Binary, decimal, and hexadecimal conversions

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Binary

Computers work on the principle of number manipulation. Inside the computer, the numbers are represented in bits and bytes. For example, the number three is represented by a byte with bits 0 and 1 set to "00000011" which is a numbering system using base 2. People commonly use a decimal or Base 10 numbering system.

What this means is that, in Base 10, you count from 0 to 9 before adding another digit. For example, the number 22 in Base 10 means we have two sets of 10's and two sets of 1's.

Base 2 is also known as **binary** since there can only be two values for a specific digit; either a 0 = OFF or a 1 = ON. You cannot have a number represented as 22 in binary notation. The decimal number 22 is represented in binary as 00010110. By following the below chart, that breaks down to:

Bit Position	7	6	5	4	3	2	1	0
	1	1	1	1	1	1	1	1
Decimal	128	64	32	16	8	4	2	1

22 or 00010110:

All numbers representing 0 are not counted, **128, 64, 32, 8, 1** because 0 represents OFF.

However, numbers representing 1 are counted, **16** + **4** + **2** = 22 because 1 represents ON.

Decimal values and binary equivalents chart

Decimal	Binary
1	1
2	10
3	11
4	100
5	101
6	110
7	111
8	1000
9	1001
10	1010
16	10000
32	100000
64	1000000
100	1100100
256	100000000

512	1000000000
1000	1111101000
1024	10000000000

Hexadecimal

Another numbering system used by computers is hexadecimal, or Base 16. In this system, the numbers are counted from 0 to 9, then letters A to F, before adding another digit. The letters A through F represent decimal numbers 10 through 15, respectively. The below chart indicates the values of the hexadecimal position compared to 16 raised to a power and decimal values. It's easier to work with large numbers using hexadecimal values than decimal.

To convert a value from hexadecimal to binary, you merely translate each hexadecimal digit into its 4-bit binary equivalent. Hexadecimal numbers have either a *0x* prefix or an *h* suffix.

For example, consider the hexadecimal number:

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0x3F7A
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Using the Binary chart and the Hex chart below, this translates into the binary value:

```
0011 1111 0111 1010
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Decimal	Hexadecimal	Binary
0	0	0000

1	1	0001
2	2	0010
3	3	0011
4	4	0100
5	5	0101
6	6	0110
7	7	0111
8	8	1000
9	9	1001
10	A	1010
11	B	1011
12	C	1100
13	D	1101
14	E	1110
15	F	1111