DAY 69 • LIVE

2-3 Q

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# MCA CET 2025

# COMPUTER

# NUMBER SYSTEM

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8th – Logic / D.E.
10th – C. Prog.

# Types of Numbers

1. Decimal Number — (10)
2. Binary Number — (2)
3. Octal Number — (8)
4. Hexadecimal Number (16) ⇒

0 15
0 – F

| 0 — 9 | 10 | 11 | 12 | 13 | 14 | 15 |
|---|---|---|---|---|---|---|
| | A | B | C | D | E | F |

# Conversion of Number

Binary ⇄ Dec

Dec ⇄ Octal

Hexa ⇄ Dec

$32_{10} \Rightarrow (\underline{100000})_2$

| | | |
|---|---|---|
| 2 | 32 | |
| 2 | 16 | 0 |
| 2 | 8 | 0 |
| 2 | 4 | 0 |
| 2 | 2 | 0 |
| 2 | 1 | 0 |
| | 0 | 1 |

fractional: $(10101100.1110000011\ldots)_2$

# Convert $(172.878)_{10}$ to binar y

| | | |
|---|---|---|
| 2 | 172 | |
| 2 | 86 | 0 |
| 2 | 43 | 0 |
| 2 | 21 | 1 |
| 2 | 10 | 1 |
| 2 | 5 | 0 |
| 2 | 2 | 1 |
| 2 | 1 | 0 |
| | 0 | 1 |

| | | |
|---|---|---|
| 0.878×2 | 1.756 | 1 |
| 0.756×2 | 1.512 | 1 |
| 0.512×2 | 1.024 | 1 |
| 0.024×2 | 0.048 | 0 |
| 0.048×2 | 0.096 | 0 |
| 0.096×2 | 0.192 | 0 |
| 0.192×2 | 0.384 | 0 |
| 0.384×2 | 0.768 | 0 |
| 0.768×2 | 1.536 | 1 |
| 0.536×2 | 1.072 | 1 |

Fractional Binary $\longrightarrow$ Decimal.

# 110.101 to decimal

$$2^2 \quad 2^1 \quad \boxed{2^0 \times 0} \quad 2^{-1} \quad \boxed{2^{-2} \times 0} \quad 2^{-3}$$

$$4 \quad 2 \quad \frac{1}{2} \quad \frac{1}{8}$$

$$4 + 2 + 0.5 + 0.125 = 6.625_{10}$$

# Binary Addition

1+1=0 plus take carry of 1 in next column

0+0=0

1+0=1

0+1=1

1+1+1 = 1 plus take carry of 1 in next column

```
 1  1 1
  1011
+ 1001
------
 10100
```

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

11

Carry

# Binary Subtraction

0 – 0 = 0

0 – 1 = 1 with a borrow from next column

1 – 0 = 1

1 – 1 = 0

$$\begin{array}{rcr} {\scriptstyle 0\ 10} & & \\ 1\ \cancel{1}\ \cancel{0} & \Rightarrow & 6_{10} \\ 1\ 0\ 1 & \Rightarrow & -5_{10} \\ \hline 0\ 0\ 1_2 & & 1_{10} \\ \hline \end{array}$$

# Complement of a number

- Decimal
  - 10's
  - 9's
- Binary
  - 1's
  - 2's.

# Complement with base n

Find the complement of $37_{10}$ → 10's
→ 9's

$$\begin{array}{r} 99 \\ -\ 37 \\ \hline 62 \end{array}$$

62 ⇐ 9's Complement

10's Complement:

= 9's complement +1

= 62 + 1

= 63

Binary Complement.

# Complement with base n

Find the complement of $101_2$ → 1's, 2's.

1's complement.

101

$$\boxed{1\text{'s} \Longrightarrow 010}$$

2's complement.

→ 1's complement + 1

= 010 + 1

= $011 = 11_2$

NOTE: If there's a carry overflow in 2's complement then we discard it.

Find 1's and 2's complement of 000000

(a) 111111, 100000

(b) 000000, 000000

(c) 111111, 000000

(d) 011111, 111111

1st ⇒ 111111

additional carry

$$
\begin{array}{r}
\boxed{1}\,11111 \\
111111 \\
+\;1 \\
\hline
\boxed{1}\,000000
\end{array}
$$

0

$\boxed{000000}$

$(1)_{10} \longrightarrow (1)_2$

Binary $\Longrightarrow$ Hexa.

$1_2$ in 16 bit 0000 0000 0000 0001

1's comp $\Rightarrow$ 1111 1111 1111 1110

+1

The 2's complement representation of -1 in 16 bit in hexadecimal form is

A. FFFF

B. FFFE

C. ABCD

D. BCDA

2's comp. 1111 1111 1111 1111

8 4 2 1

15

F F F F

$$(111001)_2 \Longrightarrow (\underline{\;39\;})_{16}$$

$$\underline{0011} \quad \underline{1001}$$

$$2 \quad 1 \qquad\qquad 8 \quad 1$$

$$3 \qquad\qquad 9$$

Shortcut Hexa ⇌ Binary (4)

$(AF)_{16} \Longrightarrow (10101111)_2$

A → 10 → 1010

F ⇓ 1111

(0-7)

① Octal Shortcut Method. (3 bits)

Oct ⇄ Binary

4 1

$(\underline{101}\ \underline{111})_2 \Longrightarrow (57)_8$

$\Downarrow$

5 7

$(27)_8 \Longrightarrow (010111)_2$

$\Downarrow \quad \Downarrow$

010 111

2's complement of 11001100 is

(a) 01010100

(b) 00110011

(c) 01000100

(d) 00110100

$$\begin{array}{r} 00110011 \\ +\quad 1 \\ \hline 00110100 \\ \hline \end{array}$$

9's complement of 629 Is

(a) 370

(b) 371

(c) 361

(d) 325

Comp = 10min

$$\begin{array}{r} 999 \\ -\ 629 \\ \hline 370 \\ +\ 1 \\ \hline 371 \end{array}$$

$370 \leftarrow$ 9's

$371 \leftarrow$ 10's

Addition of + 50 and - 55 in 8 bit register using 2's complement will be

(a) 0 0000101

(b) 1 1111011

(c) 1 1111010

(d) None of the above

| | | |
|---|---|---|
| 2 | 50 | |
| 2 | 25 | 0 |
| 2 | 12 | 1 |
| 2 | 6 | 0 |
| 2 | 3 | 0 |
| 2 | 1 | 1 |
| | 0 | 1 |

| | | |
|---|---|---|
| 2 | 55 | |
| 2 | 27 | 1 |
| 2 | 13 | 1 |
| 2 | 6 | 1 |
| 2 | 3 | 0 |
| 2 | 1 | 1 |
| | 0 | 1 |

Sign bit → 0 → +ve
→ 1 → -ve

| 0 | | | | | | | |
|---|---|---|---|---|---|---|---|

MSB ⇒ most Significant Bit

$50_2 = 110010$

00110010

$55_2 = 110111$ → 00110111

1's ⇒ 11001000

+ 1

2's 11001001 ⇐ -55

50 → 00110010

-55 → 11001001

Result → $\boxed{1}$1111011 → 1's → +1 →

-ve

00000100 +1 = 5 -5

The decimal equivalent of Hexadecimal 2B is

(a) 51

(b) 43

(c) 52

(d) None

2 11

0010 1011

16×0

32 8 2 1

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Perform Two's complement addition of two negative numbers $(11101)_2$ and $(11110)_2$

A. 00000

B. 00101

C. 11011

D. 11111

MSB

Overflow

$$\begin{array}{rl} & \boxed{1}\;1\;1 \\ & 1\,1\,1\,0\,1 \\ + & 1\,1\,1\,1\,0 \\ \hline & \boxed{1}\;\underline{1\,1\,0\,1\,1} \end{array}$$

discard

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Convert $01101_2$ to octal

A. 12

B. 15

C. 13

D. 16

15

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Hexa $\longleftrightarrow$ Binary $\longleftrightarrow$ Octal
(4 bits) (3 bits)

Find the equivalent octal of $C1_{16}$

A. $201_8$

B. $301_8$ ✓

C. $193_8$

D. $302_8$

12

A - 10

B - 11

C 1 (16)

$\downarrow$ $\downarrow$

$12_{16}$ $1_{10}$

1100 0001

| 011 | 000 | 001 |
| --- | --- | --- |
| 3 | 0 | 1 |

| 011 | 000 | 001 |
| --- | --- | --- |
| 3 | 0 | 1 |

The decimal equivalent of binary 1011.11011 is

A. 11.84375

B. 10.8435

C. 11.74389

D. 10.74375

11

$\frac{1}{16}$ $\frac{1}{32}$

8 2 1

$2^{-1}$ $2^{-2}$ $2^{-4}$ $2^{-5}$

0.5 0.25 0.0625 0.03125

0.03125
0.50000
0.25000
0.06250

84375

[MCA CET 2025]

Represent the number 85.125 in the IEEE Standard 754 single-precision floating-point format.

A. 0 01111111 01010100100000000000000

B. 0 10000101 01010100100000000000000

C. 0 01111101 01010100100000000000000

D. 1 10000101 01010100100000000000000

printing

85.125 ⟶ step 1 ⟹ Convert to Binary.

85 = 1010101

0.125 = 001

85.125 = 1010101.001

= 1.0101 01 001 × $2^6$

Scientific Notation.

Note:

Add exponent to biased

if no. is +ve

-ve ⟹ subt.

IEEE 32 bit standard.

| 0 | | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 1 | | 23-bits |
|---|---|---|---|---|---|---|---|---|---|---|---|

0101 01 001

sign (1 bit)

exponent (8 bit)

mantissa (23 bits)

1 ⟶ -ve

0 ⟶ +ve

Biased Exponent = 127+6

= $133_{10}$

= $(10000101)_2$

0100 0101

Ans:

0 01000101 01010100100000000000000

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