Hexadecimal Notation Encyclopedia Article

Hexadecimal Notation

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Hexadecimal Notation

Hexadecimal notation is a system for representing numbers using the 16 alphanumeric characters 0-9, A, B, C, D, E, and F. (*Hexa-* and *deci-* are Greek combination forms meaning "six" and "ten," hence the *hexadecimal* or six-ten [6 + 10 = 16] system.) The hexadecimal number system uses positional notation and powers of 16 to express numbers in a manner similar to that of the familiar decimal system. In the decimal system, the positions of the numerals 0-9 determine their values. Consider the decimal number 283.75; each digit is multiplied by a particular power of 10, as follows: 283.75 = $(2 \times 10^{2}) + (8 \times 10^{1}) + (3 \times 10^{0}) + (7 \times 10^{-1}) + (5 \times 10^{-2})$. Numbers expressed in hexadecimal notation use the same basic system, with two important differences: first, in addition to the numerals 0 -9, the alphabetic symbols A-F are used as numerals. The decimal equivalents of these numerals are A = 10, B = 11, C = 12, D = 13, E = 14, and F = 15. Second, powers of 16 are used in the hexadecimal system, instead of powers of 10. For the hexadecimal number C84, we have C84 = $(12 \times 16^{2}) + (8 \times 16^{1}) + (4 \times 16^{0})$ = 3072 + 12 + 4 = 3,204.

In computer work, hexadecimal notation is used as a convenient method for representing binary numbers longer than a few bits. Binary numbers are difficult for human beings to deal with directly because of their bulk, but each hexadecimal digit stands for four binary digits. For example, the binary number 1011000010111110100 can be converted to hexadecimal notation by dividing the number into groups of four binary digits (starting at the right-hand end) and replacing each group by a corresponding hexadecimal digit. Where the left-hand group is incomplete, zeros are filled in as required. The result is 0010/1100/0101/1111/0100 = 2C5F4. The greater compactness and readability of hexadecimal notation is here apparent. However, except for expert readers of hexadecimal notation, "2C5F4" is not liable to convey much. Conversion to decimal notation proceeds as follows: 2C5F4 = $(2 \times 16^{4}) + (12 \times 16^{3}) + (5 \times 16^{2}) + (15 \times 16^{1}) + (4 \times 16^{0})$ = (2 x 65,536) + (12 x 4,096) + (5 x 256) + (15 x 16) + (4 x 1) = 181,748.