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NUMBER SYSTEM

CLASS VII

CH-1 PERIOD -1

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LEARNING OUTCOMES

- Learn the types of number system used by computer
- Learn how decimal number is represented with the base and exponent.
- Learn how decimal number is converted in to binary
- Learn about binary number system and its base
- Learn the steps to convert binary to decimal

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NUMBER SYSTEM

In early days when there were no means of counting, people used to count with the help of fingers, stones, pebbles, sticks, etc. These methods were not adequate and had many limitations. To overcome these limitations, many number systems were introduced with the passage of time, like:

- Decimal number system
- Binary number system
- Octal number system
- Hexadecimal number system

A number system is a set of values used to represent different quantities.

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DECIMAL NUMBER SYSTEM

- It consist of 10 digit (0 to 9).
- Though it use 10 digit its base or radix is 10.
- The value if each digit in a number depends on-

- The face value of the digit
- The base of the number system
- The position of the digit in the number

Each position represents a specific power of base (10). The right most digit of a number is called **Least Significant Digit** whereas the left most digit is called **Most Significant Digit**. For example, the number 547 can be represented in the following way:

Example

5 4 7

$7 * 10^0$ units = 7

$4 * 10^1$ tens = 40

$5 * 10^2$ hundreds = 500

547

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BINARY NUMBER SYSTEM

The Binary number system consists of only two digits, i.e., zero and one (0 and 1). Since this system uses two digits, it has the base 2. All digital computers use this number system and convert the input data from the decimal format into its binary equivalent.

WHY BINARY?

A computer cannot understand human language, rather it understands only the binary code. Therefore, the data that is entered into a computer is converted into its binary equivalent. It further converts the binary results into their decimal equivalents for output.

CONVERSION OF DECIMAL INTO BINARY NUMBER SYSTEM

The equivalence between binary and decimal numbers can be understood with the given examples. To convert a decimal number into binary number, follow the given rules:

Step 1: Divide the given decimal number with the base 2.

Step 2: Write down the remainder, divide the quotient again by 2.

Step 3: Repeat step 2 till the quotient is zero.

Let us understand the conversion of Decimal number into Binary number with the given examples:

Aryabhat was India's greatest mathematician and astronomer. He introduced the concept of 0 (zero) without which modern computer technology would have been non-existent.

Let's Know More

Base or Radix of a Number System

The base of the number system is the number of digits used in it. E.g., Since

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examples:

Example 1:

2	25	
2	12	1 → Least Significant Digit
2	6	0
2	3	0
2	1	1
	0	1 → Most Significant Digit

Thus $(25)_{10} = (11001)_2$

The base of number is given as subscript.

Example 2:

2	321	
2	160	1 → Least Significant Digit
2	80	0
2	40	0
2	20	0
2	10	0
2	5	0
2	2	1
2	1	0
	0	1 → Most Significant Digit

Thus $(321)_{10} = (101000001)_2$

Remainders, which are obtained in each step are written in reverse order, i.e., placing the Least Significant Digit at the top and Most Significant Digit at the bottom, to form the binary equivalent of the decimal number.

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BINARY TO DECIMAL

- Multiply each binary number with its positional value, which is in terms of powers of 2, starting from the extreme right digit.
- Increase the power one by one, keeping the base fixed as 2.
- Sum up all products to get the decimal number.

Example 1:

$(1010)_2$

0×2^0 - Units = 0

1×2^1 - Tens = 2

0×2^2 - Hundreds = 0

1×2^3 - Thousands = 8

Thus $(1010)_2 = (10)_{10}$

Example 2:

$(1\ 0\ 0\ 1)_2$

$1 \times 2^0 = 1$

$0 \times 2^1 = 0$

$0 \times 2^2 = 0$

$1 \times 2^3 = 8$

Thus $(1001)_2 = (9)_{10}$

Example 3:

$(110001001)_2 = 1 \times 2^8 + 1 \times 2^7 + 0 \times 2^6 + 0 \times 2^5 + 0 \times 2^4 + 1 \times 2^3 + 0 \times 2^2 + 0 \times 2^1 + 1 \times 2^0$

$= 256+128+0+0+0+8+0+0+1$

$= 393$

Thus $(110001001)_2 = (393)_{10}$

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recap

- The base of decimal number system is 10
- The base of binary number system is 2
- To convert decimal to binary divide the number by 2 and write the quotient and remainder and again divide the quotient and collect the remainder and this procedure continue until the quotient became zero.
- To convert binary to decimal multiply each binary digit with its positional value which in term of power of 2 from extreme right.
- Increase the power of two moving right to left
- At last add it to get decimal value.

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ASSIGNMENT

- Convert the following Decimal no to binary and vice versa?
- 1. $(145)_{10}$ =(----------)2
- 2. $(23)_{10}$ =(----------)2
- 3.$(65)_{10}$ =(----------)2
- 4.$(129)_{10}$ =(----------)2
- 5.$(36)_{10}$ =(----------)2
- 6. $(11011)_2$=(------)$_{10}$
- 7. $(11110)_2$=(-------)$_{10}$
- 8.$(10001)_2$=(-------)$_{10}$
- 9. $(101010110)_2$=(----------)$_{10}$
- 10. $(111000)_2$=(-------)$_{10}$

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THANKING YOU

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