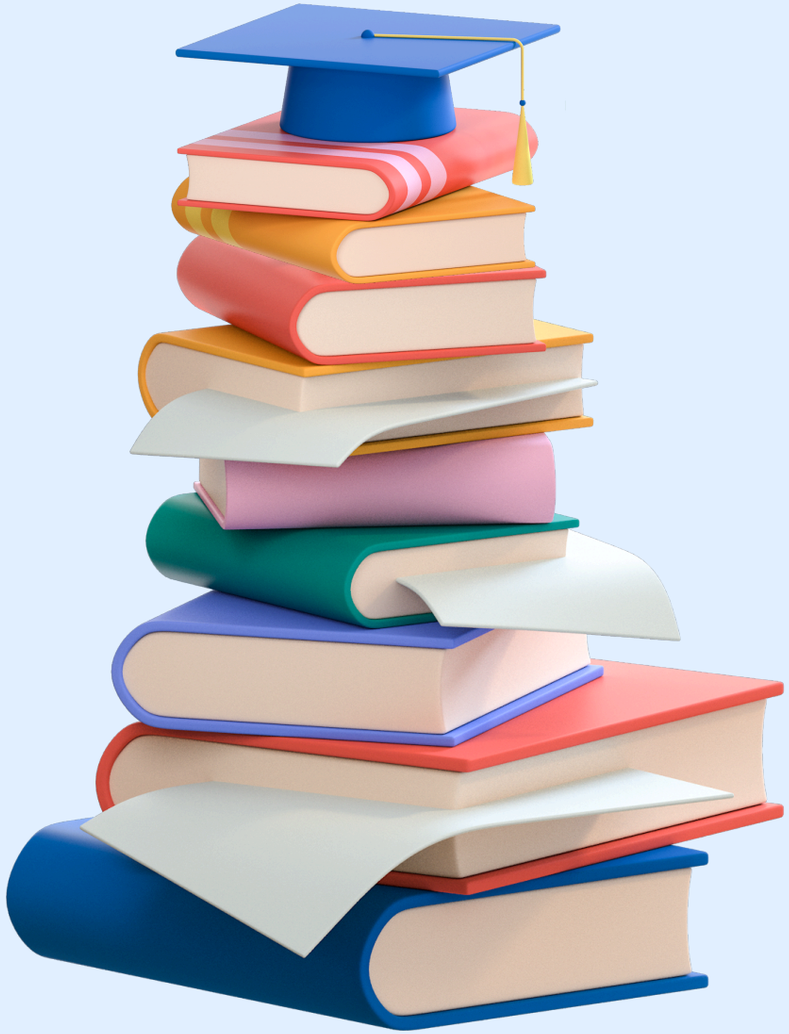
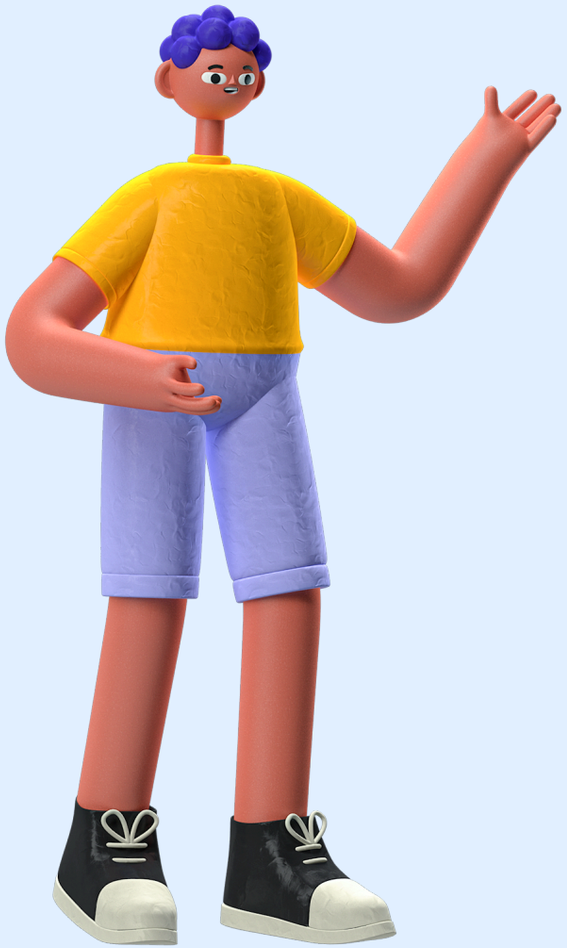
ikSaan.com

Number systems

Let’s Start



ikSaan.com



Contents

Introduction to
Number Systems

Converting Number from
One System to Another

Binary
Addition & Subtraction

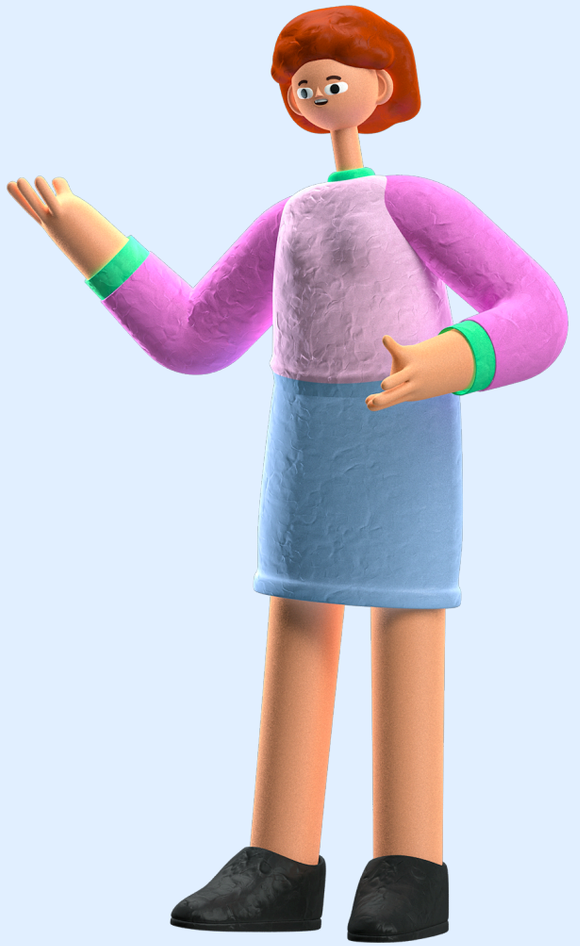
ikSaan.com

What is number system

A number system is a way of representing numbers using a set of symbols or digits.

The most common system we use in daily life is the decimal system (base 10).

In computing and AI, other number systems such as binary, octal, and hexadecimal are heavily used.



ikSaan.com

Decimal Number System (Base 10)

Digits used: 0, 1, 2, 3, 4, 5, 6, 7, 8, 9

Base: 10

How it works: The decimal system is based on powers of 10. Each digit in a number represents a power of 10, from right to left.

For example:

$$235 = (2 \times 10^2) + (3 \times 10^1) + (5 \times 10^0)$$

It’s the most familiar system to humans because we use it for everyday counting and arithmetic.

ikSaan.com

Binary Number System (Base 2)

Digits used: 0, 1

Base: 2

How it works: The binary system uses only two digits, 0 and 1, and is fundamental to how computers operate. Each binary digit (or bit) represents a power of 2.

For example:

$$1011_2 = (1 \times 2^3) + (0 \times 2^2) + (1 \times 2^1) + (1 \times 2^0) = 11 \text{ in decimal.}$$

In AI, binary is crucial because digital computers work by processing binary data, and machine learning algorithms ultimately manipulate binary representations of data.

ikSaan.com

Octal Number System (Base 8)

Digits used: 0, 1, 2, 3, 4, 5, 6, 7

Base: 8

How it works: Octal is based on powers of 8. Each digit in an octal number represents a power of 8.

For example:

$157_8 = (1 \times 8^2) + (5 \times 8^1) + (7 \times 8^0) = 111$ **in decimal.**

Octal is less commonly used directly in AI but can be found in low-level programming, such as in file permissions in Unix systems.

ikSaan.com

Hexadecimal Number System (Base 16)

Digits used: 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, A, B, C, D, E, F
Base: 16

How it works: The hexadecimal system uses sixteen symbols (0–9 and A–F, where A=10, B=11, etc.). It's more compact than binary, making it easier to read and write large numbers.

For example:
$2A_{16} = (2 \times 16^1) + (10 \times 16^0) = 42$ **in decimal.**

Hexadecimal is widely used in AI and computer science for representing memory addresses, colors, and other compact data representations.