

Stream Member Functions for Formatting

Chapter 3 introduced you to stream manipulators for formatting the appearance of data displayed by `cout`. Stream manipulators aren't the only way to format data with `cout`. Field width, precision, and format flags may also be modified by `cout`'s *member functions*. Here is an example of how the display field width can be set with a member function:

```
cout.width(5);
```

All of `cout`'s member functions are called this way. A period separates the word `cout` from the name of the member function. Any arguments needed by the function are placed in parentheses. In the statement above, `cout`'s member function `width` is called to set the field width to five spaces. This is equivalent to inserting the `setw(5)` manipulator before a variable in a `cout` statement. For example, the following code displays the contents of the variable `x` in a field of eight spaces:

```
cout.width(8);  
cout << x << endl;
```

There is also a member function named `precision`, which sets the precision of floating point numbers. The following example sets the precision to two decimal places:

```
cout.precision(2);
```

This setting will remain in effect until it is reset or until the end of the program. Format flags are set with the `setf` member function. Here is an example that sets the formatting of numbers to fixed point notation:

```
cout.setf(ios::fixed);
```

You can also send multiple flags to `setf` by separating them with the `|` symbol. Here is a statement that sets the flags for fixed point notation, decimal point displaying, and left-justification:

```
cout.setf(ios::fixed | ios::showpoint | ios::left);
```

Regardless of the way format flags are set, they may be turned off with the `unsetf` function. It works like `setf`, except the format flags you specify are disabled. The following statement turns off the `ios::fixed` and `ios::left` flags:

```
cout.unsetf(ios::fixed | ios::left);
```

Program J-1 demonstrates the precision and setf member functions.

Program J-1

```

1 // This program asks for sales figures for 3 days. The total
2 // sales is calculated and displayed in a table.
3 #include <iostream>
4 #include <iomanip>
5 using namespace std;
6
7 int main()
8 {
9     double day1, day2, day3, total;
10
11     cout << "Enter the sales for day 1: ";
12     cin >> day1;
13     cout << "Enter the sales for day 2: ";
14     cin >> day2;
15     cout << "Enter the sales for day 3: ";
16     cin >> day3;
17
18     total = day1 + day2 + day3;
19
20     cout.precision(2);
21     cout.setf(ios::fixed | ios::showpoint);
22
23     cout << "\nSales Figures\n";
24     cout << "-----\n";
25     cout << "Day 1: " << setw(8) << day1 << endl;
26     cout << "Day 2: " << setw(8) << day2 << endl;
27     cout << "Day 3: " << setw(8) << day3 << endl;
28     cout << "Total: " << setw(8) << total << endl;
29
30     return 0;
31 }
```

Program Output with Example Input Shown in Bold

Enter the sales for day 1: **2642.00**
Enter the sales for day 2: **1837.20**
Enter the sales for day 3: **1963.00**

Sales Figures

```

-----
Day 1: 2642.00
Day 2: 1837.20
Day 3: 1963.00
Total: 6442.20
```

Table J-1 summarizes the member functions we have discussed.

Table J-1

| Member Function | Description |
|--------------------------|---|
| <code>width()</code> | Sets the display field width. |
| <code>precision()</code> | Sets the precision of floating point numbers. |
| <code>setf()</code> | Sets the specified format flags. |
| <code>unsetf()</code> | Disables, or turns off, the specified format flags. |

The `cin` object also supports the `width` member function, which establishes an input field width. This is most helpful when `cin` is reading a string and storing it as a null-terminated C-string in a character array. When you are reading a string as input into a `char` array, `cin` has no way of knowing how large the array is. If the user types more characters than the array will hold, `cin` will store the string in the array anyway, overwriting whatever is in memory next to the array. An input field width solves this problem by telling `cin` the number of characters to read. Here is a statement declaring an array of ten characters and using a `cin` statement to read no more characters than the array will hold:

```
char word[10];
cin.width(10);
cin >> word;
```

The field width specified is 10. This value will cause `cin` to read no more than nine characters of input, leaving room for the null character at the end. Program J-2 demonstrates this.

Program J-2

```
1 // This program uses cin's width member function.
2 #include <iostream>
3 using namespace std;
4
5 int main()
6 {
7     char word[5];
8
9     cout << "Enter a word: ";
10    cin.width(5);
11    cin >> word;
12    cout << "You entered " << word << endl;
13    return 0;
14 }
```

Program Output with Example Input Shown in Bold

```
Enter a word: Eureka 
You entered Eura
```

In this program, `cin` only reads four characters into the `word` array. Without the field width, `cin` would have written the entire word “Eureka” into the array, overflowing it.

Using Formatting Member Functions with File Streams

The same formatting member functions used with `cout` and `cin` may also be called from file stream objects. For example, the `precision` member function may be used to establish the number of digits of precision for floating point numbers that are written to a file. Program J-3 demonstrates this.

Program J-3

```

1 // This program uses the precision member function of a
2 // file stream object to format file output.
3 #include <iostream>
4 #include <fstream>
5 using namespace std;
6
7 int main()
8 {
9     fstream dataFile;
10    double num = 123.456;
11
12    // Open the file.
13    dataFile.open("numfile.txt", ios::out);
14
15    // Write a value at various digits of precision
16    dataFile << num << endl;
17    dataFile.precision(5);
18    dataFile << num << endl;
19    dataFile.precision(4);
20    dataFile << num << endl;
21    dataFile.precision(3);
22    dataFile << num << endl;
23
24    // Close the file.
25    dataFile.close();
26    return 0;
27 }
```

Contents of File numfile.txt

```

123.456
123.46
123.5
124
```

Notice the file output is formatted just as `cout` would format screen output. In addition, you may use the `width`, `setf`, and `unsetf` functions with file stream objects.