**printf[[1]](#footnote-1)**

**Function definition:**

int printf ( <format string>, <variables, if required> );

**Print formatted data to the terminal.**

Writes the C string *format* to the terminal (a.k.a. [stdout](http://www.cplusplus.com/stdout)). If *format* includes *format specifiers* imbedded within it, the additional arguments following *format* are formatted and inserted in the resulting string replacing their respective specifiers.

**Parameters**

format

C string that contains the text to be written to the terminal (a.k.a [stdout](http://www.cplusplus.com/stdout).). It can optionally contain embedded *format specifiers* that are replaced by the values specified in subsequent additional arguments and formatted as requested.

A *format specifier* follows this prototype: [see compatibility note below]

%[flags][width][.precision][length]specifier

Where the *specifier character* at the end is the most significant component, since it defines the type and the interpretation of its corresponding argument:

|  |  |  |
| --- | --- | --- |
| ***specifier*** | **Output** | **Example** |
| d *or* i | Signed decimal integer | 392 |
| u | Unsigned decimal integer | 7235 |
| o | Unsigned octal | 610 |
| x | Unsigned hexadecimal integer | 7fa |
| X | Unsigned hexadecimal integer (uppercase) | 7FA |
| f | Decimal floating point, lowercase | 392.65 |
| F | Decimal floating point, uppercase | 392.65 |
| e | Scientific notation (mantissa/exponent), lowercase | 3.9265e+2 |
| E | Scientific notation (mantissa/exponent), uppercase | 3.9265E+2 |
| g | Use the shortest representation: %e or %f | 392.65 |
| G | Use the shortest representation: %E or %F | 392.65 |
| a | Hexadecimal floating point, lowercase | -0xc.90fep-2 |
| A | Hexadecimal floating point, uppercase | -0XC.90FEP-2 |
| c | Character | a |
| s | String of characters | sample |
| p | Pointer address | b8000000 |
| n | Use the OS-specific sequence to move to the beginning of the next line. |  |
| % | A % followed by another % character will write a single % to the stream. | % |

The *format specifier* can also contain sub-specifiers: *flags*, *width*, *.precision* and *modifiers* (in that order), which are optional and follow these specifications:

|  |  |
| --- | --- |
| ***flags*** | **description** |
| - | Left-justify within the given field width; Right justification is the default (see *width* sub-specifier). |
| + | Forces to preceed the result with a plus or minus sign (+ or -) even for positive numbers. By default, only negative numbers are preceded with a - sign. |
| *(space)* | If no sign is going to be written, a blank space is inserted before the value. |
| # | Used with o, x or X specifiers the value is preceeded with 0, 0x or 0X respectively for values different than zero. Used with a, A, e, E, f, F, g or G it forces the written output to contain a decimal point even if no more digits follow. By default, if no digits follow, no decimal point is written. |
| 0 | Left-pads the number with zeroes (0) instead of spaces when padding is specified (see *width* sub-specifier). |

|  |  |
| --- | --- |
| ***width*** | **description** |
| *(number)* | Minimum number of characters to be printed. If the value to be printed is shorter than this number, the result is padded with blank spaces. The value is not truncated even if the result is larger. |
| \* | The *width* is not specified in the *format* string, but as an additional integer value argument preceding the argument that has to be formatted. |

|  |  |
| --- | --- |
| ***.precision*** | **description** |
| .*number* | For integer specifiers (d, i, o, u, x, X): *precision* specifies the minimum number of digits to be written. If the value to be written is shorter than this number, the result is padded with leading zeros. The value is not truncated even if the result is longer. A *precision* of 0 means that no character is written for the value 0. For a, A, e, E, f and F specifiers: this is the number of digits to be printed **after** the decimal point (by default, this is 6). For g and G specifiers: This is the maximum number of significant digits to be printed. For s: this is the maximum number of characters to be printed. By default all characters are printed until the ending null character is encountered. If the period is specified without an explicit value for *precision*, 0 is assumed. |
| .\* | The *precision* is not specified in the *format* string, but as an additional integer value argument preceding the argument that has to be formatted. |

The *length* sub-specifier modifies the length of the data type. This is a chart showing the types used to interpret the corresponding arguments with and without *length* specifier (if a different type is used, the proper type promotion or conversion is performed, if allowed):

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | **specifiers** | | | | | | |
| ***length*** | **d i** | **u o x X** | **f F e E g G a A** | **c** | **s** | **p** | **n** |
| *(none)* | int | unsigned int | double | int | char\* | void\* | int\* |
| hh | signed char | unsigned char |  |  |  |  | signed char\* |
| h | short int | unsigned short int |  |  |  |  | short int\* |
| l | long int | unsigned long int |  | [wint\_t](http://www.cplusplus.com/wint_t) | wchar\_t\* |  | long int\* |
| ll | long long int | unsigned long long int |  |  |  |  | long long int\* |
| j | [intmax\_t](http://www.cplusplus.com/intmax_t) | [uintmax\_t](http://www.cplusplus.com/uintmax_t) |  |  |  |  | [intmax\_t](http://www.cplusplus.com/intmax_t)\* |
| z | [size\_t](http://www.cplusplus.com/size_t) | [size\_t](http://www.cplusplus.com/size_t) |  |  |  |  | [size\_t](http://www.cplusplus.com/size_t)\* |
| t | [ptrdiff\_t](http://www.cplusplus.com/ptrdiff_t) | [ptrdiff\_t](http://www.cplusplus.com/ptrdiff_t) |  |  |  |  | [ptrdiff\_t](http://www.cplusplus.com/ptrdiff_t)\* |
| L |  |  | long double |  |  |  |  |

Note regarding the c specifier: it takes an int as an argument, but performs the proper conversion to a char value before formatting it for output.  
  
**Note:** Yellow rows indicate specifiers and sub-specifiers introduced by C99.

... *(additional arguments)*

Depending on the *format* string, the function may expect a sequence of additional arguments, each containing a value to be used to replace a *format specifier* in the *format* string.

There should be at least as many of these arguments as the number of values specified in the *format specifiers*. Additional arguments are ignored by the function.

**Return Value**

On success, the total number of characters written is returned.  
  
If a writing error occurs, a negative number is returned.

**Compatibility**

Particular library implementations may support additional *specifiers* and *sub-specifiers*.

Those listed here are supported by the C standard published in 2011, but those in yellow were introduced in C99, and may not be supported by libraries that comply with older standards.

1. Taken from cppreference.com and edited [↑](#footnote-ref-1)