When we type some letters or words, the computer translates them in numbers as computers can understand only numbers. A computer can understand the positional number system where there are only a few symbols called digits and these symbols represent different values depending on the position they occupy in the number.

The value of each digit in a number can be determined using −

* The digit
* The position of the digit in the number
* The base of the number system (where the base is defined as the total number of digits available in the number system)

**Decimal Number System**

The number system that we use in our day-to-day life is the decimal number system. Decimal number system has base 10 as it uses 10 digits from 0 to 9. In decimal number system, the successive positions to the left of the decimal point represent units, tens, hundreds, thousands, and so on.

Say we have three numbers – 734, 971 and 207. The value of 7 in all three numbers is different−

* In 734, value of 7 is 7 hundreds or 700 or 7 × 100 or 7 × 102
* In 971, value of 7 is 7 tens or 70 or 7 × 10 or 7 × 101
* In 207, value 0f 7 is 7 units or 7 or 7 × 1 or 7 × 100
* The weightage of each position can be represented as follows –



* In digital systems, instructions are given through electric signals; variation is done by varying the voltage of the signal. Having 10 different voltages to implement decimal number system in digital equipment is difficult. So, many number systems that are easier to implement digitally have been developed.

**Binary Number System**

The easiest way to vary instructions through electric signals is two-state system – on and off. On is represented as 1 and off as 0, though 0 is not actually no signal but signal at a lower voltage. The number system having just these two digits – 0 and 1 – is called **binary number system**.

Each binary digit is also called a **bit**. Binary number system is also positional value system, where each digit has a value expressed in powers of 2, as displayed here.

Characteristics of the binary number system are as follows −

* Uses two digits, 0 and 1
* Also called as base 2 number system

In any binary number, the rightmost digit is called **least significant bit (LSB)** and leftmost digit is called **most significant bit (MSB)**.

And decimal equivalent of this number is sum of product of each digit with its positional value.

110102 = 1×24 + 1×23 + 0×22 + 1×21 + 0×20

= 16 + 8 + 0 + 2 + 0

= 2610

Computer memory is measured in terms of how many bits it can store. Here is a chart for memory capacity conversion.

* 1 byte (B) = 8 bits
* 1 Kilobytes (KB) = 1024 bytes
* 1 Megabyte (MB) = 1024 KB
* 1 Gigabyte (GB) = 1024 MB
* 1 Terabyte (TB) = 1024 GB
* 1 Petabyte (PB) = 1024 TB
* 1 Exabyte (EB) = 1024 PB
* 1 Zettabyte (ZB) = 1024 EB
* 1 Yottabyte (YB) = 1024 ZB

## Octal Number System

Characteristics of the octal number system are as follows −

* Uses eight digits, 0,1,2,3,4,5,6,7
* Also called as base 8 number system

**Octal number system** has eight digits – 0, 1, 2, 3, 4, 5, 6 and 7. Octal number system is also a positional value system with where each digit has its value expressed in powers of 8, as shown here −



* Decimal equivalent of any octal number is sum of product of each digit with its positional value.
* 7268 = 7×82 + 2×81 + 6×80
* = 448 + 16 + 6
* = 47010

## Hexadecimal Number System

**Hexadecimal number system** has 16 symbols – 0 to 9 and A to F where A is equal to 10, B is equal to 11 and so on till F. Hexadecimal number system is also a positional value system with where each digit has its value expressed in powers of 16, as shown here −



Decimal equivalent of any hexadecimal number is sum of product of each digit with its positional value.

27FB16 = 2×163 + 7×162 + 15×161 + 10×160

= 8192 + 1792 + 240 +10

= 1023410

Characteristics of hexadecimal number system are as follows −

* Uses 10 digits and 6 letters, 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, A, B, C, D, E, F
* Letters represent the numbers starting from 10. A = 10. B = 11, C = 12, D = 13, E = 14, F = 15
* Also called as base 16 number system

### Example

Hexadecimal Number: 19FDE16

Calculating Decimal Equivalent −

|  |  |  |
| --- | --- | --- |
| **Step** | **Binary Number** | **Decimal Number** |
| Step 1 | 19FDE16 | ((1 x 164) + (9 x 163) + (F x 162) + (D x 161) + (E x 160))10 |
| Step 2 | 19FDE16 | ((1 x 164) + (9 x 163) + (15 x 162) + (13 x 161) + (14 x 160))10 |
| Step 3 | 19FDE16 | (65536+ 36864 + 3840 + 208 + 14)10 |
| Step 4 | 19FDE16 | 10646210 |