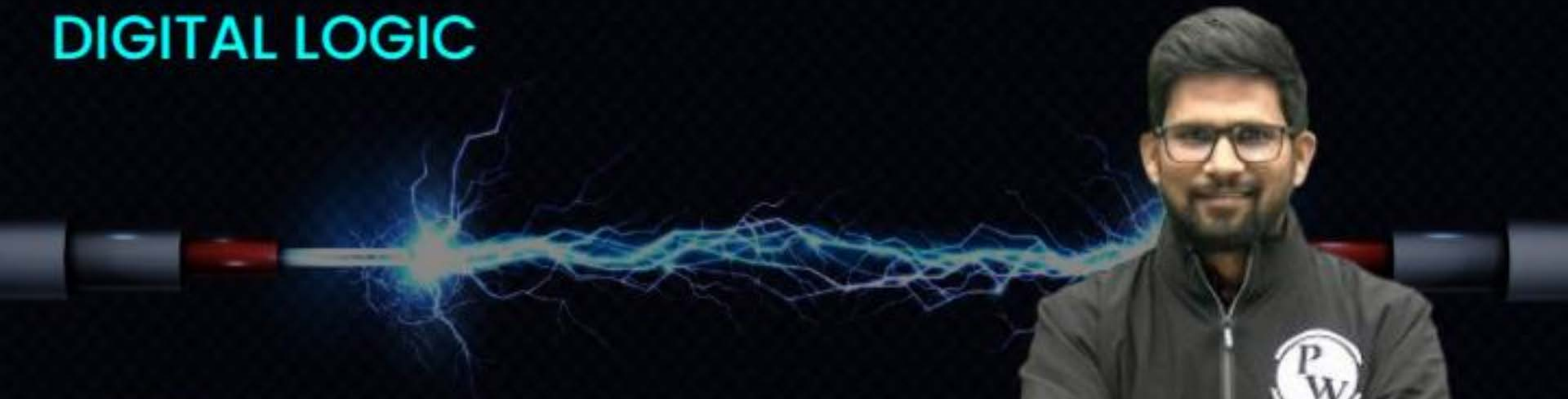
COMPUTER SCIENCE & IT

DIGITAL LOGIC



Lecture No: 01

Miscellaneous Topics

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Recap of Previous Lecture

- Question Discussion
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Number System

Number System

Base of a number system : (Radix)

base → r ⟶ $0 - (r-1)$ digits

$r = 6$, $(0-5)$ digits ⟶ $(126)_6$ ✗, $(234)_6$ ✓, $(123)_6$ ✓, $(555)_6$ ✓

$(124)_r \longrightarrow r \geq 5$

$\overset{r^2\, r^1\, r^0}{(237)}_r \longrightarrow r \geqslant 8$

$= [r^2 \times 2 + r^1 \times 3 + r^0 \times 7]_{10}$

$\overset{r^2 r^1 r^0}{(234)}_6 = \overset{6^2 6^1 6^0}{(234)}_6 = 6^2 \times 2 + 6 \times 3 + 6^0 \times 4$

$= (94)_{10}$

- Imp number system and their conversions :

decimal no. system → base → 10 → (0 – 9)

Binary no. system → base → 2 → (0 – 1)

Octal no. system → base – 8 → (0 – 7)

Hexadecimal system → base – 16 → (0 – 15), 0 – 9

$(A2)_{16}$ (A: 16^1, 2: 16^0)

$= 16 \times 10 + 2$

$= (162)_{10}$

10 → A
11 → B
12 → C
13 → D
14 → E
15 → F

$(10)_{10}$ ⟶ is a number in decimal no. system consisting of two digits 1 & 0.

- $(734)_{10} = 7\times10^2 + 3\times10 + 4\times10^0 = (734)_{10}$

- $(16)_{16}$ ⟶ is a two digit number.

$(16)_{16} = 16^1\times1 + 16^0\times6 = (22)_{10} = (26)_8$

$(16)_{16} = (22)_{10} = (26)_8$

$x \geq 4 \qquad y \geq 5$

$(123)_x = (241)_y$

$x > y$

$\Rightarrow$ binary to decimal $\rightarrow$ $\overset{2^2\ 2^1\ 2^0}{(b_2\ b_1\ b_0)}_2 = (2^2 \times b_2 + 2^1 \times b_1 + 2^0 \times b_0)_{10}$

$(1110110)_2 = 64+32+16+4+2 = (118)_{10}$

$\Rightarrow$ $\overset{8^2\ 8^1\ 8^0}{(236)}_8 = 128+24+6 = (158)_{10}$

$\Rightarrow$ $\overset{16^2\ 16^1\ 16^0}{(2AE)}_{16} = 16^2 \times 2 + 16^1 \times 10 + 16^0 \times 14 = 512+160+14 = (686)_{10}$

$\Rightarrow$ $\overset{5^2\ 5^1\ 5^0}{(124)}_5 = 25+10+4 = (39)_{10}$

⇒ Decimal to binary :

$(37)_{10} = (100101)_2$

$(52)_{10} = (110100)_2$

$(111)_{10} = (1101111)_2$

$(134)_{10} = (10000110)_2$

$(222)_{10} = (11011110)_2$

$(313)_{10} = (100111001)_2$

$(1111)_2 = (15)_{10} = (2^4-1)_{10}$

$(9999)_{10} = (10^4-1)$

$(7777)_8 = (8^4-1)$

$(77)_8 = (8^2-1)_{10}$

$(FF)_{16} = (16^2-1)_{10}$

$(23)_{10} = (27)_8 = (010111)_2 = (27)_8$

$(47)_{10} = (57)_8 = (101111)_2 = (57)_8$

$(78)_{10} = (116)_8 = (001001110)_2 = (116)_8$

64 8 1

$(237)_{10} = (355)_8 = (011101101)_2 = (355)_8$

$(010111 \cdot 010110)_2 = (27.26)_8$

Octal

0 → 000
1 → 001
2 → 010
3 → 011
4 → 100
5 → 101
6 → 110
7 → 111

$\Rightarrow (83)_{10} = (53)_{16} = (01010011)_2 = (53)_{16}$

$(329)_{10} = (149)_{16} = 00(01010010 01)_2 = (149)_{16}$

$(331)_{10} = (14B)_{16} = 000(1 0100 1011)_2 = (14B)_{16}$

0	0000
1	0001
2	0010

$\Rightarrow 00(1011 0.1011 0110 10)_2 = (2D \cdot B68)_{16}$

$\Rightarrow (236)_8 = (010\ 011\ 110)_2$

$(16BC)_{16} = (0001\ 0110\ 1011\ 1100)_2$

A	10
⋮	⋮
F	15 → (1111)

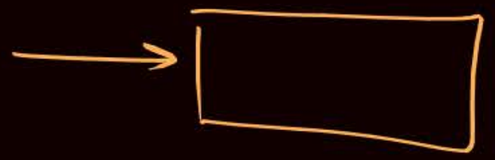
$(235)_8 = (9D)_{16} = (0\,100\,1101)_2$

(4 digit) Hexadecimal ← 16 bit

2^{16}

1011 1101 0100 1101

$= (BD49)_{16}$



$(1234)_{16}$

$(0000)_{16}$

↓

$(FFFF)_{16}$

- $(37)_{10} = (122)_5 = (101)_6$

  $(122)_5$: place values $25\ 5\ 1$; digits $(0-4)$

  $(101)_6$: place values $6^2\ 6^1\ 6^0$

- $(176)_{10} = (1201)_5 = (452)_6 = (341)_7$

  Place values: $5^3 5^2 5^1 5^0$; $6^2 6^1 6^0$; $7^2 7^1 7^0$

  Digits: $(0-4)$, $(0-5)$, $(0-6)$

- $(222)_{10} = (1342)_5 = (1010)_6 = (435)_7$

  Place values: $5^3 5^2 5^1 5^0$; $6^3 6^2 6^1 6^0$; $7^2 7^1 7^0$

  Digits: $(0-4)$, $(0-5)$, $(0-6)$

$(66)_7 = (7^2-1)_{10}$
$= (48)_{10}$

$(44)_5 = (24)_{10}$ (place values $5^1\ 5^0$)
$= (5^2-1)_{10} = (24)_{10}$

$(55)_6 = (6^2-1)$
$= (35)_{10}$

Question

A number $N_1 = (142)_5$ then it will be equal to $(xyz)_6$ then $(x + y + z)$ is ___(_____)$_{10}$___.

$5^2\ 5^1\ 5^0$

$(142)_5 = 25 + 20 + 2 = (47)_{10}$

$6^2\ 6^1\ 6^0$

$(47)_{10} = (1\ 1\ 5)_6$

$1 + 1 + 5 = (11)_6$

$x = 1$

$y = 1 \Rightarrow (7)_{10}$

$z = 5$

$$\begin{array}{r} 1 \\ +\ 1 \\ +\ 5 \\ \hline (11)_6 \end{array}$$

Question

A number $N_1 = (247.56)_8$ then its hexadecimal equivalent number is

(a) A7.B7

(b) A7.B8

(c) (47.B8)

(d) B7.B8

$= (010\ 100\ 111 . 101\ 110\ 00)_2 = (A7 . B8)_{16}$

Question

A binary no. is given as B = 101010.11010 then its hexadecimal and octal equivalent will be : $=(52.64)_8$ $=(2A.D)_{16}$

(a) $(A2.D)_{16}, (52.64)_8$

(b) $(2A.D)_{16}, (52.64)_8$

(c) $(2A.D)_{16}, (25.64)_8$

(d) $(A2.D)_{16}, (25.64)_8$

Question

Two no. N_1 and N_2 are given as

$$N_1 = (111)_2, \qquad N_2 = (777)_8$$

Then their hexadecimal equivalent will be :

(a) $(7)_{16}, (1FF)_{16}$

(b) $(7)_{16}, (777)_{16}$

(c) $(F)_{16}, (777)_{16}$

(d) $(F)_{16}, (1FF)_{16}$

$N_1 = (0111)_2 = (7)_{16}$

$N_2 = (777)_8 = (\underbrace{\text{wo}}\,\underbrace{111}\,\underbrace{111}\,\underbrace{111})$

$= (1FF)_{16}$

Question

$x \geq 5$

$y \geq 7$

A relation is given as :

$$(124)_x = (64)_y$$

Then minimum value of $(x + y)$ 14 .

$(124)_x$ $(64)_y$ $x = 6$, $y = 8$

$(x^2 + 2x + 4)_{10}$ $(6y + 4)_{10}$

$x = 5$ $(39)_{10}$ $y = 7$ $\Rightarrow (46)_{10}$

$x = 6$ $(52)_{10}$ $y = 8$ $\Rightarrow (52)_{10}$

A quadratic equation is given in base-r number system as:

$$x^2 - 15x + 60 = 0$$

One of the root of this equation is $x = (8)_r$ then

a. Other root of the equation is $(9)_r$

b. Base of number system r is $\underline{12}$.

$$\Rightarrow (15)_r = (r+5)_{10}, \quad (60)_r = (6r+0)_{10} = (6r)_{10}$$

$$x^2 - (r+5)x + 6r = 0$$

$$x = (8)_{10} \Rightarrow 64 - (r+5)8 + 6r = 0 \Rightarrow 64 - 40 = 2r \Rightarrow \boxed{r = 12}$$

$$x^2 - (a+b)x + a \cdot b = 0$$

$$(8)_{12} + (9)_{12} = (15)_{12}$$

$$x^2 - 17x + 72 = 0$$

$$(x-8)(x-9) = 0$$

$$x = (8)_{10}, (9)_{10} = (9)_{12}$$

$$(10)_{10} = (A)_{12}$$

$$(13)_{10} = (11)_{12}$$

$$x = (8)_r = (8)_{10}$$

$$(8)_{12} \times (9)_{12} = (8)_{10} \times (9)_{10} = (72)_{10} = \overset{12^1\ 12^0}{(60)_{12}}$$

Topic : 2 Min Summary

→ Numbu system & its basics

$(010.011)_2$

↓ 2's

Thank you

GW

Soldiers !