PHILOSOPHY OF NUMBER SYSTEMS

There are four types of number systems

1. decimal number systems
2. binary number systems
3. octal number systems
4. hexa decimal number systems

DECIMAL NUMBER SYSTEM

. The decimal number system includes the digits from 0 through 9 only. So The Decimal Number System uses base-10. This is also called Hindu-Arabic or Arabic number system. The digits 0, 1, 2, 3, 4, 5, 6, 7, 8, 9. The numbers 10,11,12…… are not a decimal numbers. It also requires a dot (decimal point) to represent decimal fractions. In this scheme, the numerals used in denoting a number take different place values depending upon position. In this system the number 543.21 represents the sum (5×10^2) + $(4 \times 10^1) + (3 \times 10^0) + (2 \times 10^{-1}) + (1 \times 10^{-2})$.

BINAY NUMBER SYSTEMS

Computers use the binary number system to manipulate and store all of their data including numbers, words, videos, graphics, and music. The term bit, the smallest unit of digital technology, stands for Binary digit. A byte is a group of eight bits. A kilobyte is 1,024 bytes or 8,192 bits. Using binary numbers, 1 + 1 = 10 because 2 does not exist in this system.

The advantage of the binary system is its simplicity. A computing device can be created out of anything that has a series of switches, each of which can alternate between an "on" position and an off position. These switches can be electronic, biological, or mechanical, as long as they can be moved on command from one position to the other. Most computers have electronic switches.

When a switch is "on" it represents the value of one, and when the switch is "off" it represents the value of zero. Digital devices perform mathematical operations by

turning binary switches on and off. The faster the computer can turn the switches on and off, the faster it can perform its calculations.

OCTATL NUMBER SYSTEM

Octal Number System uses Base-8. The values are, 0 1 2 3 4 5 6 7 with 0 having the least value and seven having the greatest value. Columns are used in the same way as in the decimal system, in that the left most column is used to represent the greatest value. As we have seen in the decimal system, the values in the set (0 and 1) repeat, in both the vertical and horizontal directions. 0 - 7, 10 -17, 20 - 27, 30 - 37 .....

HEXADECIMAL NUMBER SYSTEM

Another number system used by computer programmers is the hexadecimal system, base-16 , which uses 16 symbols (0,1,2,3,4,5,6,7,8,9,A,B,C,D,E,F), so 1 + 1 = 2 and 7 + 7 = E. Base-10 and base-16 number systems are more compact than the binary system. Programmers use the hexadecimal number system as a convenient, more compact way to represent binary numbers because it is very easy to convert from binary to hexadecimal and vice versa. It is more difficult to convert from binary to decimal and from decimal to binary.

Following table shows decimal number and its equivalent binary number & hexadecimal numbers

Decimal Number System	Binary Number System	Hexadecimal Number System
0	0	0
1	1	1
2	10	2
3	11	3
4	100	4

Decimal Number System	Binary Number System	Hexadecimal Number System
5	101	5
6	110	6
7	111	7
8	1000	8
9	1001	9
10	1010	A
11	1011	B
12	1100	C
13	1101	D
14	1110	E
15	1111	F
16	10000	10

Positional Notation

Each numeral in a binary number takes a value that depends on its position in the number. This is called positional notation. It is a concept that also applies to decimal numbers.

For example, the decimal number 123 represents the decimal value 100 + 20 + 3. The number one represents hundreds, the number two represents tens, and the number three represents units. A mathematical formula for generating the number 123 can be created by multiplying the number in the hundreds column (1) by 100, or 10^2; multiplying the number in the tens column (2) by 10, or 10^1; multiplying the number in the units column (3) by 1, or 10^0; and then adding the products together. The formula is: $1 \times 10^2 + 2 \times 10^1 + 3 \times 10^0 = 123$.

This shows that each value is multiplied by the base (10) raised to increasing powers. The value of the power starts at zero and is incremented by one at each new position in the formula.

This concept of positional notation also applies to binary numbers with the difference being that the base is 2. For example, to find the decimal value of the binary number 1101, the formula is $1 \times 2^3 + 1 \times 2^2 + 0 \times 2^1 + 1 \times 2^0 = 13$.

Binary addition

Rules for binary addition

1+1=10

1+0=0+1=1

0+0=0

Add following two numbers

a)101010+001010 b)101101+110011

a) 101010

001010

110100

b) 101101

110011

1000000