

Information & Communications Technologies

INF-106

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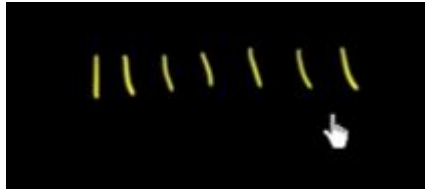
Laboratory work №1

Week 1

Learn Numerical Systems

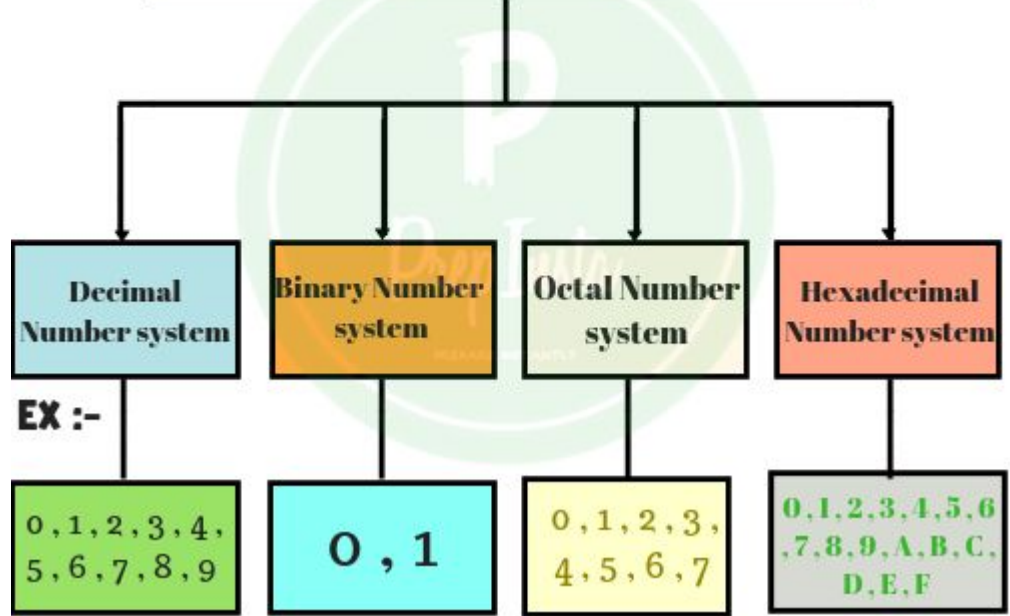


Number Systems



0123456789

Number System



Binary numbers and their decimal equivalents

1-Bit Binary Numbers	2-Bit Binary Numbers	3-Bit Binary Numbers	4-Bit Binary Numbers	Decimal Equivalents
0	00	000	0000	0
1	01	001	0001	1
	10	010	0010	2
	11	011	0011	3
		100	0100	4
		101	0101	5
		110	0110	6
		111	0111	7
			1000	8
			1001	9
			1010	10
			1011	11
			1100	12
			1101	13
			1110	14
			1111	15

- **Decimal to binary conversion**

For example, 22_{10}

Divide number by 2.

Reminder goes each columns.

$$22/2=11, \quad \mathbf{0}$$

$$11/2=5 \text{ remainder } \mathbf{1}$$

$$5/2=2 \text{ remainder } \mathbf{1} \quad \longrightarrow \quad \mathbf{10110_2}$$

$$2/2=1, \quad \mathbf{0}$$

$$1/2= 0, \text{ remainder } \mathbf{1}.$$

- Binary to decimal conversion

$$10110_2 = 1 \times 2^4 + 0 \times 2^3 + 1 \times 2^2 + 1 \times 2^1 + 0 \times 2^0 = 22_{10}$$

Decimal to octal conversion

Example, 22_{10}

Divide number by 8.

$22/8=16$, remainder 6

$2/8=0$, remainder 2  26_8

Octal to decimal conversion

$$26_8 = 2 \times 8^1 + 6 \times 8^0 = 22_{10}$$

Hexadecimal number system

Hexadecimal Digit	Decimal Equivalent	Binary Equivalent
0	0	0000
1	1	0001
2	2	0010
3	3	0011
4	4	0100
5	5	0101
6	6	0110
7	7	0111
8	8	1000
9	9	1001
A	10	1010
B	11	1011
C	12	1100
D	13	1101
E	14	1110
F	15	1111

- Decimal to hexadecimal conversion

$$22_{10}$$

Divide the number by 16.

$$22/16=1 \text{ remainder } 6$$

$$1/16=0 \text{ remainder } 1 \quad \longrightarrow \quad 16_{16}$$

- Hexadecimal to decimal conversion

$$16_{16} = 1 \times 16^1 + 6 \times 16^0 = 22_{10}$$

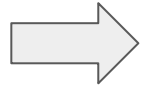
- Hexadecimal to binary conversion

Conversion between hexadecimal and binary is easy because each hexadecimal digit directly corresponds to four binary digits.

16_{16}

$1_{16} = 0001_{10}$

$6_{16} = 0110_{10}$



10110_2

- Binary to hexadecimal conversion

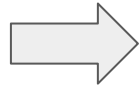
10110_2

Start reading from the right.

The four least significant bits are

$$0110_2 = 6_{16}$$

$$0001_2 = 1_{16}$$



$$16_{16}$$

Practice

- 48_{10} to binary
- 19_{10} to binary
- 10010_2 to decimal
- 11100_2 to decimal
- 64_{16} to decimal
- $2E_{16}$ to decimal



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Answers

- $48_{10} = 110000_2$
- $19_{10} = 10011_2$
- $10010_2 = 18_{10}$
- $11100_2 = 28_{10}$
- $64_{16} = 100_{10}$
- $2E_{16} = 46_{10}$

Home work

- Laboratory work 1

Questions?

