

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 data.txt	Resulting mailing.txt 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
```

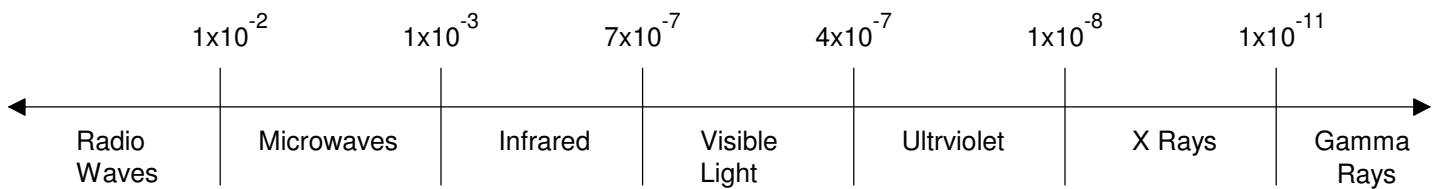
After reading the programming problem carefully, ask yourself:

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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.