MADHAV INSTITUTE OF TECHNOLOGY & SCIENCE, GWALIOR

(A Govt. Aided UGC Autonomous & NAAC Accredited Institute Affiliated to RGPV, Bhopal)

Skill Based Mini Project Report

on

Convert a given number system to Hexadeciaml number system.

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Submitted to:

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MADHAV INSTITUTE OF TECHNOLOGY & SCIENCE, GWALIOR

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CERTIFICATE

This is certified that **Sudhanshu Jain**(0901CS211115) has submitted the project report title "**Convert a given number system to Hexadecimal number system."** under the mentorship of **MAHESH PARMAR** in partial fulfilment of the requirement for the award of degree of Bachelor of Technology in Computer Science and Engineering from Madhav Institute of Technology and Science, Gwalior.

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DECLARATION

I hereby declare that the work being presented in this project report, for the partial fulfilment of requirement for the award of the degree of Bachelor of Technology in Computer Science and Engineering at Madhav Institute of Technology & Science, Gwalior is an authenticated and original record of my work under the mentorship of **MAHESH PARMAR** , **Assistant Professor**, **Computer Science and Engineering**

I declare that I have not submitted the matter embodied in this report for the award of any degree or diploma anywhere else.

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1st Year,1st SEM

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ABSTRACT

The intention behind this Project is to build a Program in which user can enter the number of any number system like Binary , Octal , Hexadecimal and reflect the output as decimal number system.

If the user want to run the program again it asks for do you want to enter another number or exit from the console that functionality is also within this program .

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INTRODUCTION

A number system is defined as a system of writing to express numbers. It is the mathematical notation for representing numbers of a given set by using digits or other symbols in a consistent manner. It provides a unique representation of every number and represents the arithmetic and algebraic structure of the figures. It also allows us to operate arithmetic operations like addition, subtraction, multiplication and division.

The value of any digit in a number can be determined by:

- The digit
- Its position in the number
- The base of the number system

Before discussing the different types of number system examples, first, let us discuss what is a number?

What is a Number?

A number is a mathematical value used for counting or measuring or labelling objects. Numbers are used to performing arithmetic calculations. Examples of numbers are natural numbers, whole numbers, rational and irrational numbers, etc. 0 is also a number that represents a null value.

A number has many other variations such as even and odd numbers, prime and composite numbers. Even and odd terms are used when a number is divisible by 2 or not, whereas prime and composite differentiate between the numbers that have only two factors and more than two factors, respectively.

In a number system, these numbers are used as digits. 0 and 1 are the most common digits in the number system, that are used to represent binary numbers. On the other hand, 0 to 9 digits are also used for other number systems. Let us learn here the types of number systems.

Types of Number Systems

There are various types of number systems in mathematics. The four most common number system types are:

1. Decimal number system (Base- 10)
2. Binary number system (Base- 2)
3. Octal number system (Base-8)
4. Hexadecimal number system (Base- 16)

Now, let us discuss the different types of number systems with examples. **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:

$(1\times10^{3}) + (4\times10^{2}) + (5\times10^{1}) + (7\times10^{0})$

$(1\times1000) + (4\times100) + (5\times10) + (7\times1)$

1000 + 400 + 50 + 7

1457

Binary Number System (Base 2 Number System)

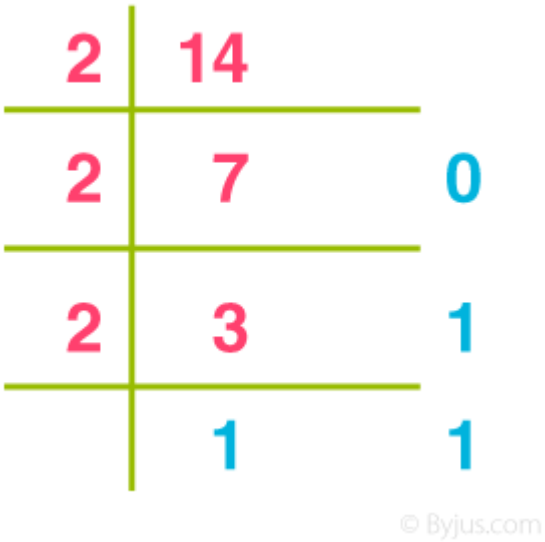
The base 2 number system is also known as the Binary number system wherein, only two binary digits exist, i.e., 0 and 1. Specifically, the usual base-2 is a radix of 2. The figures described under this system are known as binary numbers which are the combination of 0 and 1. For example, 110101 is a binary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

We can convert any system into binary and vice versa.

Example

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

Solution:



Base 2 Number System Example

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

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	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
Decimal	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15

Number System Chart

In the number system chart, the base values and the digits of different number systems can be found. Below is the chart of the numeral system.

Number System	Base value	Set of digits	Example
Base 3	3	0, 1, 2	$(123)_3$
Base 4	4	0, 1, 2, 3	$(145)_4$
Base 5	5	0, 1, 2, 3, 4	$(425)_5$
Base 6	6	0, 1, 2, 3, 4, 5	$(225)_6$
Base 7	7	0, 1, 2, 3, 4, 5, 6	$(1205)_7$
Base 8	8	0, 1, 2, 3, 4, 5, 6, 7	$(105)_8$
Base 9	9	0, 1, 2, 3, 4, 5, 6, 7, 8	$(25)_9$
Base 10	10	0, 1, 2, 3, 4, 5, 6, 7, 8, 9	$(1125)_{10}$

Number System Chart

Number System Conversion

Numbers can be represented in any of the number system categories like binary, decimal, hexadecimal, etc. Also, any number which is represented in any of the number system types can be easily converted to another. Check the detailed lesson on the conversions of number systems to learn how to convert numbers in decimal to binary and vice versa, hexadecimal to binary and vice versa, and octal to binary and vice versa using various examples.

With the help of the different conversion procedures explained above, now let us discuss in brief about the conversion of one number system to the other number system by taking a random number.

Assume the number 349. Thus, the number 349 in different number systems is as follows:

The number 349 in the binary number system is 101011101

The number 349 in the decimal number system is 349.

The number 349 in the octal number system is 535.

The number 349 in the hexadecimal number system is 15D

Number System Solved Examples

Example 1:

Convert $(1056)_{16}$ to an octal number.

Solution:

Given, 1056_{16} is a hex number.

First we need to convert the given hexadecimal number into decimal number

$(1056)_{16}$

$= 1 \times 16^3 + 0 \times 16^2 + 5 \times 16^1 + 6 \times 160$

$= 4096 + 0 + 80 + 6$

$= (4182)_{10}$

Now we will convert this decimal number to the required octal number by repetitively dividing by 8.

8	4182	Remainder
8	522	6
8	65	2
8	8	1
8	1	0
	0	1

Therefore, taking the value of the remainder from bottom to top, we get;

$(4182)_{10} = (10126)_8$

Therefore,

$(1056)_{16} = (10126)_8$

Example 2:

Convert $(1001001100)_2$ to a decimal number.

Solution:

$(1001001100)_2$

$= 1 \times 2^9 + 0 \times 2^8 + 0 \times 2^7 + 1 \times 2^6 + 0 \times 2^5 + 0 \times 2^4 + 1 \times 2^3 + 1 \times 2^2 + 0 \times 2^1 + 0 \times 2^0$

$= 512 + 64 + 8 + 4$

$= (588)_{10}$

Example 3:

Convert 10101_2 into an octal number.

Solution:

Given,

10101_2 is the binary number

We can write the given binary number as,

010 101

Now as we know, in the octal number system,

010 → 2

101 → 5

Therefore, the required octal number is $(25)_8$

Example 4:

Convert hexadecimal 2C to decimal number.

Solution:

We need to convert $2C_{16}$ into binary numbers first.

2C → 00101100

Now convert 00101100_2 into a decimal number.

$101100 = 1 \times 2^5 + 0 \times 2^4 + 1 \times 2^3 + 1 \times 2^2 + 0 \times 2^1 + 0 \times 2^0$

$= 32 + 8 + 4$

$= 44$

Convertion Algorithm

Algorithm to convert binary to decimal

1. Take a binary number as the input.
2. Divide the number by 10 and store the remainder into variable rem.
3. decimal_num=decimal_num+rem*base; Initially, the decimal_num is 0, and the base is 1, where the rem variable stores the remainder of the number.
4. Divide the quotient of the original number by 10.

5. Multiply the base by 2.
6. Print the decimal of the binary number.

Algorithm to convert octal to decimal

The concept is to extract the digits of an octal number starting with the rightmost digit and store them in a variable called ans. Multiply the digit with the appropriate base (Power of 8) and add it to the variable ans when extracting digits from an octal number. The variable ans will ultimately hold the requisite decimal number.

Steps: Assume that num is the input octal number.

Initialize x = 0, ans = 0.

Repeat the following steps while num > 0.

Set -> y = num % 10, y will have last digit.

Remove last digit of number in num variable -> num = num / 10.

ans = ans + y * 8^x

updated vale of x varable by 1 till num > 0 -> x = x + 1

Return ans.

Algorithm to convert Hexadecimal to decimal

1. Start from the right-most digit. Its weight(or coefficient) is 1.
2. Multiply the weight of the position by its digit. Add the product to the result.
   (0=0, 1=1, 2=2, … 9=9, A=10, B=11, C=12, D=13, E=14,F=15)
3. Move one digit to the left. Its weight is 16 times the previous weight.
4. Repeat 2 and 3 until you go through all hexadecimal digits.

Example: 32_{16} = ? (dec)

Step 1: The coefficient of the right-most digit is 1.

Step 2: Multiply the coefficient(1) by the value of the digit(2): 1*2 = 2

Step 3: The weight of the next digit is 1 * 16 = 16

Repeat 2: Multiply the coefficient(16) by the value of the digit(3): 16 * 3 = 48

Repeat 3: No more positions to calculate.

The result is the sum of the results.

Program

```
n='y'
while(n!='n'):
    print("LET'S DO CONVERSION...")

    print("[1].To convert Binary to Decimal number.")
    print("[2].To convert Octal to Decimal number.")
    print("[3].To convert Hexadecimal to Decimal number.")

    num = int(input("Choose an conversion[1,2,3]: "))
#binary to decimal.
    if(num==1):
        while(num):
            binary = input("Enter a Binary number: ")
            sum = 0
            i =0
            j=0
            b=len(binary)
            binary1=int(binary)
            for i in range(b-1,-1,-1):
                    if('0' in binary[i] or '1' in binary[i]):
                        # print(binary1)
                        rem = binary1 % 10
                        sum = sum + rem*pow(2,j)
                        binary1 = int(binary1 / 10)
                        # print(j)
                        T=True
                        j=j+1
                    else:
                      print("Your input is wrong :")
                      T=False
                      break;
            if(T==False):
                 continue

            print("Decimal number is: ",sum)
            while(num):
                            num = input("Do you want to continue(y/n):")
                            if(num=='n' or num=='N' or num=='y' or num=='Y'):
                                n=num.lower()
                                num=0
                                break
                            else:
                                print("pls enter right key:")


    elif(num==2):
```

```
        while(num):

            octal = input("Enter a Octal number: ")
            dec_value = 0
            base =1
            b=len(octal)
            octal1=int(octal)
            for i in range(b-1,-1,-1):
                if('0' in octal[i]  or '1'in octal[i] or '2'in octal[i] or '3' in
octal[i] or '4' in octal[i]  or '5'in octal[i]  or '6'in octal[i] or '7'in octal[i]
):
                        rem = octal1 % 10
                        octal1= int(octal1 / 10)
                        dec_value = dec_value + rem * base
                        base =base * 8
                        T=True
                else:
                 print("Your input is wrong :")
                 T=False
                 break

            if(T==False):
                 continue

            print("Decimal number is: ",dec_value)
            while(num):
                        num = input("Do you want to continue(y/n):")
                        if(num=='n' or num=='N' or num=='y' or num=='Y'):
                            n=num.lower()
                            num=0
                            break
                        else:
                            print("pls enter right key:")
```

Output

```
LET'S DO CONVERSION...
[1].To convert Binary to Decimal number.
[2].To convert Octal to Decimal number.
[3].To convert Hexadecimal to Decimal number.
Choose an conversion[1,2,3]: 1
Enter a Binary number: 0101
Decimal number is:  5
Do you want to continue(y/n):y
LET'S DO CONVERSION...
[1].To convert Binary to Decimal number.
[2].To convert Octal to Decimal number.
[3].To convert Hexadecimal to Decimal number.
Choose an conversion[1,2,3]: 2
Enter a Octal number: 1234762
Decimal number is:  342514
Do you want to continue(y/n):y
```