

## NUMBER SYSTEMS : PART-I

### INTRODUCTION

A Number System defines a set of values to represent different quantities. Quantifying values and items is helpful for humans to make sense of their environment. For example, the number of flats in an apartment; the number of students in a class etc.

The common Number Systems are :-

- (i) The Decimal Number System
- (ii) The Binary Number System
- (iii) The Octal Number System
- (iv) The Hexadecimal Number System

Every Number System has an unique 'Base' or 'Radix'. The base or radix of a Number System specifies the number of distinct digits or symbols that can be used in that particular system. In ancient times, different civilizations used different radices. For example, the Babylonians used the radix 60; the Mayans used 18 and 20.

Modern computers use only two digits ['0' and '1'], and as such, have a base or radix of '2'. This system is referred to as the Binary Number System.

### FEATURES OF THE COMMON NUMBER SYSTEMS

The following table shows the unique features of the commonly used Number Systems :-

<u>Number System</u>	<u>Base or Radix</u>	<u>Digits / Symbols Used</u>	<u>Use</u>
Decimal Number System	10	0 to 9	Used by humans for counting.
Binary Number System	2	0 and 1	Used to : (i) Perform calculations in the CPU (ii) Store data in the computer's memory
Octal Number Systems	8	0 to 7	Used to represent large values in older computers.
Hexadecimal Number System	16	0 to 9 and A to F	Used to represent large values in newer computers.

In the Hexadecimal Number System 'A' is used to represent 10; 'B' represents 11 and so on till 'F' for 15.

The base or radix of a number is always expressed as a subscript.

For example:     (195)<sub>10</sub>  
                  (1011)<sub>2</sub>  
                  (712)<sub>8</sub>

In the above examples, '10', '2' and '8' are the subscripts signifying that 195 is a Decimal Number, 1011 is a Binary Number and 712 is an Octal Number.

Q1> Can the digit '8' be used in the Octal Number System?

Q2> Write the Hexadecimal equivalents of : (a) 9 (b) 0  
(c) 11 (d) 14

Q3> A Number System has a radix of seven. List the digits that can be used in that Number System.

Q4> A Number System allows the use of the digits '0' and '1' and also the alphabets 'i' and 'x'. What is the base of this Number System?

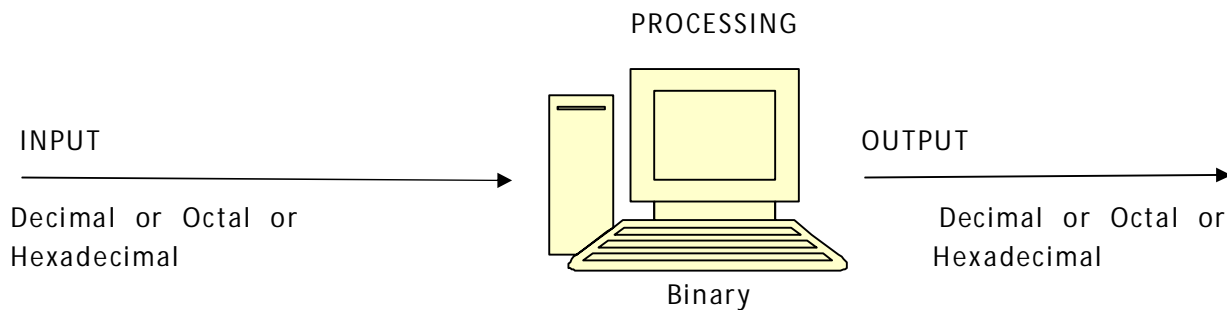
Q5> Find the error :  $(853)_8$

Mini-Project: Prepare a short presentation on the counting method(s) used by the  
(a) Babylonians (b) Mayans

### BASE CONVERSIONS

Inputs given to a computer are usually in the Decimal, Octal or Hexadecimal systems. However, the computer does the processing in the Binary system. For producing the output, the results of the processing are again converted to Decimal, Octal or Hexadecimal, depending on the user's requirements.

This gives rise to the need of conversions between the different number systems.



*We have already studied base conversions of whole numbers in Std-VI.*

*Students are advised to make a thorough revision of the base-conversion methods studied in Std-VI so that we may move on to the more advanced topics in the upcoming modules.*