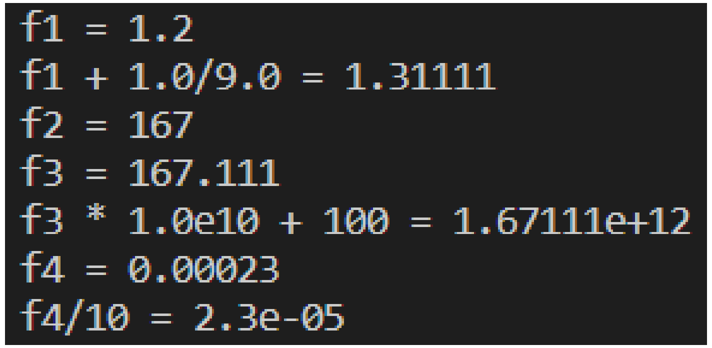
1. Formatting with cout

Floating-point types are displayed with a total of six digits, except that trailing zeros aren’t displayed. The float number is displayed in *fixed-point notation* or else in *E notation* depending on the value of the number. In particular, *E notation* is used if the exponent is 6 or larger or -5 or smaller.

```
int main()
{
    double f1 = 1.200;
    std::cout << "f1 = " << f1 << std::endl;
    std::cout << "f1 + 1.0/9.0 = " << f1 + 1.0/9.0 << std::endl;

    double f2 = 1.67E2;
    std::cout << "f2 = " << f2 << std::endl;

    double f3 = f2 + 1.0/9.0;
    std::cout << "f3 = " << f3 << std::endl;
    std::cout << "f3 * 1.0e10 + 100 = " << f3 * 1.0e10 + 100 << std::endl;

    double f4 = 2.3e-4;
    std::cout << "f4 = " << f4 << std::endl;
    std::cout << "f4/10 = " << f4/10 << std::endl;

    return 0;
}
```



```
f1 = 1.2
f1 + 1.0/9.0 = 1.31111
f2 = 167
f3 = 167.111
f3 * 1.0e10 + 100 = 1.67111e+12
f4 = 0.00023
f4/10 = 2.3e-05
```

C++ provides two methods to control the **output formats**

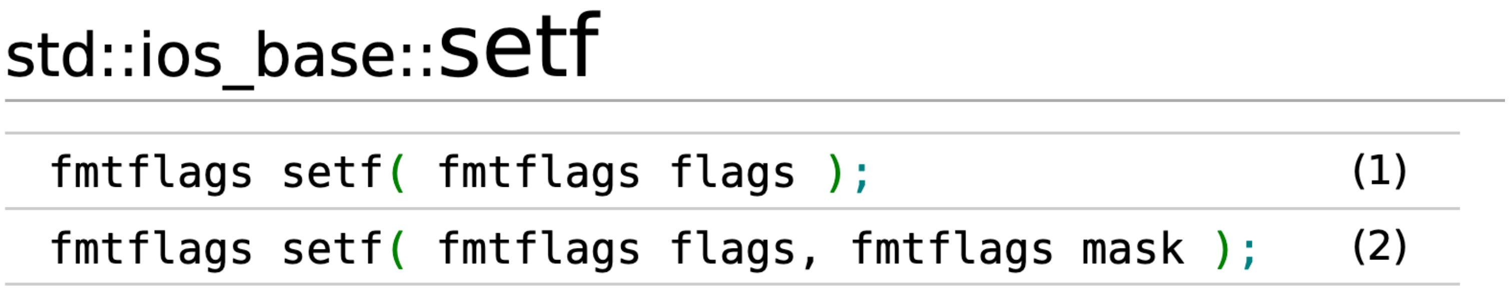
1.1 Using member functions of ios class

1.2 Using iomanip manipulators

1.1 Using member functions of ios class

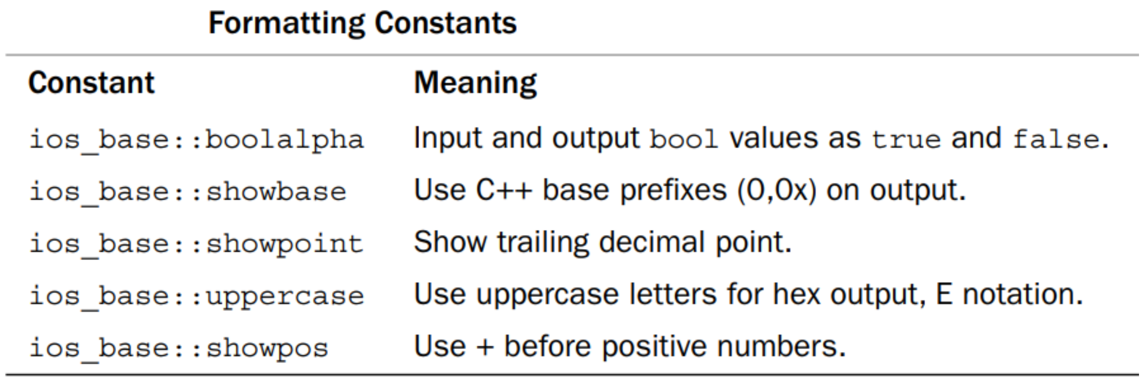
1.1.1 cout.setf(): The setf() function has two prototypes,the first one is:

cout.set(fmtflags);



std::ios_base::setf

```
fmtflags setf( fmtflags flags );                    (1)
fmtflags setf( fmtflags flags, fmtflags mask );     (2)
```

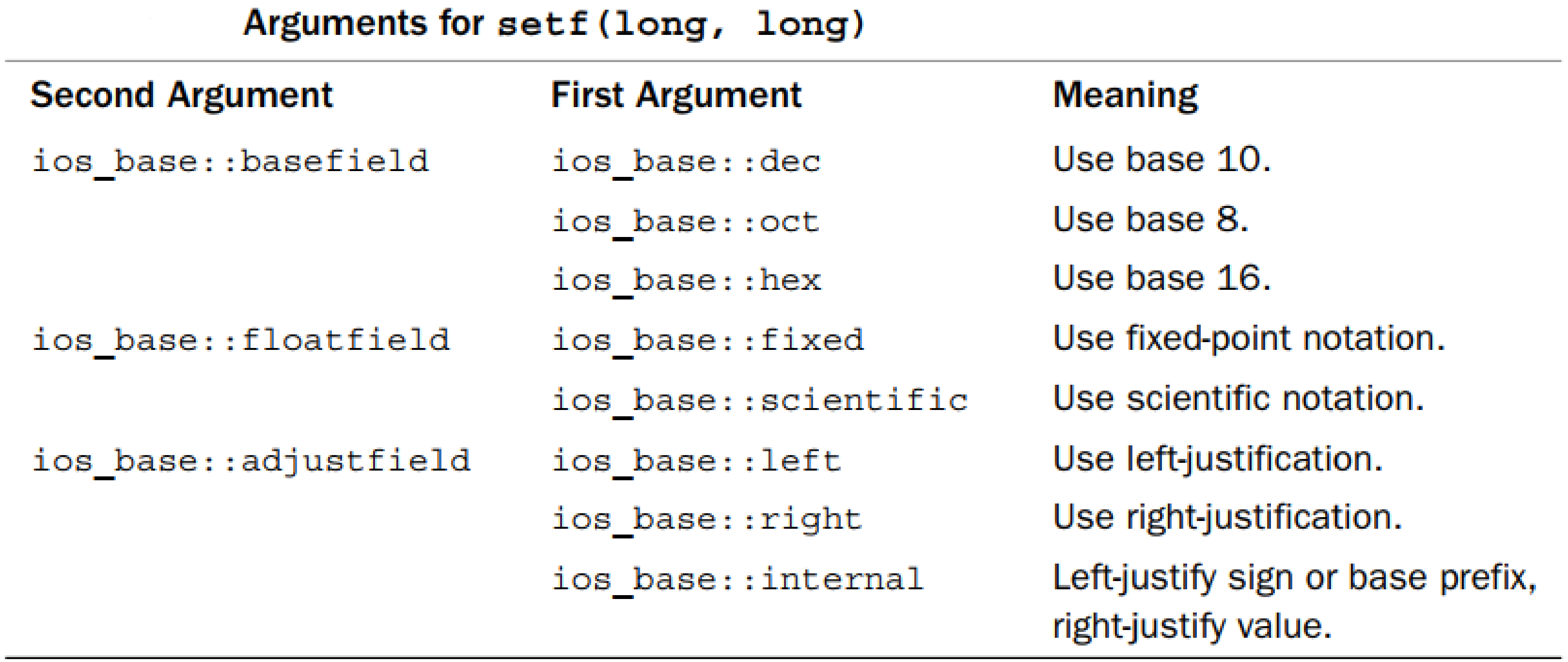


Formatting Constants

Constant	**Meaning**
`ios_base::boolalpha`	Input and output `bool` values as `true` and `false`.
`ios_base::showbase`	Use C++ base prefixes (0,0x) on output.
`ios_base::showpoint`	Show trailing decimal point.
`ios_base::uppercase`	Use uppercase letters for hex output, E notation.
`ios_base::showpos`	Use + before positive numbers.

1.1 Using member functions of ios class

The second one is:
  cout.set(fmtflags,fmtflags);



Arguments for `setf(long, long)`

Second Argument	First Argument	Meaning
`ios_base::basefield`	`ios_base::dec`	Use base 10.
	`ios_base::oct`	Use base 8.
	`ios_base::hex`	Use base 16.
`ios_base::floatfield`	`ios_base::fixed`	Use fixed-point notation.
	`ios_base::scientific`	Use scientific notation.
`ios_base::adjustfield`	`ios_base::left`	Use left-justification.
	`ios_base::right`	Use right-justification.
	`ios_base::internal`	Left-justify sign or base prefix, right-justify value.

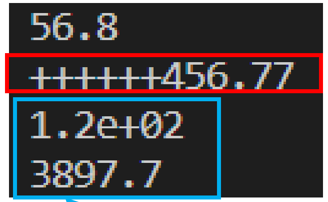
1.1 Using member functions of ios class

1.1.2. cout.**width**(len) //set the field width

1.1.3. cout.**fill**(ch) // fill character to be used with justified field

1.1.4. cout.**precision**(p) // set the precision of floating-point numbers

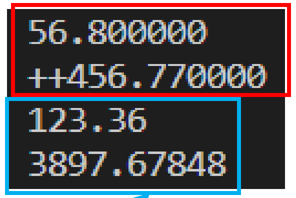
```
#include <iostream>
using namespace std;

int main()
{
    cout << 56.8 << endl;
    cout.width(12);
    cout.fill('+');
    cout << 456.77 << endl;

    cout.precision(2);
    cout << 123.356 << endl;
    cout.precision(5);
    cout << 3897.678485 << endl;

    return 0;
}
```



```
56.8
++++++456.77
1.2e+02
3897.7
```

significant digits

```
#include <iostream>
using namespace std;

int main()
{
    cout.setf(ios_base::fixed, ios_base::floatfield);
    cout << 56.8 << endl;
    cout.width(12);
    cout.fill('+');
    cout << 456.77 << endl;

    cout.precision(2);
    cout << 123.356 << endl;
    cout.precision(5);
    cout << 3897.678485 << endl;

    return 0;
}
```

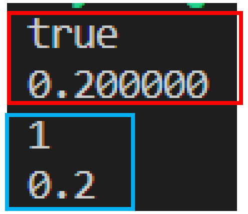


```
56.800000
++456.770000
123.36
3897.67848
```

precision of
floating number

The effect of calling ***setf()*** can be undone with ***unsetf()***.

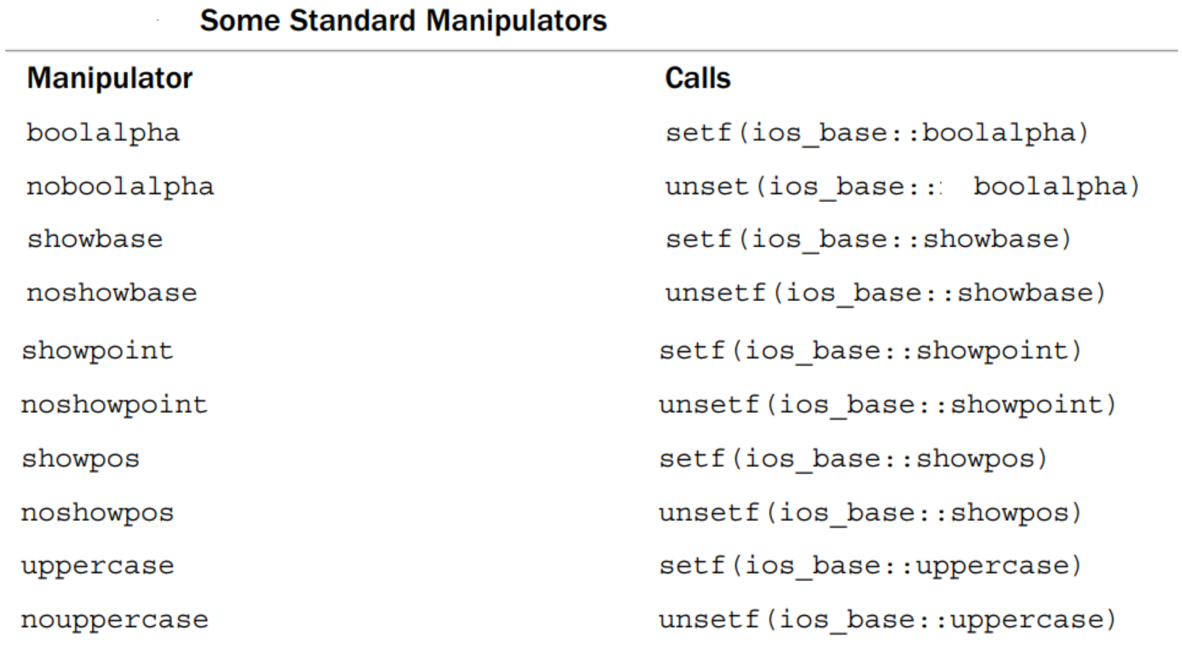
```
#include <iostream>
using namespace std;

int main()
{
    bool flag = true;
    float f = 0.20f;

    cout.setf(ios::showpoint);
    cout.setf(ios::boolalpha);
    cout << flag << endl;
    cout << f << endl;

    cout.unsetf(ios::boolalpha);
    cout.unsetf(ios::showpoint);
    cout << flag << endl;
    cout << f << endl;

    return 0;
}
```



```
true
0.200000
1
0.2
```

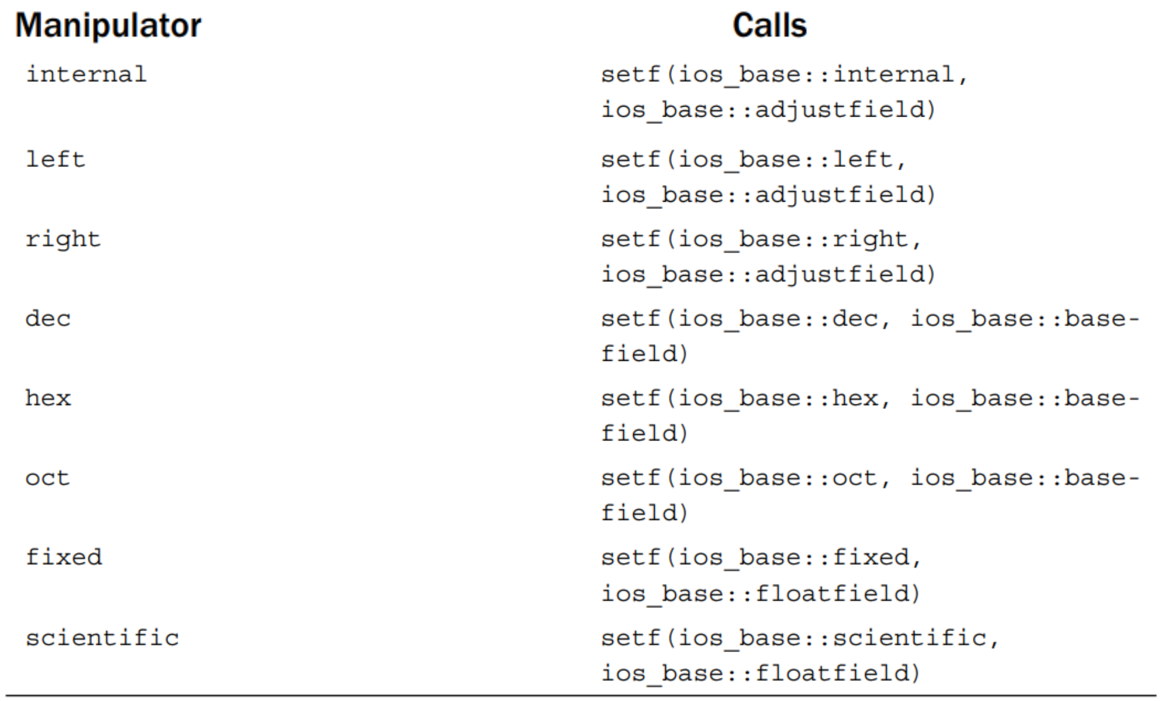
Standard Manipulators

C++ offers several manipulators to invoke setf(),automatically supplying the right arguments.



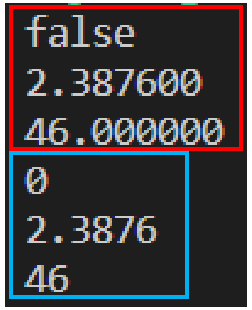
Some Standard Manipulators

Manipulator	Calls
boolalpha	setf(ios_base::boolalpha)
noboolalpha	unset(ios_base:: boolalpha)
showbase	setf(ios_base::showbase)
noshowbase	unsetf(ios_base::showbase)
showpoint	setf(ios_base::showpoint)
noshowpoint	unsetf(ios_base::showpoint)
showpos	setf(ios_base::showpos)
noshowpos	unsetf(ios_base::showpos)
uppercase	setf(ios_base::uppercase)
nouppercase	unsetf(ios_base::uppercase)



Manipulator	Calls
internal	setf(ios_base::internal, ios_base::adjustfield)
left	setf(ios_base::left, ios_base::adjustfield)
right	setf(ios_base::right, ios_base::adjustfield)
dec	setf(ios_base::dec, ios_base::basefield)
hex	setf(ios_base::hex, ios_base::basefield)
oct	setf(ios_base::oct, ios_base::basefield)
fixed	setf(ios_base::fixed, ios_base::floatfield)
scientific	setf(ios_base::scientific, ios_base::floatfield)

```
#include <iostream>
using namespace std;

int main()
{
    bool flag = false;
    double a = 2.3876;
    double b = 0.46e2;

    cout << boolalpha << flag << endl;
    cout << fixed << a << endl;
    cout << b << endl;

    cout << noboolalpha << flag << endl;
    cout.unsetf(ios::fixed);
    cout << a << endl;
    cout << b << endl;

    return 0;
}
```



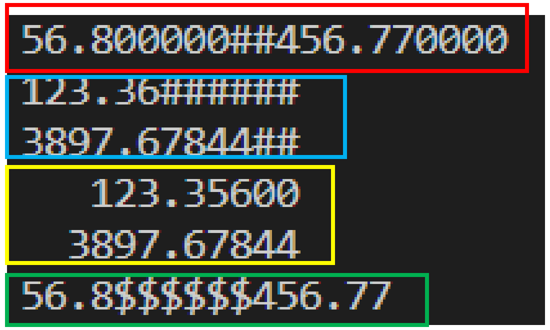
```
false
2.387600
46.000000
0
2.3876
46
```

● 1.2 Using iomanip manipulators

#include <iomanip>

1. setw(p)   2. setfill(ch)   3. setprecision(d)

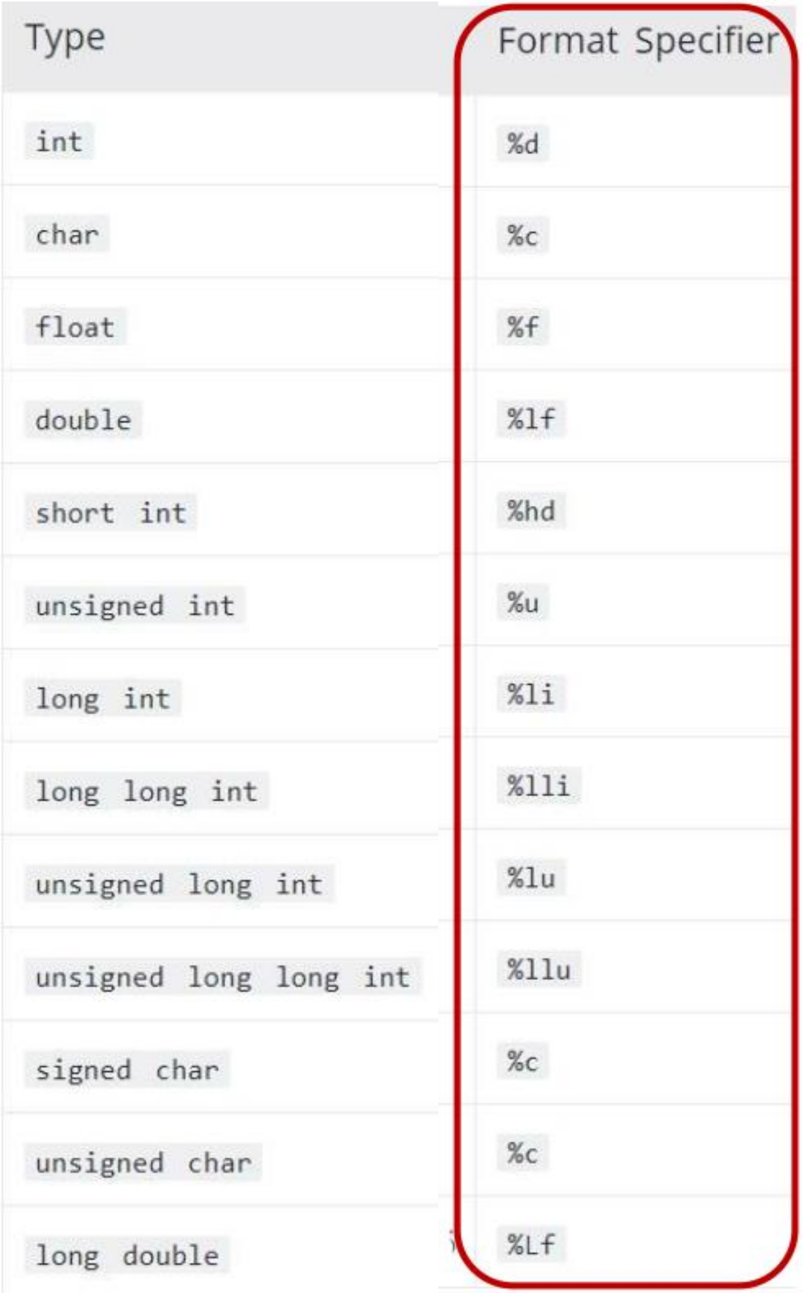
```
#include <iostream>
#include <iomanip>
using namespace std;

int main()
{
   cout.setf(ios_base::fixed, ios_base::floatfield);
   cout << 56.8 << setw(12) << setfill('#') << 456.77 << endl;

   cout << left;
   cout << setw(12) << setprecision(2) << 123.356 << endl;
   cout << setw(12) << setprecision(5) << 3897.6784385 << endl;

   cout << right;
   cout << setw(12) << setfill(' ') << 123.356 << endl;
   cout << setw(12) << setfill(' ') << 3897.6784385 << endl;

   cout.unsetf(ios_base::fixed);
   cout << 56.8 << setw(12) << setfill('$') << 456.77 << endl;

   return 0;
}
```



```
56.800000##456.770000
123.36######
3897.67844##
   123.35600
  3897.67844
56.8$$$$$$456.77
```

printf() vs cout

Which one do you prefer?

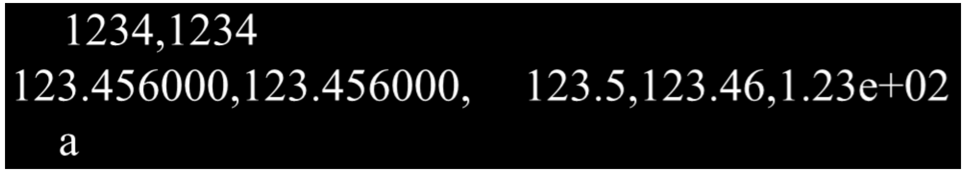


Type	Format Specifier
int	%d
char	%c
float	%f
double	%lf
short int	%hd
unsigned int	%u
long int	%li
long long int	%lli
unsigned long int	%lu
unsigned long long int	%llu
signed char	%c
unsigned char	%c
long double	%Lf

Example:

```
int a=1234;
float f=123.456;
char ch='a';
printf("%8d,%2d\n",a,a);
printf("%f,%8f,%8.1f,%.2f,%.2e\n",f,f,f,f,f);
printf("%3c\n",ch);
```

Sample output:



```
    1234,1234
123.456000,123.456000,    123.5,123.46,1.23e+02
  a
```