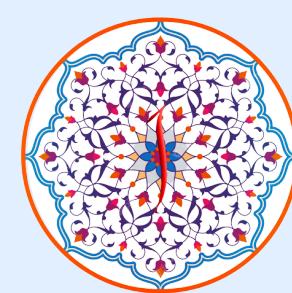


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Number systems

Let's Start





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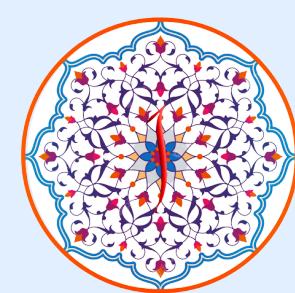
Introduction to
Number Systems



Converting Number from
One System to Another



Binary
Addition & Subtraction



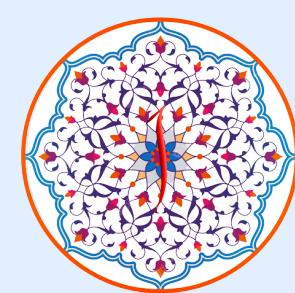
What is number system

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.





Decimal Number System (Base 10)

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

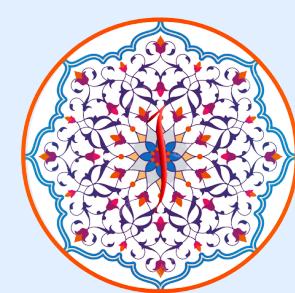
Base: 10

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.



Binary Number System (Base 2)

Digits used: 0, 1

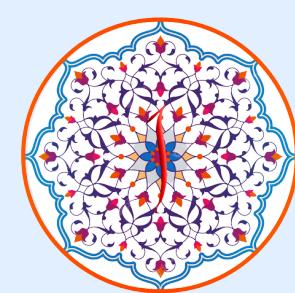
Base: 2

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.



Octal Number System (Base 8)

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

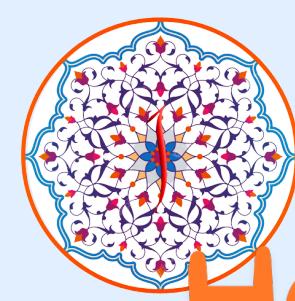
Base: 8

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

For example:

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

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



Hexadecimal Number System (Base 16)

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

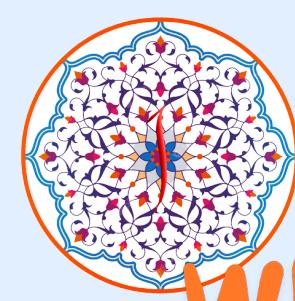
Base: 16

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:

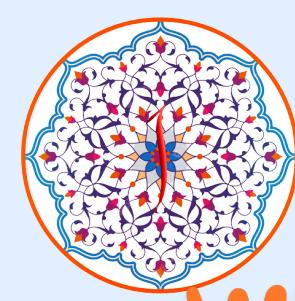
$$2A_{16} = (2 \times 16^1) + (10 \times 16^0) = 42 \text{ in decimal.}$$

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



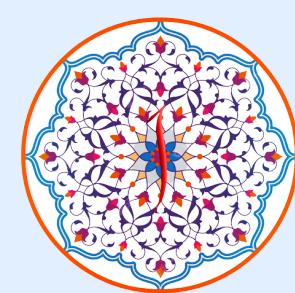
Why Are Number Systems Important in AI?

- **Data Representation:** All data in AI systems—whether text, images, or numbers—are stored and processed as binary numbers. Understanding how these are encoded helps in tasks such as image processing, natural language processing, and deep learning.
- **Efficient Processing:** Many AI models, especially in deep learning, require handling large volumes of data. Optimized data representation (e.g., using binary or hexadecimal) enables faster computation and memory efficiency.



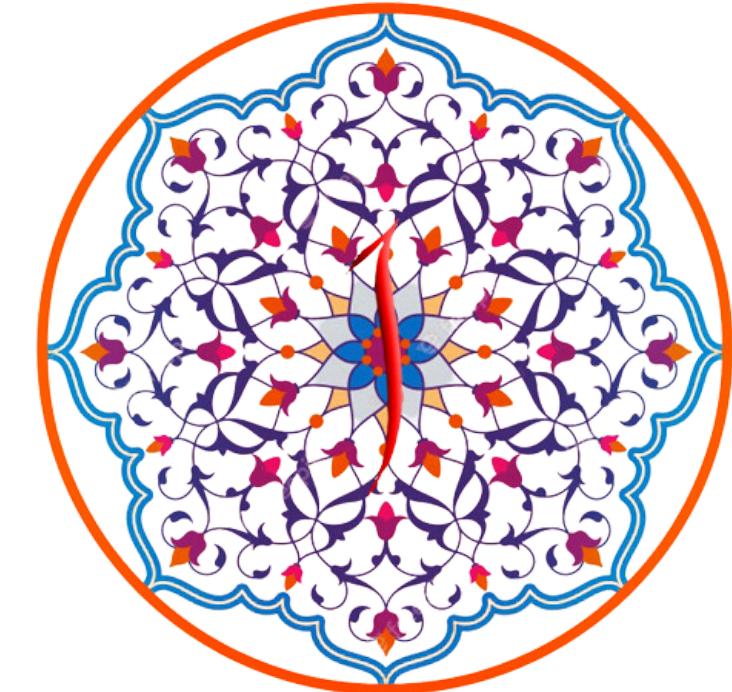
Why Are Number Systems Important in AI?

- **Neural Networks:** In neural networks, weights and biases are represented as binary floating-point numbers, and understanding how these numbers are manipulated at a binary level can lead to optimizations in AI algorithms.
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- **Error Detection & Correction:** AI systems must handle errors during data transmission and processing. Binary systems allow the use of parity bits and other techniques to detect and correct errors, which is fundamental to reliable AI systems.



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THANK
you



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Number systems, especially binary, play an essential role in AI and computing. Whether it's for data encoding, algorithm optimization, or error handling, a solid grasp of how different number systems work will help you as you delve deeper into AI concepts.