

# NUMBER SYSTEM

# FOLLOWING TOPICS:

- ❖ What are Number Systems?
- ❖ Types of Number Systems
- ❖ What are the uses/significance of each number system?

# What are Number System?

- ❖ Number System is a system representing numbers. It is also called the system of numeration and it defines a set of values to represent a quantity. These numbers are used as digits and the most common ones are 0 and 1, that are used to represent binary numbers. Digits from 0 to 9 are used to represent other types of number systems.
- ❖ It is the mathematical notation for representing numbers of a given set by using digits or other symbols in a consistent manner. It also allows us to operate arithmetic operations like addition, subtraction, multiplication and division.

# What are the types of Number Systems?

Number system is consist of four most common system types :

- Decimal number system (Base- 10)
- Binary number system (Base- 2)
- Octal number system (Base-8)
- Hexadecimal number system (Base- 16)

## Decimal Number System (Base 10 Number System)

- ❖ The decimal number system has a base of 10 because it uses ten digits from 0 to 9. In the decimal number system, the positions successive to the left of the decimal point represent units, tens, hundreds, thousands and so on. This system is expressed in decimal numbers. Every position shows a particular power of the base (10).

## Example of Decimal Number System:

The decimal number 1457 consists of the digit 7 in the units position, 5 in the tens place, 4 in the hundreds position, and 1 in the thousands place whose value can be written as:

$$(1 \times 10^3) + (4 \times 10^2) + (5 \times 10^1) + (7 \times 10^0)$$

$$(1 \times 1000) + (4 \times 100) + (5 \times 10) + (7 \times 1)$$

$$1000 + 400 + 50 + 7$$

$$1457$$

# Binary Number System (Base 2 Number System)

❖ The base 2 number system is also known as the Binary number system wherein, only two binary digits exist, i.e., 0 and 1. Specifically, the usual base-2 is a radix of 2. The figures described under this system are known as binary numbers which are the combination of 0 and 1. For example, 110101 is a binary number.

We can convert any system into binary and vice versa.

## Example

Write  $(14)_{10}$  as a binary number.

Solution:

2	14	
2	7	0
2	3	1
	1	1

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$$\therefore (14)_{10} = 1110_2$$

# Octal Number System (Base 8 Number System)

- ❖ In the octal number system, the base is 8 and it uses numbers from 0 to 7 to represent numbers. Octal numbers are commonly used in computer applications. Converting an octal number to decimal is the same as decimal conversion and is explained below using an example.

*Example: Convert  $215_8$  into decimal.*

*Solution:*

$$215_8 = 2 \times 8^2 + 1 \times 8^1 + 5 \times 8^0$$

$$= 2 \times 64 + 1 \times 8 + 5 \times 1$$

$$= 128 + 8 + 5$$

$$= 141_{10}$$

# Hexadecimal Number System (Base 16 Number System)

- ◆ In the hexadecimal system, numbers are written or represented with base 16. In the hexadecimal system, the numbers are first represented just like in the decimal system, i.e. from 0 to 9. Then, the numbers are represented using the alphabet from A to F. The below-given table shows the representation of numbers in the hexadecimal number system.

## Hexadecimal Number System Table

Below is the table of hexadecimal number systems with equivalent values of the binary and decimal number systems.

Decimal Numbers	4-bit Binary Number	Hexadecimal Number
0	0000	0
1	0001	1
2	0010	2
3	0011	3
4	0100	4
5	0101	5
6	0110	6
7	0111	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

# What are the uses/significance of each number system?

- ❖ The Number System is a way of representing numbers on the number line with the help of a set of Symbols and rules. All the Mathematical concepts and formulas are based on Number system. We have curated the importance of number system in this article below.
- ❖ Number systems help in representing the numbers in a small symbol set. Binary numbers are mostly used in computers that use digits like 0 and 1 for calculating simple problems. The number systems also help in converting one number system to another.

## **REFLECTION/ANALYSIS:**

The number system provides a thorough analysis of the ways in which numbers—ancient and contemporary—have influenced human cognition and technological advancement. The move from binary and hexadecimal systems—which are essential to computer programs. The examination of the binary system's use in digital computing demonstrates how mathematical ideas have real-world applications in addition to being abstract ideas that underpin contemporary technology.

I illustrate how the number system has shaped many other sectors in terms of response. It does a good job of explaining how important numerical systems are to everyday living and scientific progress. It may be enhanced, though, by include additional instances of how particular numeric systems have impacted advancements in technology and culture. A examination of number systems' future, especially in light of developing technologies, could also offer a forward-looking viewpoint to balance the historical analysis. It explores the implication of various number systems, such as decimal and binary, on modern technologies. It demonstrates the real-world applications of theoretical ideas by showing how computer operations are supported by binary code. The topic of comprehending different number systems and how this might improve problem-solving techniques and creativity is covered in detail.

It is a fundamental tool used in various aspects of life, from simple counting to complex scientific calculations. The number system, the framework that defines the structure and representation of numbers, is a subject of great interest and importance. The number system is a complex and fascinating concept that underpins our understanding of mathematics. From the simplicity of natural numbers to the intricacies of irrational numbers, each system plays a vital role in our daily lives. By exploring and appreciating the different types of numbers and their properties, we can develop a deeper understanding of the mathematical world, computing programs and its applications.

# REFERENCES:

Tolchinsky, L. (2003). The Cradle of Culture and What Children Know About Writing and Numbers Before Being (1st ed.). Psychology Press. <https://doi.org/10.4324/9781410607195>

Mohr-Daurat HTheodorakis GPirk H(2024)Hardware-Efficient Data Imputation through DBMS ExtensibilityProceedings of the VLDB Endowment10.14778/3681954.3682016**17**:11(3497-3510)Online publication date: 1-Jul-2024<https://dl.acm.org/doi/10.14778/3681954.3682016>

Mohr-Daurat HTheodorakis GPirk H(2024)Hardware-Efficient Data Imputation through DBMS ExtensibilityProceedings of the VLDB Endowment10.14778/3681954.3682016**17**:11(3497-3510)Online publication date: 1-Jul-2024<https://dl.acm.org/doi/10.14778/3681954.3682016>

.(2019)Towards semantic mathematical editingJournal of Symbolic Computation10.1016/j.jsc.2014.09.040**71**:C1-46Online publication date: 3-Jan-2019 <https://dl.acm.org/doi/10.1016/j.jsc.2014.09.040>

And Koepf W.(2019).Closed form Laurent-Puiseux series of algebraic functionsApplicable Algebra in Engineering, Communication and Computing10.1007/BF01613613**17**:121-26Online publication date: 16-Jul-2019<https://dl.acm.org/doi/10.1007/BF01613613>

# REFERENCES:

Admin. (2023, February 20). *Number system (definition, types, conversion & examples)*. BYJUS. <https://byjus.com/math/number-system/>

Admin. (2021, September 30). *What is hexadecimal numbers system? table, conversions, examples*. BYJUS. <https://byjus.com/math/hexadecimal-number-system/>

Awati, R. (2022, June 20). *What is hexadecimal numbering?*. Whatls. <https://www.techtarget.com/whatis/definition/hexadecimal>

(PDF) novel approach to the learning of various number systems. (n.d.-a).

[https://www.researchgate.net/publication/258493858\\_Novel\\_Approach\\_to\\_the\\_Learning\\_of\\_Various\\_Number\\_Systems](https://www.researchgate.net/publication/258493858_Novel_Approach_to_the_Learning_of_Various_Number_Systems)

Duke, S., & Obidunnu, N. (n.d.). *The inverted-triangle technique of converting the computer number systems (binary, octal and hexadecimal) to decimal*. Global Journal of Pure and Applied Sciences.

<https://www.ajol.info/index.php/gjpas/article/view/45392> DOI:  
10.4314/gjpas.v15i2.45392

# REFERENCES:

GeeksforGeeks. (2024b, July 31). *What is the importance of the number system?* <https://www.geeksforgeeks.org/what-is-the-importance-of-the-number-system/>

Stuid. (2023, January 11). *Importance of Number System*. Blog. <https://blog.stuidapp.com/importance-of-number-system/>

Uke, N. (2014, March 12).

<Http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.401.8095&rep=rep1&type=pdf>. Academia.edu. [https://www.academia.edu/6390087/http\\_citeseerx\\_ist\\_psu\\_edu\\_viewdoc\\_download\\_doi\\_10\\_1\\_1\\_401\\_8\\_095\\_and\\_rep\\_rep1\\_and\\_type\\_pdf](https://www.academia.edu/6390087/http_citeseerx_ist_psu_edu_viewdoc_download_doi_10_1_1_401_8_095_and_rep_rep1_and_type_pdf)

Corbett, N. G. G. (n.d.). Number. [https://books.google.com.ph/books?hl=tl&lr=&id=7jc-pgAFcE0C&oi=fnd&pg=PR12&dq=the%2Buse%2Bnumber%2Bsystem&ots=1yTCtGfwyG&sig=PtxWH\\_Cag83GRAWE27gH9uzabDs&redir\\_esc=y#v=onepage&q=the%20use%20number%20system&f=false](https://books.google.com.ph/books?hl=tl&lr=&id=7jc-pgAFcE0C&oi=fnd&pg=PR12&dq=the%2Buse%2Bnumber%2Bsystem&ots=1yTCtGfwyG&sig=PtxWH_Cag83GRAWE27gH9uzabDs&redir_esc=y#v=onepage&q=the%20use%20number%20system&f=false)

Admin. (2024, March 26). *What are the importance of number system in computer technology*. Computer Basic Tutorials. <https://www.chtips.com/computer-fundamentals/importance-of-number-system-in-computer/>