

Number Systems

Number Systems

What is it?

Number Systems

- ❖ It is a system that is used to represent numbers, to know a value, and to use that value to represent any calculations. One of the common number systems is base 10 counting, which we do by counting with our hands. Still, more counting systems are used, for instance, computers use binary to represent an off or on bit by representing them as 0(off), and 1(on) it may be simple. Still, it is a foundation of computing that contributed to running logical operations on the devices that we use every day.
- ❖ So, what are the other number systems we commonly use? Well for today's subject that will be our center of discussion.

Types Number Systems

BASE₂ Binary System

- ❖ A binary System is a system that uses only two digits to represent 1 and 0, respectively on/off, and it is used in computers for logical, or boolean operations, for a simple system.
- ❖ The use of this system for computers is to make use of its two i/o systems, with digital logic gates.
- ❖ It is used in computing for data representation of all types of data, and including multiple bits can represent complex data. i.e (pictures, videos, software applications, audio, etc.)
- ❖ For how it works each digit is based on powers of 2, for example, the 1001_2 is 9 in decimal which represents $1 \times 2^3 + 0 \times 2^2 + 0 \times 2^1 + 1 \times 2^0$ respectively.

Types Number Systems

BASE₈ Octal System

- ❖ Octal number systems are from 0 to 7, numbers since 0 is already a valid number in terms of computing system.
- ❖ It is a number system based on 8, and it is mostly used for low-level memory addresses or file management, it has limited usage in terms of computing, however, it is an integral part of coding, since it's easier to read in octal, than a long string of binaries.
- ❖ Octal is computed as $1 \times 8^2 + 0 \times 8^1 + 0 \times 8^0 = 64_{10}$ in decimal.

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BASE₁₀ Decimal System

- ❖ Base 10 is the most commonly used number system out of all systems as it was used traditionally by us by counting the number of fingers on our hands which is usually 10.
- ❖ The digit's position is relative to how big the value of the digit, is and is based on 10 for example $375_{10} = 3 \times 10^2 + 7 \times 10^1 + 5 \times 10^0 = 300 + 70 + 5 = 375$.
- ❖ It is mostly used for human-arithmetic operations there is little difference in using decimal over using other number systems that are widely used like binary, octal, and hexadecimal, it is mostly for human readability in terms of computing.

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BASE₁₆ Hexadecimal System

- ❖ Hexadecimal as the name means is a 16-number system Hex means 6 while decimal for 10 and add it you will have numbers 0-15.
- ❖ Rather than using numbers after 9 hexadecimal numbers system uses letters to represent the values from 10-15 using A, B, C, D, E, and F in increasing order per letter.
- ❖ It has a base of 16, for example, AF_{16} computed to decimal is $10 \times 16^1 + 15 \times 16^0 = 160 + 15 = 175_{10}$.
- ❖ Base 16 is used in multiple applications, because of the compactness it offers, we use it in determining the color with it.
- ❖ We also use hexadecimal for low-level addresses similar to octal, and for machine codes, error codes are used for their compactness and ease of reading.

The background of the image is a photograph of a greenhouse. In the foreground, there are various plants, including some with long, pointed leaves and others with more rounded foliage. A window is visible in the upper center, showing a glimpse of the outside world. The overall lighting is soft and diffused, typical of an indoor garden environment.

Analysis

Analysis

Number systems have a diverse array of systems that we can use, not only to represent data, but also to process data to different types of each other like binary to decimal, decimal to octal, and so forth. Furthermore binary influenced the use of the octal, decimal, and hexadecimal in storing, manipulating, and retrieving data as is or converting them to the different types of systems to a more compact, and readable code than reading 1s and 0s on your screen. This number system is like a retrospect in which you can see the evolution of computing, like for example the IP addresses were supposed to only house millions of devices, but it wasn't enough so we compromised to accommodate a wider population of devices, it is also similar to these number systems that we have discussed so far.

There are a lot of number systems out there and their specific use case, as for these number system that we discuss, there are lot of it that has a specific use case, and it is mostly used for computational needs, to make things easier for us to read machine codes it also dawned on me how these number systems shape our technological advancements in computation, like binary system before its usage with computer we use it in morse code, or determining whether something is true or not and represent it as 0, and 1. despite a system that composed of only two numbers it made these complex processes.

citations

- ❖ <https://byjus.com/maths/number-system/>
- ❖ <https://www.splashlearn.com/math-vocabulary/octal-number-system>
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