

8. Hexadecimal

Hexadecimal number system is used to represent large numbers with fewer digits
Hexadecimal is base 16, Binary is Base 2, and decimal is Base 10

Binary vs. decimal vs. hexadecimal numbering

BINARY	DECIMAL	HEXADECIMAL	BINARY	DECIMAL	HEXADECIMAL
0	0	0	1010	10	A
1	1	1	1011	11	B
10	2	2	1100	12	C
11	3	3	1101	13	D
100	4	4	1110	14	E
101	5	5	1111	15	F
110	6	6	10000	16	10
111	7	7	10001	17	11
1000	8	8	Etc.	Etc.	Etc.
1001	9	9			

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Since Hexadecimal is Base 16, it means that there are 16 symbols. It starts off with 0-9

0	1	2	3	4	5	6	7	8	9
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Then it continues with the letters

A	B	C	D	E	F
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So overall it would be

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

Decimal	0	1	2	3	...	10	11	12	13	14	15
Hexadecimal	0	1	2	3	...	A	B	C	D	E	F

The reason why we need hexadecimal number is to quickly write binary string equivalents in shorter form. When 16 or 32 bit numbers are involved it becomes harder to read and write binary without producing errors. By using hexadecimal you have a more compact way to represent binary numbers with fewer digits.

Representation of Hexadecimal in Binary

Hex	0	1	2	3	4	5	6	7	8	9
4-bit binary number	0000	0001	0010	0011	0100	0101	0110	0111	1000	1001

Hex	A	B	C	D	E	F				
4-bit binary number	1010	1011	1100	1101	1110	1111				

Sometimes you'll see stuff like **0xBEEF**, which is a hexadecimal representation of a large number. Like Binary we can convert this to decimal, ignore the **0x** part just focus on the **BEEF**:

Hex	B	E	E	F
Decimal	11	14	14	16
Position	3s	2s	1s	0s

To calculate we must know that **F** is at the 0th position, **E** is at the 1st, **E** again is 2nd, and **B** is at the 3rd, for every decimal we must multiply the decimal of the hex by 16^n where n is the hex's position.

$$B = 11 * (16^3) = 45056$$

$$E = 14 * (16^2) = 3584$$

$$E = 14 * (16^1) = 224$$

$$F = 15 * (16^0) = 15$$

And when we add **BEEF** decimal values altogether,

$$45056 + 3584 + 224 + 15 = 48879$$

Hence the value of **0xBEEF** is **48879**.

Source: [What is hexadecimal numbering? \(techtarget.com\)](https://techtarget.com/what-is-hexadecimal-numbering/).

See Also:

[1. Binary and Data](#)