SNS COLLEGE OF TECHNOLOGY

Coimbatore-35
An Autonomous Institution

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DEPARTMENT OF ELECTRONICS & COMMUNICATION ENGINEERING

23ECB201 – DIGITAL SYSTEM DESIGN

II YEAR/ III SEMESTER

1

UNIT I – BOOLEAN THEOREMS AND LOGIC REDUCTION

1.1- NUMBER SYSTEM

NUMBER SYSTEMS

- **Numbers** - We use numbers to
  communicate
  perform tasks
  quantify
  measure

- The number system has a base of 16 means there are total 16 symbols(0, 1, 2, 3, 4, 5, 6, 7, 8, 9, A, B, C, D, E, F)

Number system in digital electronics

- A system that is used for representing numbers is called the number system
- In digital electronics, the numbers are used to represent the information
- it is important to learn and understand different types of number systems so we can easily represent and interpret the information in the form of numbers

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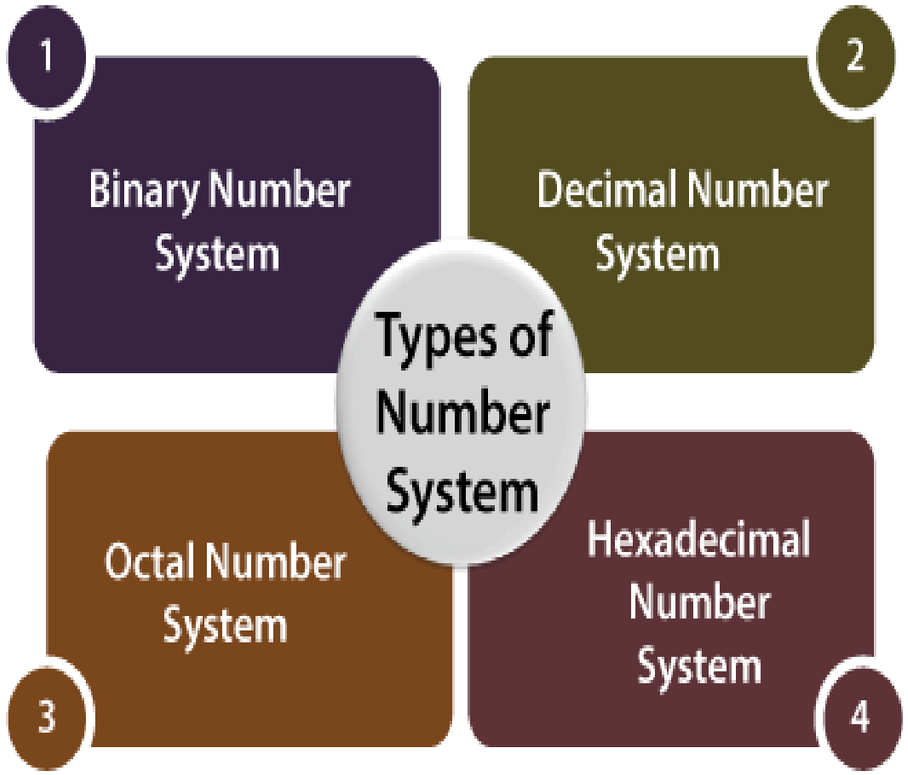
NUMBER SYSTEMS

- The digit value in the number system is calculated using:
  the digit
  the index, where the digit is present in the number.
  the base numbers, the total number of digits available in the number system.

Types of Number system

1. Binary Number System
2. Decimal Number System
3. Hexadecimal Number System
4. Octal Number System



BINARY NUMBER SYSTEMS

- Generally, a binary number system is used in the digital computers
- In this number system, it carries only two digits, either 0 or 1
- There are two types of electronic pulses present in a binary number system
  first one is the absence of an electronic pulse representing '0‘
  second one is the presence of electronic pulse representing '1‘
- Each digit is known as a bit
- A four-bit collection (1101) is known as a nibble
- collection of eight bits (11001010) is known as a byte
- The location of a digit in a binary number represents a specific power of the base (2) of the number system

Characteristics

- It holds only two values, i.e., either 0 or 1
- It is also known as the base 2 number system
- The position of a digit represents the 0 power of the base(2). Example: 2^0
- The position of the last digit represents the x power of the base(2). Example: 2^x, where x represents the last position, i.e., 1

Examples:

$(10100)_2$, $(11011)_2$, $(11001)_2$, $(000101)_2$, $(011010)_2$.

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DECIMAL NUMBER SYSTEMS

- The decimal numbers are used in our day to day life.
- The decimal number system contains ten digits from 0 to 9(base 10)
- The position in the decimal number system specifies the power of the base (10)
- The 0 is the minimum value of the digit, and 9 is the maximum value of the digit
- For example

  the decimal number 2541 consist of the digit

  1 in the unit position

  4 in the tens position

  5 in the hundreds position

  2 in the thousand positions and the value will be written as

$(2\times1000) + (5\times100) + (4\times10) + (1\times1)$

$(2\times10^3) + (5\times10^2) + (4\times10^1) + (1\times10^0)$

$2000 + 500 + 40 + 1$

2541

OCTAL NUMBER SYSTEMS

- The octal number system has base 8(means it has only eight digits from 0 to 7)
- There are only eight possible digit values to represent a number
- With the help of only three bits, an octal number is represented
- Each set of bits has a distinct value between 0 and 7.

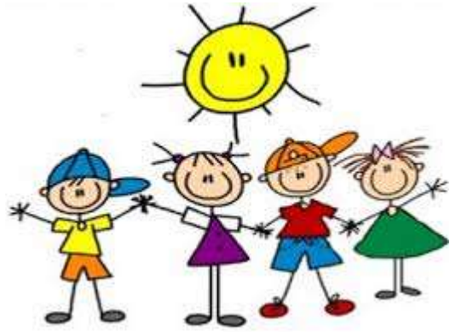
Characteristics

- An octal number system carries eight digits starting from 0, 1, 2, 3, 4, 5, 6, and 7
- It is also known as the base 8 number system
- The position of a digit represents the 0 power of the base(8) Example: 8^0
- The position of the last digit represents the x power of the base(8). Example: 8^x, where x represents the last position, i.e., 1

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

Examples:
$(273)_8$, $(5644)_8$, $(0.5365)_8$, $(1123)_8$, $(1223)_8$

Activity



HEXADECIMAL NUMBER SYSTEMS

- It is another technique to represent the number in the digital system called the **hexadecimal number system**
- The number system has a base of 16 means there are total 16 symbols(0, 1, 2, 3, 4, 5, 6, 7, 8, 9, A, B, C, D, E, F) used for representing a number
- The single-bit representation of decimal values10, 11, 12, 13, 14, and 15 are represented by A, B, C, D, E, and F
- Only 4 bits are required for representing a number in a hexadecimal number. Each set of bits has a distinct value between 0 and 15

Characteristics:

1.It has ten digits from 0 to 9 and 6 letters from A to F.
2.The letters from A to F defines numbers from 10 to 15.
3.It is also known as the base 16number system.
4.In hexadecimal number, the position of a digit represents the 0 power of the base(16). Example: 16^0
5.In hexadecimal number, the position of the last digit represents the x power of the base(16). Example: 16^x, where x represents the last position, i.e., 1

HEXADECIMAL NUMBER SYSTEMS

Binary Number	Hexadecimal Number
0000	0
0001	1
0010	2
0011	3
0100	4
0101	5
0110	6
0111	7
1000	8
1001	9
1010	A
1011	B
1100	C
1101	D
1110	E
1111	F

Examples:
$(FAC2)_{16}$, $(564)_{16}$, $(0ABD5)_{16}$, $(1123)_{16}$, $(11F3)_{16}$

ASSESSMENTS ?

1. List out the primary number systems used in digital electronics
2. How do you convert a binary number to its decimal equivalent, and vice versa?
3. What are signed and unsigned binary numbers, and how do they differ?


Thank
you