NUMBER SYSTEM

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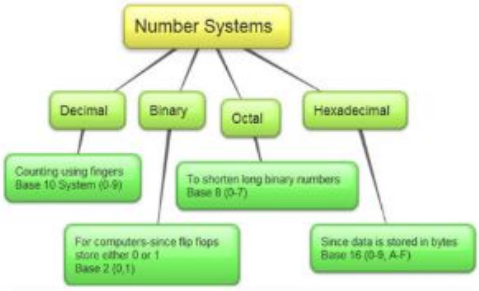

Number system can be defined as the combination of different numbers which helps in the calculation. History of number starts from the primitive age of human being. The development of number system has integrated with the development of human beings. In the primitive age, people used to count stones and pebbles.

Binary Numbers

Binary Number is a number of two base numbers. It is represented by 1 and 0. 1 or 0 is called Binary digits.We can generate this number with the combination of 0 and 1. It is represented with suffix two. Eg $(10101)_2$. Following table shows some decimal number and their equivalent binary numbers**.

Decimal (Denary) Numbers

The number of base or radix ten is called decimal numbers. It is the first number system in which all the ancient and modern mathematical calculation is done. Another number system is derived from this number. It is generated by the combination of 0, 1, 2, 3, 4, 5, 6, 7, 8, 9. We can represent these numbers with suffix two. Eg $(9810)_{10}$The following chart displays relations among several number systems derived from the decimal number.

Octal Numbers

The number with base eight is called octal number. It is represented by Q or O. We can generate these numbers with the combination of 0, 1, 2 3, 4, 5, 6, 7. We can represent these numbers wit suffix eight. Eg $(5432)_8$

Hexadecimal Numbers

The number with base sixteen is called hexadecimal number. We can generate these numbers with the combination of 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, A,B, C, D, E, F. Where A=10, B=11, C=13, D=14, E=15, F=16. We can represent these numbers with suffix sixteen. E.g. $(12AB)_{16}$ Where A=10, B=11. The 4-bit format of the binary is used for hexadecimal to binary conversion.

**Equivalent values for different number systems

Decimal	Binary	Octal	Hexadeciamal
0	0	0	0
1	1	1	1
2	10	2	2
3	11	3	3
4	100	4	4
5	101	5	5
6	110	6	6
7	111	7	7
8	1000	10	8
9	1001	11	9
10	1010	12	A
11	1011	13	B
12	1100	14	C
13	1101	15	D
14	1110	16	E
15	1111	17	F

BINARY ARITHMETIC AND CONVERSION

Conversion from Decimal to Binary

To convert the decimal number to binary number, repeated division by two is needed.

Examples: Convert following into binary numbers:

1. $(45)_{10} = (101101)_2$

   2 45 1
   2 22 0
   2 11 1
   2 5 1
   2 2 0
   1

   $=(101101)_2$

2. $(225)_{10} = (10111001)_2$

   2 225 1
   2 112 0
   2 56 0
   2 23 1
   2 11 1
   2 5 1
   2 2 0
   1

   $= (10111001)_2$

Conversion from Binary to Decimal

To convert binary to the decimal number system, multiply given number by 2.

1. $(1101)_2 = (?)_{10}$

$=1x2^3+ 1 x 2^2+ 0x 2^1+ 1x 2^0$
$=8 + 4 + 0 + 1$
$=13$

Rules for Binary Addition

ABA+B
000
011
101
110 with carry 1

Examples:

1. 1100 + 1111= 11011

   1 Carry
   1 100
   1 111

   11011

Rules for Binary Multiplication

ABA*B
000
010
100
111

Example:

$$\begin{array}{r} 11 \\ \times 10 \\ \hline 00 \\ +11\times \\ \hline 110 \end{array}$$