Double-Precision Variable Encyclopedia Article

Double-Precision Variable

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Double-Precision Variable

Precision is the exactitude with which a number represents some quantity. The more digits a number has to the right of its decimal point, the more precise it can be. For example, it is more precise to say that one meter equals 39.37 inches than to say that one meter equals 39.4 inches. A number format allowing two digits to the right of the decimal point (as in "39.37") permits the **expression** of differences as small as a hundredth (the difference between, say, 39.37 and 39.36), and is said to be precise to one part in a hundred.

A typical floating-point number in a digital computer has a fractional component that is 24 bits long, giving a **precision** of one part in 2^{24}. That is, for a given exponent, differences as small as $1/2^{24} = 5.9 \times 10^{-8}$ can be expressed using a normal floating-point number, which is also called a "single-precision number." Greater precision, if required, can be achieved in two ways. The simpler is to make use of a standard floating-point number format having more bits in its fractional component; this need is filled by double-precision numbers. The IEEE (Institute of Electrical and Electronic Engineers) double-precision format, for example, has a 52-bit fraction, over twice as many bits as the single-precision format. Double-precision arithmetic--the performance of a series of calculations using double-precision numbers--is a special case of multiple-precision arithmetic, computation in which more than one binary word is used to represent every single number. Multiple-precision arithmetic is both slower and more memory-intensive than single-precision arithmetic. It is slower because each multiple-precision number must be fed through the computer's **central processing unit** in fragments, and it is more memory-intensive because each multiple-precision number is at least twice the size of a single-precision number. Efficiency-conscious programmers do not invoke multiple precision carelessly.