Bitwise Operator and Number System

8 am

Bitwise operator:

9 am

Base 10 Number System = Decimd number syste

10 am

i.e (0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10)

11 am

Base 2 Number System : Binary Number syst

noon

i.e 0, 1

1 pm

Bit Manupulations :-

2 pm

0 = False
1 = True

Operators :

3 pm

① AND

4 pm

a	b	a & b
0	0	0
0	1	0
1	0	0
1	1	1

5 pm

Sunday 31

evening

7 pm

② Given number n find its even or odd

④ When you & 1 with any nvber digit remains same

```
  1 1 0 0 1
& 1 1 1 1 1
-----------
  1 1 0 0 1
```

② OR (if any one is true entire expression is true)

a	b	a||b
0	1	0
0	0	1
1	1	1
1	0	1

③ imp XOR (^) if and only if [only one should be true]
exclusive OR

a	b	a ^ b
0	1	1
0	0	0
1	1	0
1	0	1

→ $a \wedge 1 = \overline{a}$ (complement on 1)

$a \wedge 0 = a$

$a \wedge a = 0$

Complement (~)

8 am

$a = 10110$

9 am

$\bar{a} = 01001$

10 am

11 am

noon ~~Conversion of number sy~~

1 pm Number system;

2 pm

① Decimal number Syst - Base 10

3 pm

② Binary numbes → Base 2

4 pm

③ Octal base → 0, 1, 2, 3, 4, 5, 6, 7 ⇒ Base 8

5 pm

evening

$(9)_{10} = (11)_8$

7 pm

⑤ Hexa Decimal = 0-9 & A-F

0, 1, 2, 3, 4, 5, 6, 7, 8, 9, A, B, C, D, E, F

$(10)_{10} = (A)_{16}$

Conversion of number syst

① Conversion decimal to base b

② Base to decimal

8 am

9 am

10 am

Convert $(17)_{10}$ to base 2

11 am

Keep dividing by base, take remainders

noon

write in opposite

1 pm

2 pm

$2|17$
$2|8$ - 1
$2|4$ - 0
$2|2$ - 0
1

$= (10001)_2$

3 pm

4 pm

5 pm

$(17)_{10} = (?)_8 \Rightarrow (21)_8$

evening

$8|17$
2 - 1

7 pm

② Convert any base to decimal

$(10001)_2 = (?)_{10}$

Multiply and add the power of base with digits

$(10001)_2$ =

$1\times2^4 + 0\times2^3 + 0\times2^2 + 0\times2^1 + 1\times2^0$

~~$= 32 + 0 + 0 + 0 + 1$~~

$= 16 + 0 + 0 + 0 + 1 = 17$

a) $(21)_8 = (\ )_{10}$

$2\times8^1 + 1\times8^0$

$\Rightarrow 16 + 1 = 17$

Continuation with Bitwise :

⇒ Left shift Operator (<<) :

$(10)_{10} = (1010)_2$ $\quad 10 << 1$

step :- $1010 << 1 = 10100 = 20$

$\therefore a << 1 = 2a$

8 am

General point:-

9 am

$a << b = 2^b$

10 am

11 am

-> Right shift (>>)

noon

1 pm Q> 0011 001 >> 1

2 pm

-> 001100 = 1100

3 pm

4 pm

Generally,

5 pm

$$a >> b = \frac{a}{2^b}$$

evening

7 pm addition in binary:-

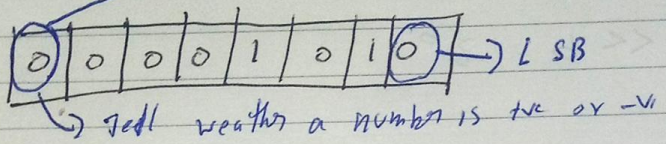
12 + 7 ->

```
 1
  1100
  0111
 -----
 10011
```

Negative of a number in Binary form

1 byte = 8 bits → MSB

10 =>



-10 => ?

1 → -ve

0 → +ve

MSB = Most significant is reserve

Step 1 :-

① complement of no.

② +1 to it

⇒ aka 2's complement method

Sunday 07

$(10)_{10} = (0\ 0\ 0\ 0\ 1\ 0\ 1\ 0)_2$ → 1 byte

① 1 1 1 1 0 1 0 1

② 1 1 1 1 0 1 0 1

\+ 1

$(1\ 1\ 1\ 1\ 0\ 1\ 1\ 0)_2 = (-10)$

Why 2's complement gives -ve of a number

what if ~~number~~ number is more than 8 1's

e.g:

```
  100000000
- 000001010
-----------
```

What is this!

100000000 = 111111111 + 1

Now: 111111111 + 1 - 000001010

=> 111111111 - 000001010 + 1

complement of a number

1000 = 111 + 1
8 = 7 + 1

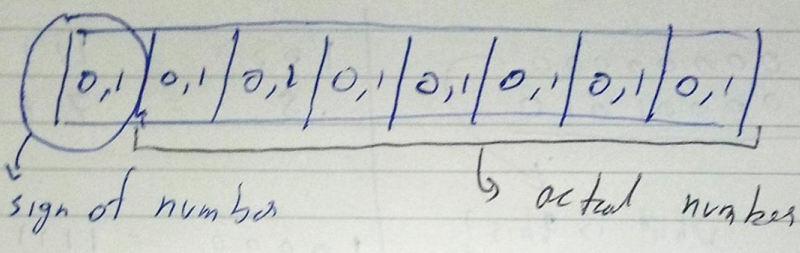
10000 = 1111 + 1
16 = 15 + 1

```
  1111
+ 0001
-------
 10000  ✓✓
```

```
  11111111
- 00001010
----------
  11110101
```

Range of number:-

① 1 byte = 8 bits = 2^8 = 256 numbers can be stored



actual number stored in bits = n-1

1 byte = 7 bit = 128 number

-ve(128) + +ve(128) = ~~257 numbers~~

Formula to find range (n bits)

$$-2^{n-1} \text{ to } 2^{n-1} - 1$$