1 Number System

LEARNING OUTCOMES

After the lesson, students will be able to:

- Define the Binary number system.
- Define the Octal number system.
- Define the Decimal number system.
- Define the Hexadecimal (hex) number system.
- Convert a given number from one system to another.

WARM UP

Write down the various arithmetic operations we use in mathematics and their formulas.

Ans. Students can do this with the help of the teacher.

CHAPTER NOTES

- When we type some letters or words, the computer translates them into numbers. This is because the computer can understand the positional number system where there are only a few symbols, called digits, and these symbols represent different values.
- The value of each digit in a number can be determined using the digit, the position of the digit in the number and the base of the number system (where the base is defined as the total number of digits available in the number system).
- Number System is a technique to represent numbers in the computer

system architecture where every value that you are saving or getting into/from computer memory has a defined number system.

» Computer architecture supports the following number systems: Decimal number system, Binary number system, Octal number system, Hexadecimal (hex) number system.

» Decimal Number System is called a decimal system because when we write decimal (base 10) numbers, we use a positional notation system. Each digit is multiplied by an appropriate power of 10 depending on its position in the number.

» The number system that we use in our day-to-day life is the decimal number system.

» Machine language has binary values or two values, the combination of which represents the data. These two states are the 'on' state, represented by '1', and the 'off' state, represented by '0'.

» When we write a binary number, each binary digit is multiplied by an appropriate power of 2 which is based on its position in the number.

» In the binary number system, there are only two possible values, 0 and 1, which can appear in each digit position rather than the ten that can appear in a decimal number.

» The term 'bit' is a contraction of the words 'binary' and 'digit'. This term describes the number of binary digits that would be required to write a given number or information.

» Each 0 or 1 term of machine language forms a bit. A group of 8 bits, such as 01100001, is a byte. So a bit is the smallest unit of memory or instruction that can be given or stored on a computer.

» A combination of bytes comes with various names, such as kilobyte. One kilobyte is a collection of 1000 bytes.

» The octal number system uses numbers from 0 to 7 (i.e., 8 digits), and the numbers used are with the base 8.

» The octal number system uses eight digits: 0,1,2,3,4,5,6 and 7. It is also called base 8 number system.

» The first position in an octal number represents the power '0' of the base (8) starting from the leftmost number, i.e., 80.

» The last position in an octal number represents the power ‘x’ of the base (8). Example: 8x, where x represents the last position - 1.

» In the hexadecimal number system, the base used is 16. So there are 16 digits used to represent a given number. This number system is called hexadecimal number system and each digit position represents the power of 16.

» The following are the hexadecimal numerals: 10 digits and 6 letters, that is, 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, A, B, C, D, E, F. The letters represent the numbers starting from 10. A = 10, B = 11, C = 12, D = 13, E = 14, F = 15. It is also called the base 16 number system.

» The first position in a hexadecimal number represents the power ‘0’ of the base (16) starting from the leftmost number. Example: 16^0.

» The last position in a hexadecimal number represents the power ‘x’ of the base (16). For example, 16x where x represents the last position - 1.

DEMONSTRATION

Show how to perform number conversions.

LAB ACTIVITIES

A. Convert the following decimal numbers into binary:

1. 65
2. 876

B. Convert the following binary numbers into decimal numbers:

1. 1011
2. 101100

C. Perform binary addition:

1. 110101 + 000111
2. 10001010 + 100000101

D. Perform binary subtraction:

1. 10010 - 000010
2. 1110000110 - 0000001010

ASSESSMENT

Teacher can ask the students to name and define the different types of number systems.