CODE-EPIC

Code Epic Technologies

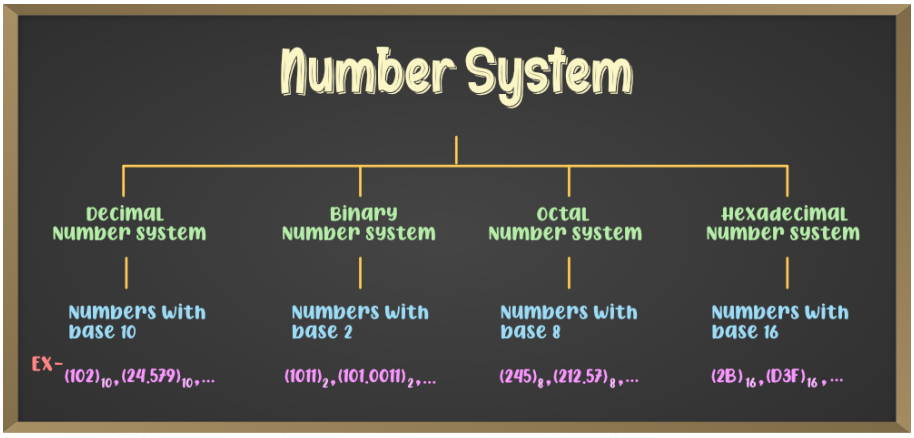
Number System

Surviving technology

cr4sh.m4d0v3r
https://code-epic.github.io

June 2022

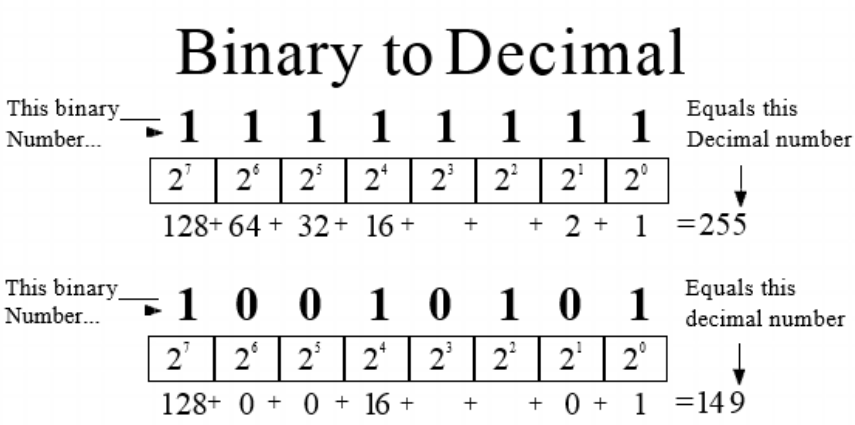
1 Number System



The number system or the numeral system is the system of naming or representing numbers. We know that a number is a mathematical value that helps to count or measure objects and it helps in performing various mathematical calculations. There are different types of number systems in Maths like decimal number system, binary number system, octal number system, and hexadecimal number system. We are going to learn what different types, conversion procedures with some number system examples in detail.

Binary Number system

In mathematics, positional numeral system employing 2 as the base and so requiring only two different symbols for its digits, 0 and 1, instead of the usual 10 different symbols needed in the decimal system. The numbers from 0 to 10 are thus in binary 0, 1, 10, 11, 100, 101, 110, 111, 1000, 1001, and 1010. The importance of the binary system to information theory and computer technology derives mainly from the compact and reliable manner in which 0s and 1s can be represented in electromechanical devices with two states—such as “on-off,” “open-closed,” or “go–no go.” (See numerals and numeral systems: The binary system.)



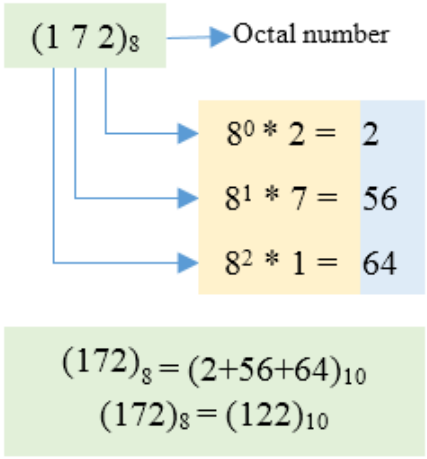
Objective

Having sharp skills in number systems will aid you in computer. With the ability to convert numbers without the use of a calculator, you will be able to quickly and easily solve problems that may arise.

Computer systems use the binary numbering system to operate. Why do you think binary is referred to as the "natural" numbering system for computersto accomplish their tasks?

Computers and networking equipment use binary numbers, a series of BITS (short for binary digits) that are either ON (a binary 1) or OFF (a binary 0). They are encoded internally in the PC on microchips and on the computer motherboard's bus as electrical voltages.

Understanding binary numbers and how they relate to decimal numbers is critical to understanding how computers work internally.



Octal Number System

Has a base of eight and uses the numbers from 0 to 7. The octal numbers, in the number system, are usually represented by binary numbers when they are grouped in pairs of three. For example, an octal number 128 is expressed as 0010102 in the binary system, where 1 is equivalent to 001 and 2 is equivalent to 010.

Applications

The octal Number system is widely used in computer application sectors and also in the aviation sector to use the number in the form of code.

Based on octal number system applications, several computing systems are developed. All the modern generation computing system uses 16-bit, 32-bit or 64-bit word which is further divided into 8-bit words. Similarly, for various programming languages, octal numbers are used to do coding or to write the encrypted language, which is only understood by the computing machine.

Transponders used in the aircraft transmit a code which is expressed as four octal digit number. These codes are interrogated by ground radar.

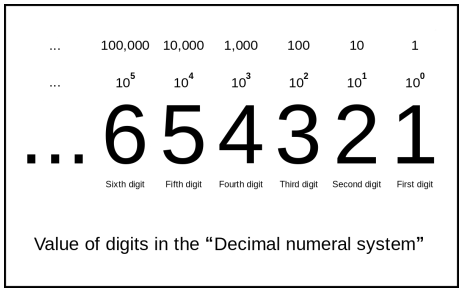
Importance

The octal number system uses less digits (3-bits) than hexadecimal numbers (4-bits), which is one of the advantages. It is therefore, there will be less computations and the possibility of the occurrence of error will degrade.

Because of less digits, it is also easy to convert octal to any other number system and vice-versa.

One of the disadvantages is that computers do not understand the octal numbers in a direct way and hence it has to be converted into binary numbers first.

```c
/**
* C program to convert Octal number system to Decimal number system
*/

#include <stdio.h>
#include <math.h>

int main()
{
        long long octal, tempOctal, decimal;
        int rem, place;

        /* Input octal number from user */
        printf("Enter any octal number: ");
        scanf("%lld", &octal);
        tempOctal = octal;

        decimal = 0;
        place = 0;

        /*
        * Convert octal to decimal
        */
        while(tempOctal > 0)
        {
                /* Extract the last digit of octal */
                rem = tempOctal % 10;

                /* Convert last octal digit to decimal */
                decimal += pow(8, place) * rem;

                /* Remove the last octal digit */
                tempOctal /= 10;

                place++;
        }

        printf("Octal number = %lld\n", octal);
        printf("Decimal number = %lld", decimal);

        return 0;
}
```

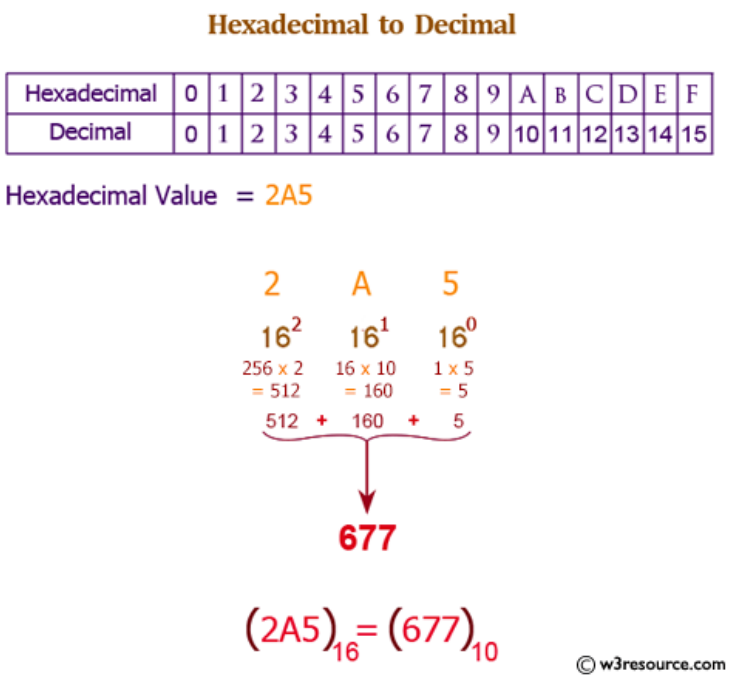


Decimal number system

Is the number system we use every day and uses digits from 0 - 9 i.e. 0, 1, 2, 3, 4, 5, 6, 7, 8, & 9. The base number of the decimal number system is 10 as the total number available in this number system is 10. If any number is represented without a base, it means that its base is 10.

decimal system, also called HinduArabic number system or Arabic number system, in mathematics, positional numeral system employing 10 as the base and requiring 10 different numerals, the digits 0, 1, 2, 3, 4, 5, 6, 7, 8, 9. It also requires a dot (decimal point) to represent decimal fractions. In this scheme, the numerals used in denoting a number take different place values depending upon position. In a base10 system the number 543.21 represents the sum. $(5.102) + (4.101) + (3.100) + (2.10 - 1) + (1.10 - 2)$

This number system, with its associated arithmetic algorithms, has furnished the basis for the development of Western commerce and science since its introduction to the West in the 12th century CE.



Hexadecimal number system

The hexadecimal number system is a type of number system, that has a base value equal to 16. It is also pronounced sometimes as 'hex'. Hexadecimal numbers are represented by only 16 symbols. These symbols or values are 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, A, B, C, D, E and F. Each digit represents a decimal value. For example, D is equal to base-10 13.

Hexadecimal number systems can be converted to other number systems such as binary number (base-2), octal number (base-8) and decimal number systems (base-10).

The list of 16 hexadecimal digits with their equivalent decimal, octal and binary representation is given here in the form of a table, which will help in number system conversion.

In many languages, 0x is also used as prefix for hexadecimal values.

For example, 0x3AB8 is a valid hexadecimal value. But 0xZXY is not.

```c
#include <stdio.h>
#include <string.h>

int main()
{
        char givenStr[100], hexStr[100];

        int i, j = 0;

        printf("Enter a string: ");
        scanf("%[^\n]s", givenStr);

        for (i = 0; i < strlen(givenStr); i++)
        {
                sprintf(hexStr + j, "%02X", givenStr[i]);
                j += 2;
        }

        hexStr[j] = '\0';

        printf("Final hexadecimal string: %s\n", hexStr);

        return 0;
}
```

This is

```
Enter a string: hello
Final hexadecimal string: 68656C6C6F

Enter a string: a
Final hexadecimal string: 61

Enter a string: world
Final hexadecimal string: 776F726C64
```

Hex Dump

In computing, a hex dump is a hexadecimal view (on screen or paper) of computer data, from memory or from a computer file or storage device. Looking at a hex dump of data is usually done in the context of either debugging or reverse engineering.

In a hex dump, each byte (8 bits) is represented as a two-digit hexadecimal number. Hex dumps are commonly organized into rows of 8 or 16 bytes, sometimes separated by whitespaces. Some hex dumps have the hexadecimal memory address at the beginning.

Some common names for this program function are hexdump, hd, od, xxd

and simply dump or even D.

The leftmost column is the hexadecimal displacement (or address) for the values of the following columns. Each row displays 16 bytes.

An additional column shows the corresponding ASCII character translation with hexdump -C as displayed by Unix hexdump:

Hexdumping for fun and profit

Hexdump is a fascinating tool that not only teaches you more about how computers process and convert information, but also about how file formats and compiled binaries function. You should try running hexdump on files at random throughout the day as you work. You never know what kinds of information you may find, nor when having that insight may be useful.

2 Recomendation

Manual hexdump https://real-world-systems.com/docs/hexdump.1.html
Hex-Code Video https://www.youtube.com/watch?v=dmbOGHwA91o
Tool for more app and hex-code https://gchq.github.io/CyberChef/
Introduction CyberChef Video https://www.youtube.com/watch?v=tOCIc2R_xmU