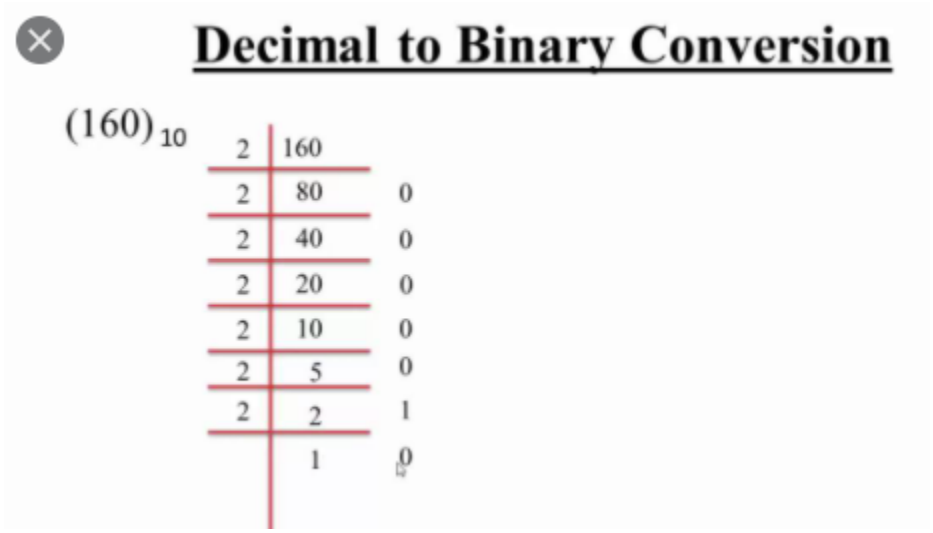
6. Octal number has a base 8. Values ranging from (0,1,2,....7)
7. Binary number has a base 2 (0,1)
8. Hexadecimal number has a base 16 . Values ranging from (0,1,2,3,4,5...9,A,B,C,D,E,F)
   Where A-10, B-11, C-12, D-13, E- 14, F- 15.

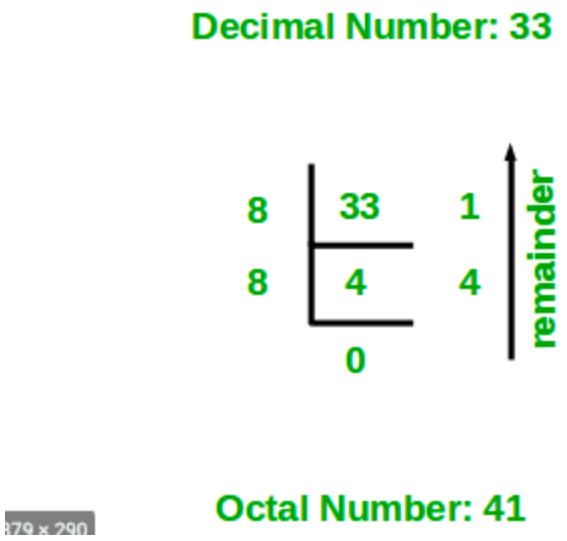
9. **<u>Converting any number into its decimal format.</u>**
   $(3192)_{10}$ =2*10^0 + 9*10^1 + 1*10^2 + 3* 10^3 =2*1 + 9*10 + 1*100+3*1000= $(3192)_{10}$
   $(3172)_8$ = 2*8^0 + 7*8^1 + 1*8^2 + 3*8^3 = 2*1 + 7*8 + 1*64 + 3*512 =$(1658)_{10}$
   $(1010)_2$= 0*2^0 + 1*2^1 + 0*2^2 + 1*2^3 = 0 + 2 + 0 + 8 = $(10)_{10}$

10. converting a number from decimal to any other format.
    Keep on dividing the number by the base of the other format and note the remainder of the number.



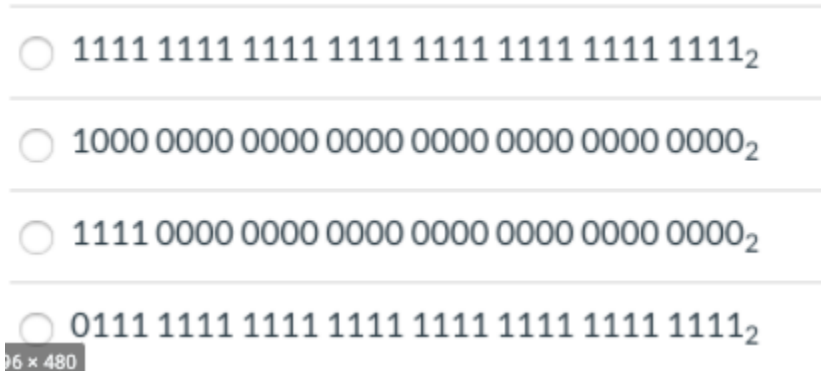

377 × 301






11. What will be length number if an integer number is converted into hexadecimal format

    Int = 4 bytes = 4*8 bits =32 bit.
    In the binary representation it will be 32 bits long.
    Example:-

    Range of number we can have is 2^32 == (2^4)^8 == (16)^8.
    Therefore the maximum Hexadecimal number will be size 8.
    Ranging from
    0000 0000
    0000 0001
    0000 0002
    .
    .
    .
    FFFF FFFE
    FFFF FFFF

12. Watch this video to understand the various operations :-
    https://www.youtube.com/watch?v=NLKQEOgBAnw&ab_channel=HackerRank

13. Understand about the right and left shift operations from this video
    https://www.youtube.com/watch?v=MiJdgxTWaFs&ab_channel=ApnaCollege

14. Property of right shift operation :-
    Those many bits are remove from the right
    110101>>3 == 110

    ## Property

    Whenever we do a right shift we actually perform **integer** division the number by 2^n where n is the number specified in right operation

    Example:-
    15 >>0 = 15 /(2^0) =15.
    15 >>1 = 15/ (2^1) =7
    15 >>2 = 15(2^2) =3
    100>>4 = 100/(2^4) = 6
    (Note the division here is integer division)

15. Property of left shift is multiplying the number by 2^n.
    Those many bits are added to  the right
    110101<<3 == 110101000

    Example :-
    6<<4 = 6*(2^4) = 96
    4<<7 = 4 *(2^7) = 512

**16. Or Operation**

101010
110110
111110

## Property

Whenever we do an OR operation between 2 numbers A OR B = R
R is always greater than( greatest between A and B)

**17.  AND Operation**

101010
110110
100010

## Property

Whenever we do an AND operation between 2 numbers A AND B = R
R is always less than( smallest  between A and B)

**18. XOR Operation**

XOR between same bits gives 0  (1 ^1 =0  , 0 ^0 =0
And XOR between different bits gives 1 (1^0 =1 , 0 ^1 =1 )

## Property

Whenever we do an XOR  operation between 2 same numbers output is 0 and XOR between a number and 0 we get the same number A .

A^A =0
A^0 =A

Try to Solve the following question using XOR property

1. Swap value in a variable  without using 3 variable