

# DIFFERENT DATA TYPES

## The Five Basic Data Types

There are five atomic data types in the C subset: character, integer, floating-point, double floating-point, and valueless (**char**, **int**, **float**, **double**, and **void**, respectively). As you will see, all other data types in C are based upon one of these types. The size and range of these data types may vary between processor types and compilers. However, in all cases a character is 1 byte. The size of an integer is usually the same as the word length of the execution environment of the program. For most 16-bit environments, such as DOS or Windows 3.1, an integer is 16 bits. For most 32-bit environments, such as Windows 2000, an integer is 32 bits. However, you cannot make assumptions about the size of an integer if you want your programs to be portable to the widest range of environments. It is important to understand that both C and C++ only stipulate the *minimal range* of each data type, not its size in bytes.

*To the five basic data types defined by C, C++ adds two more: **bool** and **wchar\_t**. These are discussed in Part Two.* The exact format of floating-point values will depend upon how they are implemented. Integers will generally correspond to the natural size of a word on the host computer. Values of type **char** are generally used to hold values defined by the ASCII character set. Values outside that range may be handled differently by different compilers. The range of **float** and **double** will depend upon the method used to represent the floating-point numbers. Whatever the method, the range is quite large. Standard C specifies that the minimum range for a floating-point value is  $1E-37$  to  $1E+37$ . The minimum number of digits of precision for each floating-point type is shown in Table 1-1.

*Standard C++ does not specify a minimum size or range for the basic types. Instead, it simply states that they must meet certain requirements. For example, Standard C++ states that an **int***

will “have the natural size suggested by the architecture of the execution environment.” In all cases, this will meet or exceed the minimum ranges specified by Standard C. Each C++ compiler specifies the size and range of the basic types in the header `<climits>`.

Type	Typical Size in Bits	Minimal Range
char	8	-127 to 127
unsigned char	8	0 to 255
signed char	8	-127 to 127
int	16 or 32	-32,767 to 32,767
unsigned int	16 or 32	0 to 65,535
signed int	16 or 32	same as <b>int</b>
short int	16	-32,767 to 32,767
unsigned short int	16	0 to 65,535
signed short int	16	same as <b>short int</b>
long int	32	-2,147,483,647 to 2,147,483,647
signed long int	32	same as <b>long int</b>
unsigned long int	32	0 to 4,294,967,295
float	32	Six digits of precision
double	64	Ten digits of precision
long double	80	Ten digits of precision

Table 1-1. All Data Types Defined by the ANSI/ISO C Standard



Thus, the following sets of type specifiers are equivalent:

<b>Specifier</b>	<b>Same As</b>
signed	signed int
unsigned	unsigned int
long	long int
short	short int

Although the **int** is implied, many programmers specify the **int** anyway.

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