~~X88 Ad~~ BCD Addition

Binary coded decimal, 0 to 9 (4 bit)   (Hexa decimal Form normally)

```
  1 4              0001   0100
+ 2 8      ——→   + 0010   1000
  ___             ————————————
                   0011   1100  ⟶ greater than 9? → add 6
                     +1 + 0110      adding 6
                        —————
                     3    0010
                     4     2
```

Eg 24 + 78   ~~5~~

```
        0010   0100
      + 0111   1000
      ——————————————
        1001   1 00  ——→ greater than 9
                +0110 = 6
greater than 9 ← 1010   0010
      + 0110 = 6
      ——————————————
      1 0000   0010
      ——————————————
      1   0     2   ——→ 102
```

Eg: 547 + 521

```
      0101   0100   0111
      0101   0010   0001
      ————————————————————
      1010   0110   1000
      0110
      ————————————————————
  1   0000
  ————————————————————
  1    0     6     8  ——→ 1068
```

XS3 Addition

non weighted code
used to simply express the code
"excess 3", adding 3

Sum of the codes
is alway 9

$8421 \longrightarrow$ not XS3
$2421 \longrightarrow$ XS3

self complementory code

9s complement $\longrightarrow$
$\longrightarrow$ of $54 = 99-54 = 45$

Adding 1 to 9s complement makes it 10s complement

XS3 for $5 \longrightarrow 8 = 1000$

Adding 3 $\updownarrow$ Complement

$4 \longrightarrow 7 = 0111$

Eg. $3+2$

For XS3 addition,
$\longrightarrow$ add 3 to both
$\longrightarrow$ and subtract 3 from ans if no carry
$\longrightarrow$ add 3 if there is carry

5	0110
5	0101
	1011 $\longrightarrow$ +
	$-$ 3 if no carry is generated
	1000 3 is subtracted

$= 8$ XS3 $\longrightarrow 5$

Eg. $6+8$

9	1000
11	1011
0001	0011
1	2
0011	0011
0100	0100

if there is carry
3 is added

$\longrightarrow 4$ XS3 of answer ?

Eg $388^{7} + 249 \longrightarrow$ 6 11 10 + 5 7 12   Aryaman

387 $\rightarrow$ 6   11   10
249 $\rightarrow$ 5   7   12

     0110   1011   1010
     0101   0111   1100
     —————————————————
     1100   0011   0110
   − 0011   + 0011   + 0011
     —————————————————
     1001   0110   1001 $\longrightarrow$ 9   6   9   XS3 form

            Ans = 636

Grey Code

○ One code change at a time

we keep adding
while noting MSB

Binary : 1011

Grey Code : 1101

N	B	G
0	0000	0000
1	0000̶1̶	0001
2	0010	0011
3	0011	0010
4	0100	011̶1̶0
5	0101	0111
6	0110	0101
7	0̶1̶1̶1̶	0100

↓ Only 1 bit changes

And So On...

To convert from grey to binary

G => 1011

B => 1 1 0 1

note MSP

add result to next bit, neglect the carry