

Hex

Hexadecimal numbers are based on the number 16. A hexadecimal number uses 16 symbols which are 0, 1, 2 ... 8, 9, A, B, C, D, E and F. A stands for ten, B stands for eleven, C stands for twelve etc. The term 'hexadecimal' is shortened to 'hex'. Hex numbers are used as a shortcut notation for binary numbers. The conversions from binary to hex and vice-versa are very simple and straightforward.

In the following table we can see the representations of the numbers from zero to fifteen in all three bases.

Hexadecimal	Binary	Decimal
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
A	1010	10
B	1011	11
C	1100	12
D	1101	13
E	1110	14
F	1111	15

An example of a hex (hexadecimal) number: 3C90B.

Conversion from binary to hex

It is easy to convert from an integer binary number to hex. This is accomplished by the following two steps:

1. Break the binary number into 4-bit sections from the LSB (least significant bit) to the MSB (most significant bit).
2. Convert each 4-bit binary number to its Hex equivalent.

The following example shows how the binary value 1010111110110010 is converted to hex.

1010	1111	1011	0010
A	F	B	2

Conversion from Hex to Binary

This is done by expressing each hexadecimal symbol in four bits. The result in sequence is the result. In the following example the hex number 190 is converted to binary.

$$190_{16} = \begin{array}{c} 1 \\ \diagdown \quad \diagup \\ 0001 \end{array} \begin{array}{c} 9 \\ \diagdown \quad \diagup \\ 1001 \end{array} \begin{array}{c} 0_{16} \\ \diagdown \quad \diagup \\ 0000_2 \end{array}$$

Leading zeros, in binary numbers, may be omitted:

$$000110010000_2 = 110010000_2$$

Conversion from decimal to hexadecimal

This can be done by converting the decimal number to binary and then convert the binary number to hex.

Conversion from hex to decimal

This can be done by converting the hex number to binary and then convert the binary number to decimal.

Exercise

Perform the following conversions:

- Convert 10001110101_2 to hex.
- Convert 20154_{10} to hex.
- Convert $3F7A_{16}$ to decimal.
- Convert $5BA_{16}$ to binary.