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## Number Systems

### ➤ ON / OFF

- The computer can construct a sophisticated ways of representing data using only two states: ***ON / OFF***...
- This two-state system is called Binary System...
- While the decimal number system has a base of ***10*** (***0, 1, 2, 3, ..., 7, 8, 9***), The binary system has a base of ***2*** (***0, 1***) which correspond to the ***ON / OFF*** states...
- The combination of ***0***s and ***1***s can represent a large numbers...

### ➤ Bit

- Each ***0*** or ***1*** in a binary system is called a bit (binary digit) ...
- It is the basic unit for storing data in a computer...
- But a single bit cannot store all the numbers, letters and special characters that the computer must process... The bits are put together in a group called a **Byte**...

**➤ Byte**

- There are usually **8 bits** in a **byte**, which represents one **Character** of data... a letter, digit, or special character...
- Capacity of memory and storage are expressed in the number of bytes...
  - ◆ **Kilobytes**: Abbreviated by **KB** or **K**, it represents 2 to the power of 10 (  $2^{10}$  ) which is **1024 bytes**...
  - ◆ **Megabytes**: Abbreviated by **MB** , it represents **1024 X 1024** bytes which is roughly **one million** bytes...
  - ◆ **Gigabytes**: Abbreviated by **GB** , it represents roughly **one billion** bytes...

**➤ Word**

- A computer Word is the number of bits that make up a unit of data, as defined by the computer system... (It varies from a computer to another)...
- Generally, the larger the word, the more powerful the computer (An 8- bit machine could handle 1 byte at a time... but a 64-bit machine can handle 8 bytes at a time... 8 times the faster)

**➤ Number Systems**

- ◆ **Binary**: Base 2 number system...
- ◆ **Octal**: Base 8 number system...
- ◆ **Decimal**: Base 10 number system...
- ◆ **Hexadecimal**: Base 16 number system...

<b>Binary</b>	<b>Octal</b>	<b>Decimal</b>	<b>Hexadecimal</b>
0	0	0	0
1	1	1	1
	2	2	2
	3	3	3
	4	4	4
	5	5	5
	6	6	6
	7	7	7
		8	8
		9	9
			A
			B
			C
			D
			E
			F
			10 <sub>(10)</sub>
			11 <sub>(10)</sub>
			12 <sub>(10)</sub>
			13 <sub>(10)</sub>
			14 <sub>(10)</sub>
			15 <sub>(10)</sub>

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**➤ Decimal, Binary, Octal and Hexadecimal equivalents**

<b>Decimal</b>	<b>Binary</b>	<b>Octal</b>	<b>Hexadecimal</b>
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
16	10000	20	10

**➤ C++ supported Data Type and Ranges**

Type Name	Bytes	Range of Values
char, signed char	1	-128 to 127
unsigned char	1	0 to 255
short short int signed short int	2	-32,768 to 32,767
unsigned short unsigned short int	2	0 to 65,535
long long int signed long int	4	-2,147,483,648 to 2,147,483,647
unsigned long unsigned long int	4	0 to 4,294,967,295
float	4	3.4e +/- 38 (7 digits)
double	8	1.7e +/- 308 (15 digits)
long double	10	1.2e +/- 4932 (19 digits)