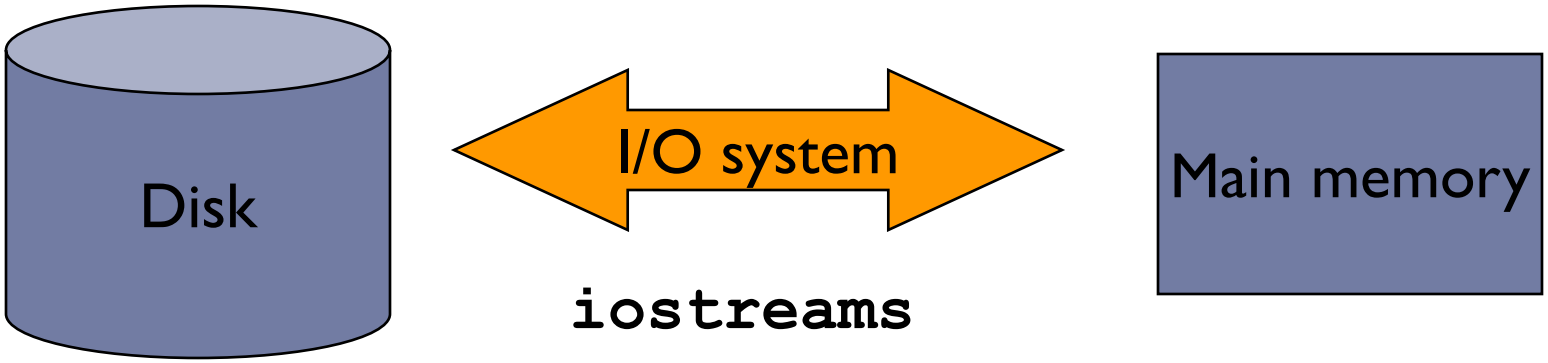
6 Files & Streams

Nur Nabilah Abu Mangshor

Objectives

- Learn about file operation in c++
- Discover basic operation in c++
- Learn how to open, read, write and close a file

General Model (Files)



`iostreams`

Files
(sequences of bytes)

Objects
(of various types)

Introduction

- **File**
  - A file is a **collection of information**, usually **stored on a computer's disk**. Information can be saved to files and then later reused
- **File Name**
  - All files are assigned a name that is used for **identification purposes** by the operating system and the user

Why we use file?

- **Convenient** way to deal large quantities of data.
- Store data **permanently** (until file is deleted).
- Avoid typing data into program multiple times.
- Share data between programs.
- We need to know:
- how to "connect" file to program
- how to tell the program to read data
- how to tell the program to write data
- error checking and handling EOF

Introduction (cont)

- **Stream**
  - A transfer of information in the form of a sequence of bytes

- **I/O Operations**:
  - **Input** : A stream that flows from an input device (i.e keyboard, disk drive, network connection) to main memory
  - **Output** : A stream that flows from main memory to an output device (i.e screen, printer, disk drive)

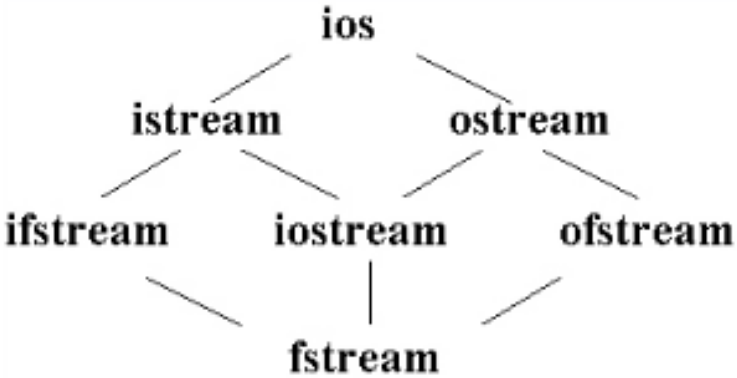
Using Input/Output Files

- **Stream** – A sequence of characters
  - interactive `<iostream>`
    - `cin` – input stream associated with keyboard
    - `cout` – output stream associated with display
  - file `<fstream>`
    - `ifstream` – defines new **input stream** (normally associated with a file)
    - `ofstream` – defines new **output stream** (normally associated with a file)

Stream I/O Library Header Files

- Note: There is no ".h" on standard header files : **`<fstream>`**
- **`<fstream>`** : contains information for performing file I/O operations
- **`<iostream>`** : contains basic information required for all stream I/O operations
- **`iomanip`** : contains information useful for performing formatted I/O with parameterized stream manipulators
- **`strstream`** : contains information for performing in-memory I/O operations (into or from string memory)

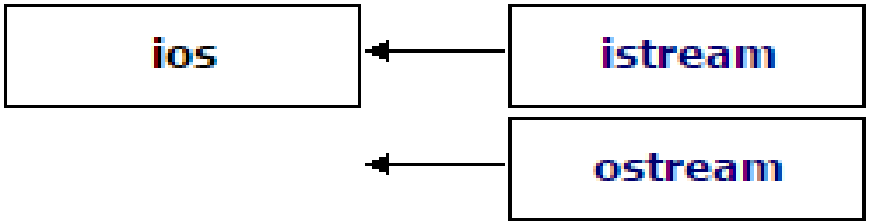
Classes for I/O Stream



- `ios` is the base class
- `iostream` and `ostream` inherit from `ios`
- `ifstream` inherits from `istream` (and `ios`)
- `ofstream` inherits from `ostream` (and `ios`)
- `iostream` inherits from `istream` and `ostream` (and `ios`)
- `fstream` inherits from `ifstream`, `iostream` and `ofstream`

Classes for I/O Stream (cont)

- `ios` is a base class if all stream classes



- `istream` is header providing the standard input and combined input/output stream classes
- `ostream` a header providing the standard output class

Operations on File

General File I/O Steps

- Declare a file name variable
- Associate the file name variable with the disk file name
- Open the file
- Use the file (write / read)
- Close the file

Opening a File

- A file must be opened before we can read or write on it
- Use the member function **`open()`**
- The syntax:

```
objectName.open(fileName);
```

- Where *`objectName`* is either object for **reading** a file or object for **writing** a file
- *`fileName`* is a string holds the name of the file

File I/O Example : Opening

```
#include <conio>
#include <fstream>

int main ()
{
  ofstream myfile;
  myfile.open ("example.txt");

  getch();
  return 0;
}
```

- The statement **`myFile.open("example.txt");`** opens a text file name **`"example.txt"`**

Reading a File

- Once a file has successfully opened, you can read from it in the same way as you would read with `cin` or write to it in the same way as `cout`
- `ifstream` object is used to open file only for reading

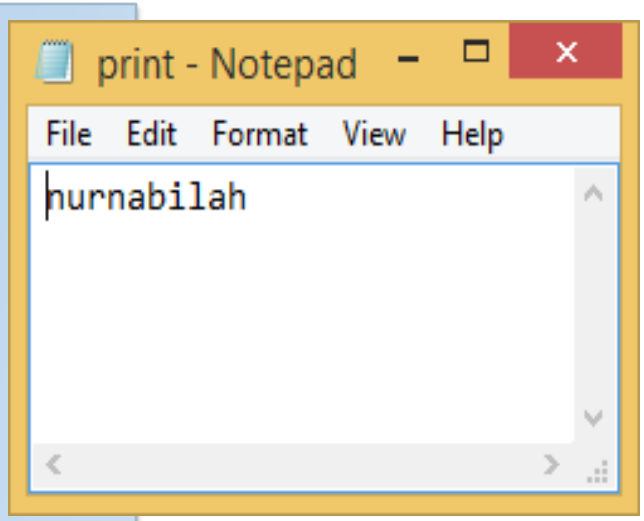
File I/O Example : Reading

```
#include <conio>
#include <fstream>

int main ()
{
    // open a file in read mode.
    ifstream infile;
    infile.open("print.txt");

    cout << "Reading from the file" <<
        endl;
    infile >> name;

    // write the data at the screen.
    cout << name << endl;  getch();
  return 0;
}
```



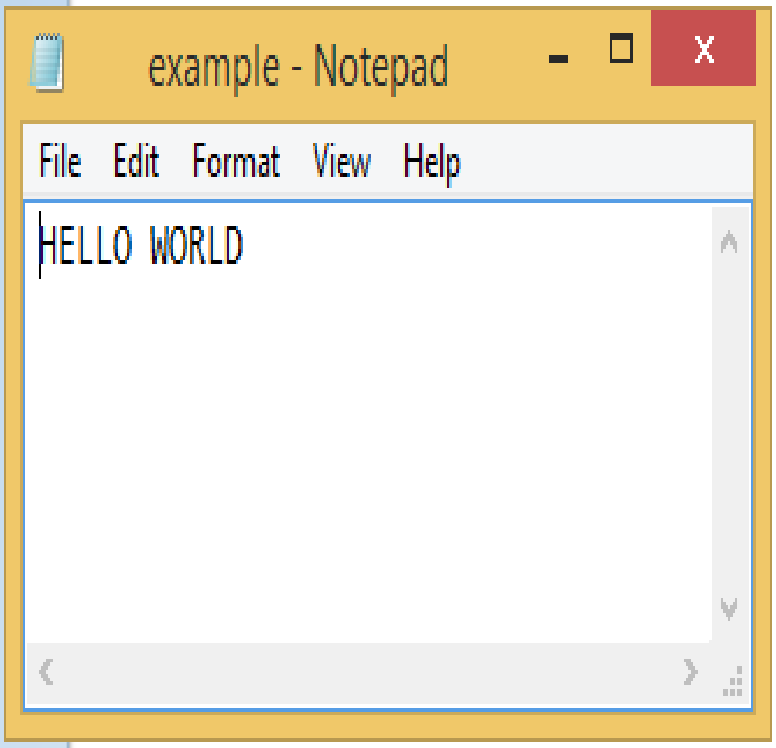
Writing a File

- A file must be opened before we can read or write on it
- write to it in the same way as `cout`
- `ofstream` or `fstream` object may be used to open a file for writing

File I/O Example : Writing

```
#include <iostream>
#include <conio>
#include <fstream>

int main ()
{
  ofstream myfile;
  myfile.open ("example.txt");
  myfile << "HELLO WORLD";
  myfile.close();
  getch();
  return 0;
}
```



Standard Input

- Standard Input is where things come from when you use `cin`. For example:

```
cin >> val;
```

- Standard input associated with the keyboard

Standard Output

- Standard output is exactly where things go when you use **cout**. For example :

```
cout << "Value = " << val << endl;
```

- Standard output associated with the screen

Closing a File

- A file shall be closed once we finished our input and output operation on it
- This member function `close()` takes flushes the associated buffers and closes the file

```
myfile.close();
```

- A statement above closes a file name myfile

Example

```
int main ()
{
    char name[10];
    // open a file in write
mode.
    ofstream outfile;
    outfile.open("print.txt");

    cout << "Writing to the
file" << endl;
    cout << "Enter your name: ";
    cin.getline(name, 100);

    // write inputted data into
the file.
    outfile << name << endl;
```

```
// open a file in read mode.
    ifstream infile;
    infile.open("print.txt");

    cout << "\nReading from the
file" << endl;
    infile >> name;

    // write the data at the
screen.
    cout << name << endl;

    getch();
    return 0;
    }
```

Example (cont)

C:\BC5\BIN\CSC404-FILES\Files_1.exe

```
Writing to the file
Enter your name: nurnabilah

Reading from the file
nurnabilah
```

print - Notepad

File Edit Format View Help

```
nurnabilah
```

Summary of Input File-Related Functions

```
#include <fstream>
ifstream.fsIn;
```

- **`fsIn.open (const char[] fname)`**
  - Connets stream `fsIn` to the external file `fname`
- **`fsIn.get(char& c)`**
  - Extracts next character from the input stream `fsIn` and places it in the character variable c
- **`fsIn.eof()`**
  - Tests for the end-of-file condition
- **`fsIn.close()`**
  - Disconnect the stream and the associated file
- **`fsIn >> c`**
  - For input value. Behaves just like `cin>>`

File Open Mode

Name	Description
ios::in	Open file to read
ios::out	Open file to write
ios::app	All the data you write, is put at the end of the file. It calls ios::out
ios::ate	All the data you write, is put at the end of the file. It does not call ios::out
ios::trunc	Deletes all previous content in the file. (empties the file)
ios::nocreate	If the file does not exists, opening it with the open() function gets impossible.
ios::noreplace	If the file exists, trying to open it with the open() function, returns an error.
ios::binary	Opens the file in binary mode.

File Open Mode

```
#include <fstream>
int main(void)
{
ofstream outFile("file1.txt", ios::out);
outFile << "That's new!\n";
outFile.close();
        Return 0;
}
```

If you want to set more than one open mode, just use the **OR** operator- **|**. This way:

ios::ate | ios::binary

Summary of Output File-Related Functions (cont)

```
#include <fstream>
ofstream.fsOut;
```

- **`fsOut.open (const char[] fname)`**
  - Connets stream `fsOut` to the external file `fname`
- **`fsOut.get(char& c)`**
  - Inserts character `c` from the output stream `fsOut`
- **`fsOut.eof()`**
  - Tests for the end-of-file condition
- **`fsOut.close()`**
  - Disconnect the stream and the associated file
- **`fsOut << c`**
  - For display output value. Behaves just like `cout>>`

File format

- In c++ files we (read from/ write to) them as a stream of characters

- What if I want to write or read numbers ?

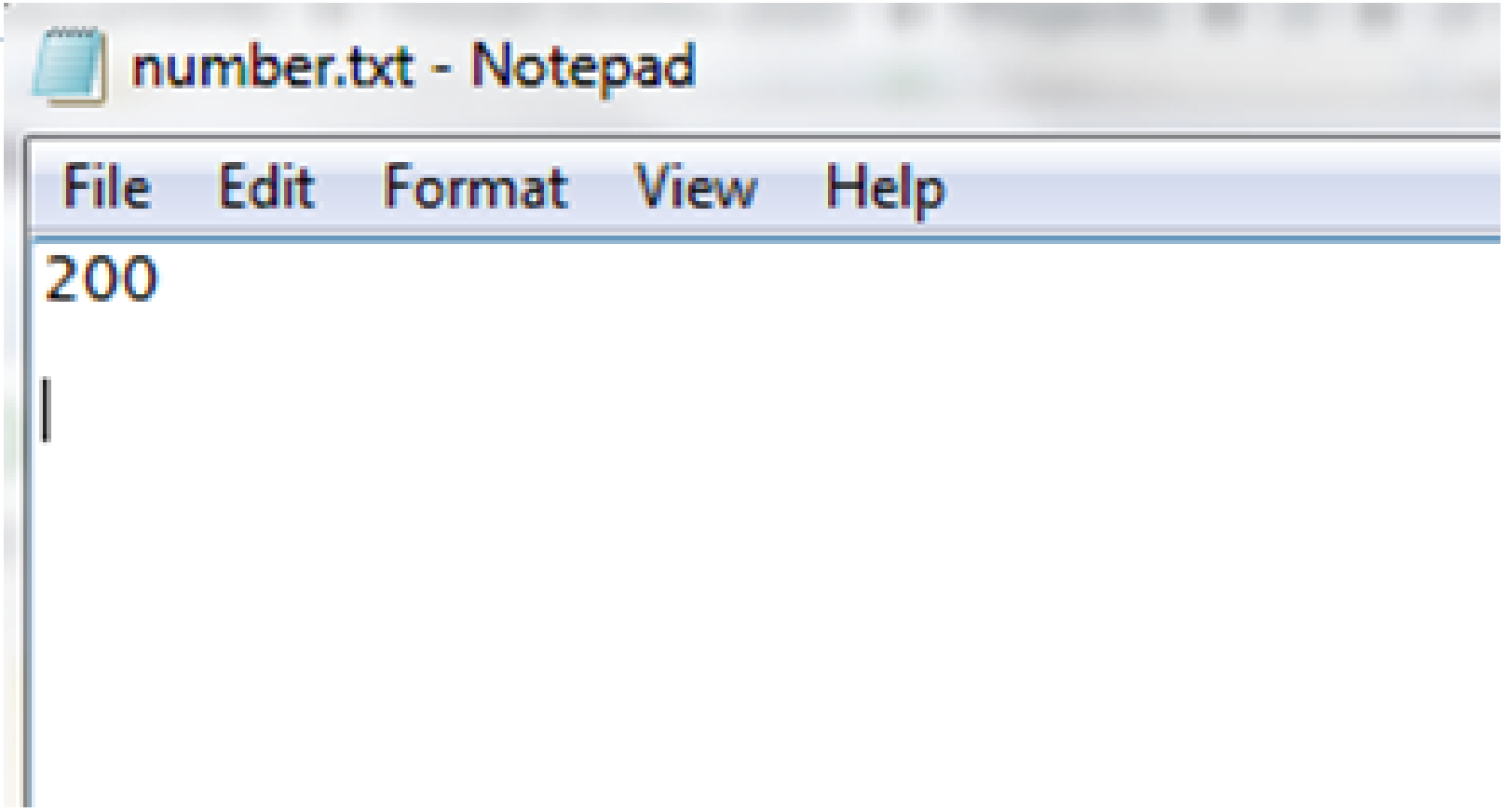
Example writing to file

```
#include <iostream>
#include <fstream>
using namespace std;
void  main()
{
ofstream outFile;
// open an exist file fout.txt
    outFile.open("number.txt",ios::app);

if (!outFile.is_open())
{ cout << " problem with opening the file ";}
else
{outFile <<200 <<endl ;
cout << "done writing" <<endl;}

outFile.close();

}
```


number.txt - Notepad
File Edit Format View Help
200

Example Reading from file

```
#include <iostream>
#include <fstream>
#include <string>
#include <sstream>
using namespace std;
void main()
{//Declare and open a text file
ifstream INFile("number.txt");
string line;
int total=0;
while(! INFile.eof())
{
getline(INFile, line);
//converting line string to int
stringstream(line) >> total;
cout << line  <<endl;
cout <<total +1<<endl;}
INFile.close(); // close the file
}
```

C:\Windows\system32\cmd.exe

```
200
201
Press any key to continue . . .
```

Reference

- D. S. Malik. 2009. C++ Programming From Problem Analysis to Program Design.