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## Hexadecimal Number System

In the **hexadecimal number system**, the numbers are represented with base 16. It is also pronounced sometimes as '**hex**'. Just like the **binary number**, **octal number** and **decimal number** whose base representation are 2, 8 and 10, respectively, the hexadecimal conversion is also possible which can be represented in a table. This concept is widely explained in the syllabus of Class 9. The **list of 16 hexadecimal digits** with their decimal, octal and binary representation is provided here in the form of a table, which will help in number system conversion. This list can be used as a translator also.

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### Hexadecimal Numbers List

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

## Hexadecimal Number System Conversions

As we know, there are 16 digits in hexadecimal numbers, represented from 0 to 9 same like decimals, but after that, it starts with an alphabetical representation of preceding numbers such as A, B, C, D and E. Let us see the conversion of 'hex' into other number systems.

### Hexadecimal to Decimal Number System Conversion

Here, you will see the representation of a hexadecimal number into decimal form.

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

### Decimal to Hexadecimal Number System Conversion

You have learned how to convert hexadecimal number to decimal number. Now let us find out how we can convert a decimal number in hexadecimal. Follow the below steps:

- Firstly divide the number by 16
- Take the quotient and divide again by 16
- The remainder left will produce the hex value
- Repeats the steps until the quotient has become 0

**Example:** Convert  $(242)_{10}$  into hexadecimal.

**Solution:** Divide 242 by 16 and repeat the steps, till the quotient is left as 0.

$$\begin{array}{r|l}
 16 & 242 \\
 \hline
 16 & 15 \quad 2 \rightarrow 2 \\
 \hline
 & 0 \quad 15 \rightarrow F
 \end{array}$$

Therefore,  $(242)_{10} = (F2)_{16}$

### Hexadecimal to Octal Number System Conversion

Here, you will see the representation of a hexadecimal number into octal number form.

Hexadecimal	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
Octal	0	1	2	3	4	5	6	7	10	11	12	13	14	15	16	17

### Octal to Hexadecimal Number System Conversion

To convert octal to hex, we have to first convert octal number to decimal and then decimal to hexadecimal. Let us understand it with the help of an example;

**Example:** Convert  $(121)_8$  into hexadecimal.

**Solution:** First convert 121 into decimal number.

$$\Rightarrow 1 \times 8^2 + 2 \times 8^1 + 1 \times 8^0$$

$$\Rightarrow 1 \times 64 + 2 \times 8 + 1 \times 1$$

$$\Rightarrow 64 + 16 + 1$$

$$\Rightarrow 81$$

$$(121)_8 = 81_{10}$$

Now converting  $81_{10}$  into a hexadecimal number.

$$\begin{array}{r|l} 16 & 81 \\ \hline 16 & 5 \quad 1 \rightarrow 1 \\ \hline & 0 \quad 5 \rightarrow 5 \end{array}$$

Therefore,  $81_{10} = 51_{16}$

## Hexadecimal to Binary Number System Conversion

Here, you will see the representation of a hexadecimal number into binary form. We can use only 4 digits to represent each hexadecimal number, where each group has a distinct value from 0000 (for 0) and 1111 (for F = 15 = 8 + 4 + 2 + 1).

Hexadecimal	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
Binary	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
			0	1	0	0	1	1	0	0	1	1	0	0	1	1
					0	1	0	1								

## Binary to Hexadecimal Number System Conversion

Binary to hexadecimal conversion is a simple method to do. You just have to put the values of the binary number to the relevant hexadecimal number.

**Example:** Convert  $(11100011)_2$  to hexadecimal.

**Solution:** From the table, we can write, 11100011 as E3.

Therefore,  $(11100011)_2 = (E3)_{16}$

## Hexadecimal Number System Conversion Examples

**Example 1:** What is 5C6 (Hexadecimal)?

Solution: Step 1: The "5" is the "16 x 16" position, so that means  $5 \times 16 \times 16$

Step 2: The 'C' (12) is in the "16" position, so that means  $12 \times 16$ .

Step 3: The "6" in the "1" position so that means 6.

Answer is :  $5C6 = 5 \times 16 \times 16 + 12 \times 16 + 6 = (1478)$  in Decimal.

**Example 2:** What is 3C5 (Hexadecimal)?

Solution: Step 1: The "3" is the "16 x 16" position, so that means  $3 \times 16 \times 16$

Step 2: The 'C' (12) is in the "16" position, so that means  $12 \times 16$ .

Step 3: The "5" in the "1" position so that means 5.

Answer is :  $3C5 = 3 \times 16 \times 16 + 12 \times 16 + 5 = (965)$  in Decimal.

**Example 3:** What is 7B5 (Hexadecimal)?

Solution: Step 1: The "7" is the "16 x 16" position, so that means  $7 \times 16 \times 16$

Step 2: The 'B' (11) is in the "16" position, so that means  $11 \times 16$ .

Step 3: The "5" in the "1" position so that means 5.

Answer is :  $7B5 = 7 \times 16 \times 16 + 11 \times 16 + 5 = (1973)$  in Decimal.

**Example 4:** What is 2E8 (Hexadecimal)?

Solution: Step 1: The “2 “ is the “16 x 16” position, so that means 2 x16 x16

Step 2: The ‘E’ (14) is in the “16” position, so that means 14 x 16.

Step 3: The “2” in the “1” position so that means 2.

Answer is : 2E8 = 2 x 16 x 16 + 14 x 16 +8 = (744 ) in Decimal.

**Example 5:** What is 4F8 (Hexadecimal)?

Solution: Step 1: The “4 “ is the “16 x 16” position, so that means 4 x16 x16

Step 2: The ‘F’ (15) is in the “16” position, so that means 15 x 16.

Step 3: The “8” in the “1” position so that means 8.

Answer is : 4F8 = 4 x16 x 16 + 15 x 16 +8 = (1272) in Decimal.

Test your Knowledge:


What is 5D6 (Hexadecimal)?

**Notes:**

- Out of many types of number representation techniques, Hexadecimal number system is one having a value of base 16.
- So Hexadecimal numbers have 16 symbols or digital values, i.e 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, A, B, C, D, E, F.
- A, B, C, D, E, F are single bit representations of 10, 11, 12, 13, 14 and 15 respectively.
- Addition of either an *o* prefix or an *h* prefix indicates Hexadecimal.

A power of 16 is the weight of the position of every digit.

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