

What are Number Systems?



Number systems are:

- systems in mathematics that are used to express numbers in various forms and are understood by computers. A number is a mathematical value used for counting and measuring objects, and for performing arithmetic calculations.
- There are 4 types of number systems which are binary, decimal, octal, and hexadecimal
- It is also called the system of numeration and it defines a set of values to represent a quantity.

Types of Number Systems

Binary System

uses only two digits: 0 and 1. The numbers in this system have a base of 2. Digits 0 and 1 are called bits and 8 bits together make a byte. The data in computers is stored in terms of bits and bytes.

01100112

1011001112

Decimal System

consists of 10 digits 0, 1, 2, 3, 4, 5, 6, 7, 8, and 9 and is the most commonly used number system. Using the combination of these 10 digits to form all other numbers. The value of a digit in a number depends upon its position in the number.

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Octal System

uses eight digits: 0,1,2,3,4,5,6 and 7 with the base of 8. The advantage of this system is that it has lesser digits when compared to several other systems, hence, there would be fewer computational errors. Digits like 8 and 9 are not included in the octal number system.

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132568

Hexadecimal System

uses sixteen digits/alphabets: 0,1,2,3,4,5,6,7,8,9 and A,B,C,D,E,F with the base number as 16. Here, A-F of the hexadecimal system means the numbers 10-15 of the decimal number system respectively. This system is used in computers to reduce the large-sized strings of the binary system.

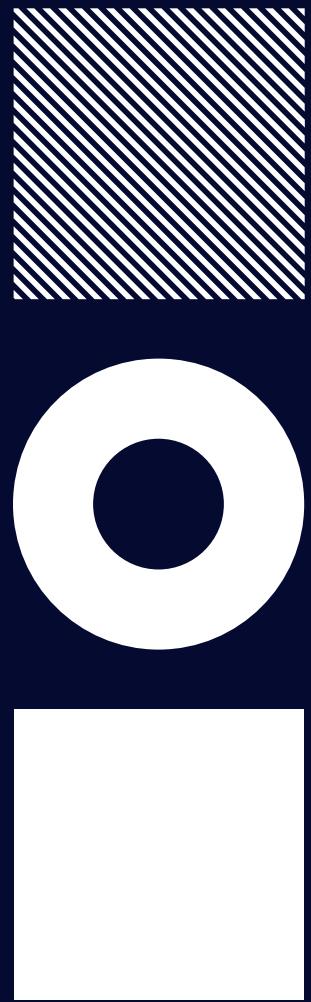
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Table for Binary, Decimal, Octal, and Hexadecimal

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

In our day-to-day lives we will have to depict/represent certain objects with a quantity. The number system can be defined as the system which uses particular words or symbols for quantifying a given object or value. For example, teachers would grade/assign a particular numerical value to the examination paper depending upon the student's performance giving us an idea about the knowledge and preparation level of the student.





Number systems represents the specific identity that a number possesses on the number line and provides it with a significant notation. It also represents the arithmetic structure of the number and helps us in calculating the numbers using which we can get a specific number.

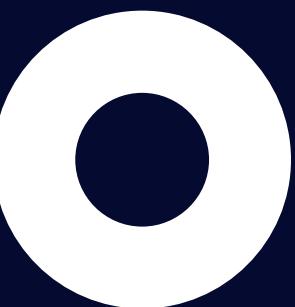
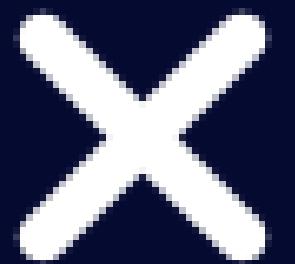
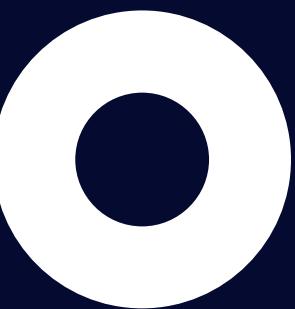
The importance of Number Systems is that

- It helps us keep count of things around us.
- Enables unique/accurate representation of several types of numbers.
- Used for computation in the banking sector.
- Helps us in encrypting data, avoiding hacking and misuse of data.
- Allows easy conversion of numbers for technical purposes.
- It should be noted that every fiber of data gets stored in the computer as a number.
- It enables to keep count of all the things around people. Like how many apples are in the basket, or the number of milk cartons to be purchased, etc.
- It enables the unique and accurate representation of different types of numbers.
- Making a phone call is possible only because we have a proper and efficient number system.
- Elevators used in public places also depend upon number systems for their functioning.

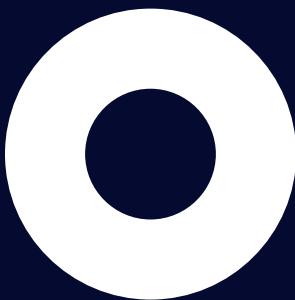
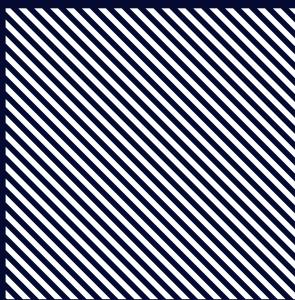
Analysis and Reaction

In science, technology, mathematics, and daily life, number systems are essential. They offer a standardized and organized method for representing, comprehending, and working with numbers which is a necessary skill for data processing, computation, and communication. Modern engineering, computing, and even simple arithmetic could not function effectively or reliably without number systems.

The ability of both humans and robots to accurately describe quantities and carry out actions is one of the primary reasons number systems are significant. The decimal system (base 10) is the most widely used in mathematics and is utilized in the majority of human endeavors, including computations, measuring distances, and counting money. However, computers use alternative number systems, such as binary (base 2), octal (base 8), and hexadecimal (base 16), instead of immediately understanding decimal numbers. All digital technology is based on the binary system, which exclusively employs 0s and 1s. The binary code is the fundamental language of computing which expresses all of the instructions, data points, and operations in a computer system.



Analysis and Reaction

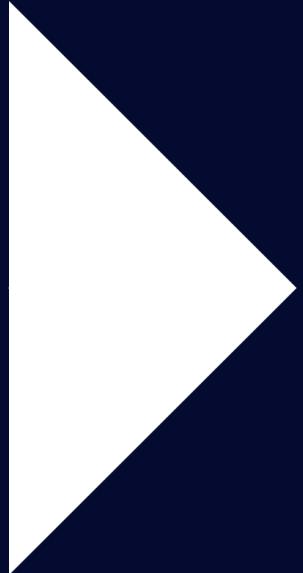


Hexadecimal on the other hand is also very important because it gives a more compact and understandable way to express binary numbers. The common use case of hexadecimal is programming, memory addressing, and debugging. This was similar to octal since it was previously early implemented in older computer systems to simplify binary before hexadecimal became the standard.

Outside of computing, number systems are essential for data representation and communication. For example, binary system is useful on digital gadgets such as digital watches, calculators, and cellphones. While hexadecimal system represents IP addresses and color codes used in networking and web technologies. Scientists and engineers also use many number systems in circuit design, information encoding, and signal processing.

To conclude this topic, it represents the foundation of all mathematical and digital operations. Number systems continue to be a vital idea that underpins the organization and advancement of contemporary civilization, whether in simple mathematics, software development, or sophisticated technological systems. Without number systems, the technologies that we would have are less advanced and losing the most essential tools for understanding and interacting with the world.

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