CONVERSIONS (B2 ↔ B10 ↔ B16)

65_{10} to binary...

2	65	
2	32	1
2	16	0
2	8	0
2	4	0
2	2	0
2	1	0
	0	1

ANS : 1000001

binary → hexadecimal
(2) → (16)
4 bits → 1 bit

group binary to 4 x 4 bits

$11\ 0010\ 1110_2$

11	0010	1110
3	2	14
3	2	E

$\Rightarrow 32E_{16}$

hexadecimal → binary

$C4D_{16}$

C	4	D
12	4	13
1100	0100	1101

hexadecimal → decimal
16 → 10

$C4D_{16}$

op			
x16	C	12	= 192
+4	4	4	= 196
x16			= 3136
+13	D	13	= 3149 #

ANS : 3149_{10}

1019_{10}

16	1019	
16	63	11
16	3	15
	0	3

ANS:
$3FB_{16}$ #

SIGN-MAGNITUDE / 1's & 2's complement

- X calculation
- waste single bit for sign
  - ↳ waste space

Drawbacks (sign-magnitude)

decimal number = 5

unsigned	= 0101
signed	= 0101
1's	= 0101
2's	= 0101

decimal number = -5

unsigned	=
signed	= 1101
1's	= 0101 → 1010
2's	= 0101 → +1 ⇒ 1011

2's complement (4-bit)

Q1) 3+4

$3_{10} = 0011_2$
$4_{10} = 0100_2$

$$\begin{array}{r} 0011 \\ +\,0100 \\ \hline 0111 \end{array}$$

→ $2^0 + 2^1 + 2^2$
$= 1 + 2 + 4$
$= 7$ #

Q2) 5-2 = 5+(-2)

$5_{10} = 0101$
$-2_{10} = 0010 \rightarrow 1101 + 1 \rightarrow 1110$

$$\begin{array}{r} 0101 \\ +\,1110 \\ \hline 10011 \end{array}$$

→ 0011#
↳ it's 4-bit so... the 1 0011
↳ this can be removed

HOW / WHEN will an overflow occur
- (+ve) + (+ve) = (-ve)
- (-ve) + (-ve) = (+ve)

WHY?
- no enough to represent real answer in 4 bits

SINGLE PRECISION (IEEE 754 FLOATING-POINT STANDARD)

←→	←→	←→
1 Bit sign	8 Bits Exponent	23 Bits mantissa

1) convert to binary exponent form:

$1593_{10} = 110\ 0011\ 1001_2$
$= 1.10001111001 \times 2^{10}$

2) compute sign-bit positive = 0 ; negative = 1 :

0

3) mantissa is whatever after the decimal point

4) Compute exponent using excess-k method:

$k = 2^7 - 1 = 127 \quad e = 10$

8-bit exponent

$= k + e$

$= 127 + 10$

$= 137_{10}$

Error detection

↳ send signal to one computer to another

3 ways:

- Parity bits
  - ↳ add a single bit → even parity ⇒ 0 / → odd parity ⇒ 1
  - ↳ drawbacks:
    cannot detect multiple bits error

- Checksum

- Cyclic Redundancy Checks (CRC)