

Files are long-term storage for potentially large data sets. Text files are a sequence of characters stored in a file.

Three steps are needed to use a file:

- 1) The file is *opened* to establish a connection between the program and a file. This causes the operating system to check for access permission, allocates some system resources (buffers, etc.) and other stuff.
- 2) The file is accessed by either reading data from it, writing data to it, or both.
- 3) The file is *closed* which breaks the programs connection to the file. If the file was being written, system buffers might be flushed to the disk. Any system resources associated with the open file are released.

In C++ the `fstream` header file contains the *file stream* objects:

- `ifstream` for input file stream,
- `ofstream` for output file stream, and
- `fstream` for create files, write files, or read files.

The `cin` operators and methods work for the `ifstream` objects since the `cin` is a stream of characters from the keyboard while the `ifstream` is a stream of characters from a file.

1. Suppose we want to read the text file `data.txt` containing the information about a student, and write a text file called `mailing.txt` that contains a mailing label for the student. Currently, the below program is NOT WORKING CORRECTLY. Your job is to trace and correct (“*debug*”) this program.

File <code>data.txt</code>	Resulting <code>mailing.txt</code> File	Desired Mailing Label
123456 John Smith 3 485 Main Street Cedar Falls Black Hawk County Iowa 50613	John Smith  485 Main Street, Black Hawk County Iowa	John Smith 485 Main Street Cedar Falls, Iowa 50613

```
// Program to demonstrate reading from a text file and writing to another
#include <fstream>
#include <iostream>
using namespace std;

int main() {
    const int SIZE = 50;

    int studentNumber;
    char name[SIZE];
    char streetAddress[SIZE];
    char city[SIZE];
    char state[SIZE];
    char zipCode[SIZE];
    int classCode;
    char dummy[SIZE];
    ifstream inFile;

    // Open files
    inFile.open("data.txt");
    ofstream outFile("mailingLabel.txt");

    // Read student record
    inFile >> studentNumber;
    inFile.getline(name, SIZE);
    inFile >> classCode;
    inFile.getline(streetAddress, SIZE);
    inFile.getline(city, SIZE);
    inFile.getline(dummy, SIZE);           // skip county name
    inFile.getline(state, SIZE);
    inFile.getline(zipCode, SIZE);

    // Write the mailing label the output file
    outFile << name << endl;
    outFile << streetAddress << endl;
    outFile << city << ", " << state << " " << zipCode << endl;

    // Close files
    outFile.close();
    inFile.close();
} // end main
```

2. Describe what each program does **IN ENGLISH**.

a)

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

int main() {
    const int SIZE = 100;
    char fileName[SIZE];
    char ch;
    ifstream inFile;
    int count1, count2;

    cout << "Enter the name of a text file: ";
    cin.getline(fileName, SIZE);
    inFile.open(fileName);
    if (!inFile) {
        cout << "Error opening file\n";
    } else {
        count1 = 0;
        count2 = 0;
        while(inFile.get(ch)) {
            if (ch == '\n') {
                count1++;
            } // end if
            count2++;
        } // end while
        cout << "count1 = " << count1 << endl;
        cout << "count2 = " << count2 << endl;
    } // end if
} // end main
```

b)

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

int main() {
    int size;
    int row;
    int column;

    cout << "Enter a size: ";
    cin >> size;

    for (row = 1; row <= size; row++) {
        for (column = 1; column <= size; column++) {
            cout << "* ";
        } // end for (column...)
        cout << endl;
    } // end for (row...)
} // end main
```

3. Many of you are struggling with loops (UNFORTUNATELY, THIS IS NORMAL), but you will get better with practice. To help, here are a series of questions that you can ask yourself when solving a programming problem.

After reading the programming problem carefully, ask yourself:

a) "Is looping needed?" What clues should you look for to answer this question?

b) If the answer to (a) is "Yes, a loop is needed", then ask yourself: "What type of loop (`for` or `while` loop)?"  
What clues should you look for to answer this question?

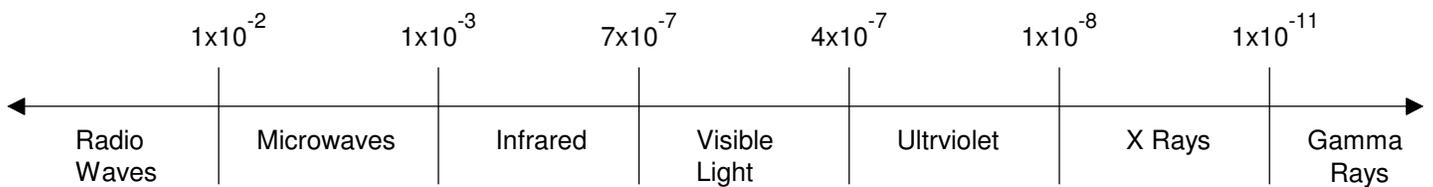
c) If the answer to (b) is "Use a `for` loop", then ask yourself: "What are you looping over, i.e., that loop-control variable, and what range of values?" What clues should you look for to answer these questions?

d) If the answer to (b) is "Use a `while` loop", then ask yourself: "Under what condition do I want to continue to loop?" What clues should you look for to answer these questions?

4. Apply your answers to the previous questions to the following problem.

a) Assuming the level of the Earth's oceans is rising at about 1.5 millimeters per year, write a program that displays a table showing the total number of millimeters that the ocean will have risen each year for the next 25 years.

b) If a scientist knows the wavelength of an electromagnetic wave, he or she can determine what type of radiation it is. Write a program that asks for the wavelength of an electromagnetic wave in meters and then displays what that wave is according to the chart below. (For example, a wave with a wavelength of  $1\text{E}-10$  meters would be an X-ray.)



c) Write a program that asks the user to enter a positive integer number. Your program should determine if the number is prime or not. Recall that a *prime number* is a positive integer such that it is not divisible by any integer other than 1 and itself.