

DSA
Alternate Base Systems
for Cross-Curricular Fun & Engineering Applications

OVERVIEW OF WHAT BASES ARE: HEXADECIMAL

DESCRIPTION OF HEXADECIMAL BASE:

Hexadecimal is base sixteen; it is widely used in computer science because, like octal, it very conveniently makes a compact encoding for binary, the base of computer logic. Traditionally, the digits 0-9 are used, then alphabetic digits, either upper or lower case; in regular expression:

First Sixteen: 1, 2, 3, 4, 5, 6, 7, 8, 9, A, B, C, D, E, F, 10

Second Sixteen: 11, 12, 13, 14, 15, 16, 17, 18, 19, 1A, 1B, 1C, 1D, 1E, 1F, 20

Third Sixteen: 21, 22, 23, 24, 25, 26, 27, 28, 29, 2A, 2B, 2C, 2D, 2E, 2F, 30, etc.

HISTORY OF HEXADECIMAL BASE:

Hexadecimal arose more or less simultaneously with the computer age; however, like dozenal, its use is common in measurement systems. (An [avoirdupois](#) pound, for example, has sixteen ounces; traditional Chinese weight units were likewise hexadecimal.) There are also advocacy groups that argue for its use as a daily base; John Nystrom's "Tonal System" was an attempt at this, though Nystrom later became a dozenalist.

USE OF THE HEXADECIMAL BASE:

Like octal, binary can be encoded in hexadecimal; and hexadecimal is used rather more frequently than octal these days for this purpose. For example, with sixteen-bit color channels, hexadecimal numbers are used to represent the amount of red, blue, and green (and sometimes an alpha channel for transparency), rather than listing out these colors in binary, which would be very bulky; or decimal, which would sometimes require two digits. For example:

channel	R	B	G	A
binary	1101	0111	1011	0100
decimal	13	7	11	4
hexadecimal	D	7	B	4

Hexadecimal is very useful this way. Indeed, it is used so frequently for this that a hexadecimal digit is called a "nibble" (four bits), which is half of a byte (eight bits). However, it is rarely if ever used for fractional values, because despite being larger than, say, dozenal, it actually has fewer factors than dozenal, and three is not one of them (that is, thirds are endlessly repeating in hexadecimal, as they are in decimal).

EXAMPLES:

Here is a number in base-10: 201.

What does it mean? It means:

two one-hundreds,
zero tens, and
one one.

What does this base-10 number, 201, equal in base-16?

It is C9. What does it mean? It means

12 (or "C") sixteens, and
nine ones

QUESTIONS:

- 1.) Can you think of better symbols to use for digits ten through fifteen?
- 2.) What advantages might hexadecimal have outside computer science?
- 3.) Does hexadecimal make a convenient daily base? Why or why not?