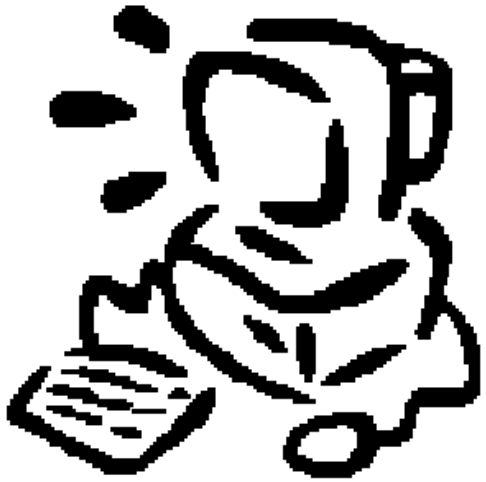
EP241 Computing Programming

Topic 9
File Management



Department of
Engineering Physics
University of Gaziantep

Course web page
www.gantep.edu.tr/~bingul/ep241

Sep 2013

Overview of Streams in C++

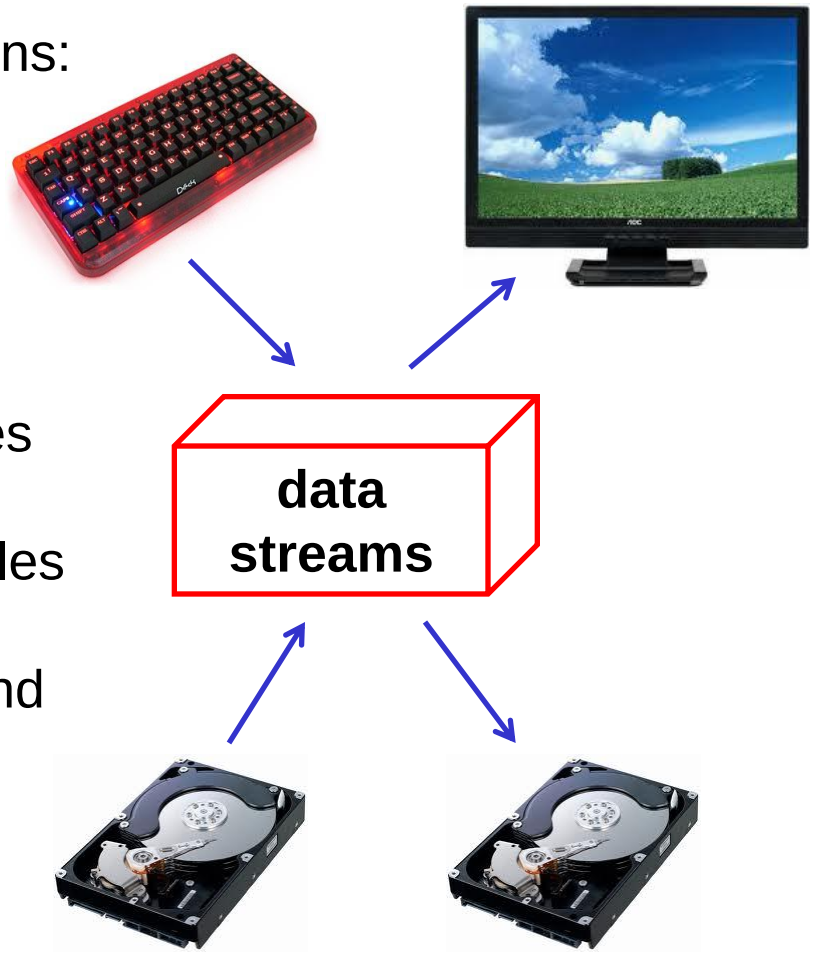
The standard C++ library provides the following classes to perform I/O operations:

`iostream` Stream class for basic I/O (without files).

`ofstream` Stream class to output to files

`ifstream` Stream class to input from files

`fstream` Stream class to both read and write from/to files.



Format Manipulators

In C++ there are different ways to format input and output.

In this course we will only use format *manipulators*.

These are objects that are placed in the data stream to change the characteristics of the input or output.

For example:

```
double x = 123.4567890123;
cout << x << endl;
cout << fixed      << setprecision(9) << x << endl;
cout << scientific << setprecision(7) << x << endl;
```

outputs:

`123.457`	Default format.
`123.456789012`	Fixed format, with 9 decimal places.
`1.2345679e+02`	Scientific format with 7 decimal places.

Note: to use manipulators you need to include the **`<iomanip>`** header.

Some commonly used manipulators.

Requires **`#include <iomanip>`**

*	**`setw(n)`**	Sets the width of the next input/output to **`n`**.
	`setfill(c)`	Fills spaces in a number with the character **`c`**.
*	**`setprecision(n)`**	Display the number with **`n`** decimal places.
*	**`fixed`**	Display values in fixed-point notation.
*	**`scientific`**	Display values in scientific notation.
	`left`	Left-justify.
	`right`	Right-justify.
	`internal`	Left-justify the sign, right-justify the value.
*	**`dec`**	Display integer values in decimal format.
*	**`oct`**	Display integer values in octal (base 8) format.
*	**`hex`**	Display integer values in hexadecimal (base 16).
	`boolalpha`	Display boolean as "**`true`**" or "**`false`**".
	`noboolalpha`	Display boolean as **`1`** or **`0`** (default).

Formatted Output

Manipulators are injected into the output stream
to control the format of following streams of data.

In general we *combine* manipulators to obtain the desired results:

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

int main() {
  double x = 123.456;
  cout << setw(10) << fixed      << setprecision(2) << x;
  cout << setw(15) << scientific << setprecision(3) << x;
}
```

Output

```
    123.46      1.235e+002
```

Column `123456789012345678901234 5`

File Input/Output

Reading from and writing to files is performed using file stream classes.

`ifstream` is used for reading (inputting) data from a file.

`ofstream` is used for writing (outputting) data to a file.

These two class require the **`<fstream>`** header to be included.

File processing requires some basic actions:

- Stating the name of the file.
- Opening an existing file, or created a new one.
- Optionally stating the read/write mode.
- Optionally determining if a file is successfully open.
- Detecting the end of a file (when reading).
- Closing a file after is has been used.

These actions are provided by **`fstream`** functions…

Some functions of `fstream`

Function	Description
`open( filename, mode)`	`filename` is the name (and path) of the file to open. `mode` is an optional parameter and can have the following flags: `ios::in` open for input operations (default for `ifstream`). `ios::out` open for output operations (default for `ofstream`). `ios::binary` open in binary mode (default is text mode). `ios::ate` set the initial position at the end of the file. (default is the beginning of the file). `ios::app` append the content to the current content of the file. `ios::trunc` delete the previous content and replace with new.
`.is_open()`	Returns `true` if a file is successfully opened.
`.eof()`	Returns `true` if a file open (for reading) has reached the end.
`.close()`	Closes the file.

Writing data to a file called **numbers.txt**

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

int main() {

  int i;
  ofstream dosya("numbers.txt");


  for (i=1; i<=10; i++){
    dosya << i << " " << i*i << endl;
  }

  dosya.close();
}
```

The file **numbers.txt** contains:

```
1 1
2 4
3 9
4 16
5 25
6 36
7 49
8 64
9 81
10 100
```

Writing data to a file called **inverse.txt**

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

int main() {

 ofstream dosya("inverse.txt");

 dosya <<setprecision(2) << scientific;
  for (int i=1; i<=10; i++){
    double x = 1.0/i;
    dosya << setw(3)  << i
          << setw(10) << x << endl;
  }

  dosya.close();
}
```

The file **inverse.txt** contains:

```
  1  1.00e+00
  2  5.00e-01
  3  3.33e-01
  4  2.50e-01
  5  2.00e-01
  6  1.67e-01
  7  1.43e-01
  8  1.25e-01
  9  1.11e-01
 10  1.00e-01
```

Writing data to a file called **data.txt**

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

int main() {

  double a[4] = {8.4, 3.6, 9.1, 4.7};

  ofstream myFile("data.txt");


    for (int i=0; i<4; i++)
        myFile << a[i] << endl;

    myFile.close();



}
```

The file **data.txt** contains:

```
8.4
3.6
9.1
4.7
```

Writing data to a file called **data.txt**

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

int main() {

  double a[4] = {8.4, 3.6, 9.1, 4.7};

  ofstream myFile("data.txt");

  if ( myFile.is_open() ) {

    for (int i=0; i<4; i++)
        myFile << a[i] << endl;

    myFile.close();

  } else
    cout << "Unable to open file!";

}
```

The file **data.txt** contains:

```
8.4
3.6
9.1
4.7
```

Reading data from a file called **data.txt**

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

int main() {
  double a[4];
  ifstream myFile("data.txt");


    for (int i=0; i<4; i++) {
        myFile >> a[i];
        cout << "a[" << i << "]="
             << a[i] << endl;
    }

    myFile.close();


}
```

Given that the file **data.txt** contains:

```
8.4
3.6
9.1
4.7
```

The output is

```
a[0]=8.4
a[1]=3.6
a[2]=9.1
a[3]=4.7
```

Reading data from a file called **data.txt**

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

int main() {
  double a[4];
  ifstream myFile("data.txt");

  if ( myFile.is_open() ) {

    for (int i=0; i<4; i++) {
        myFile >> a[i];
        cout << "a[" << i << "]="
             << a[i] << endl;
    }

    myFile.close();

  } else
    cout << "Unable to open file!";
}
```

Given that the file **data.txt** contains:

```
8.4
3.6
9.1
4.7
```

The output is

```
a[0]=8.4
a[1]=3.6
a[2]=9.1
a[3]=4.7
```

Reading data from a file called **student.dat**

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

int main() {
  const int n = 10;
  int       score[n];
  string    name[n];
  double    sum = 0.0;
  ifstream  myFile("student.dat");

  for (int i=0; i<n; i++) {
    myFile >> name[i] >> score[i];
    sum = sum + score[i];
  }
  myFile.close();

  cout << "mean of the class = "
       << sum / n << endl;
}
```

Given that the file **student.dat** contains:

```
UGUR     67
KADIR    72
SEMIH    00
GOZDE    73
FIRAT    30
EDA      51
FULYA    41
GUL      67
EMRE     30
AHMET    76
```

The output is

```
mean of the class = 50.7
```

Example: reading periodic table data from a file

atoms.txt

```
2 He Helium 4.002602 NobleGas
3 Li Lithium 6.941 AlkaliMetal
4 Be Beryllium 9.012182 AlkalineEarth
5 B Boron 10.811 Metaloid
6 C Carbon 12.0107 NonMetal
7 N Nitrogen 14.00674 NonMetal
8 O Oxygen 15.9994 NonMetal
9 F Fluorine 18.998404 Halogen
11 Na Sodium 22.9898 AlkaliMetal
12 Mg Megnesium 24.305 AlkalineEarth
```

For each atom, each property is separated by a *single space*. We call this a space-delimited list of values, and reading such lists is simple in C++ (see next page).

Example: reading periodic table data from a file

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

int main () {

  const int n = 10; // read 10 atom data
  int    number[n];
  string symbol[n], name[n], type[n];
  double   mass[n];

  ifstream atoms("atoms.txt");

  for (int i=0; i<n; i++)
    atoms >> number[i] >> symbol[i]
          >>   name[i] >> mass[i]
          >>   type[i];

  atoms.close();
  .
  . Now use the arrays
```

The format of the data is:

number(**int**)
symbol (**string**)
name (**string**)
mass (**double**)
type (**string**)

Here we are assuming that we have exactly **n**=10 atoms in the file!

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

int main () {

  vector<int>    number;
  vector<string> symbol, name, type;
  vector<double> mass;

  ifstream atoms("atoms.txt");

  int z; string s, n, t; double m;
  while(true) {

    atoms >> z >> s >> n >> m >> t;
    if ( atoms.eof() ) break;
    number.push_back(z); symbol.push_back(s);
      name.push_back(n); mass.push_back(m);
      type.push_back(t);
  }
  atoms.close();
  .
  . Now use the vector arrays
```

If we don't know how many atoms there are in the file, then we can use **vectors** with the `.push_back` method, and the `.eof` method to detect the end of the file.

Note that we need scalars `z`, `s` , `n` , `m` and `t` to read values from the file and insert them into the vectors.

The file `atoms.txt` can now be expanded to incorporate more atoms without changing the program that reads the data.

Homework

Please see:

http://www1.gantep.edu.tr/~bingul/ep241/homework.php