

Comp 11 Lectures

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File I/O, Memory, and Multi-dimensional Arrays

Comp 11 - Pre-Class warm up

Have you ever right clicked a .pdf file and opened it up in notepad or a text editor? What do you see? What about if you open a .txt file?

Lecture

Donald Knuth



Figure 1: Donald Knuth is one of the great computer scientists of the last 50 years. He is best known for his work *The Art of Computer Programming*.

Filo I/O

Array initialization

- Looking back at our previous class, we were able to store information in an array.
- But we still had to do some sort of manual labor.

- C++ luckily, has libraries for helping us.
- The `<fstream>` library gives us new types (just like the `<string>` gives us access to the string type)

Filo I/O - Output

```
1 // writing on a text file
2 #include <iostream>
3 #include <fstream>
4
5 int main () {
6     std::ofstream myfile ("example.txt");
7     if (myfile.is_open())
8     {
9         myfile << "Line 1 of our file\n";
10        myfile << "Line 2 of our file.\n";
11        myfile.close();
12    }
13    else {
14        std::cout << "Unable to open file";
15    }
16    return 0;
17 }
```

Listing 1: Create a file and output

Filo I/O - Input (Reading from a file)

```
1 #include <iostream>
2 #include <fstream>
3 #include <string>
4
5 int main () {
6     std::string line;
7     std::ifstream myfile ("example.txt");
8     if (myfile.is_open()){
9         while ( getline (myfile, line) ){
10             std::cout << line << '\n';
11         }
12         myfile.close();
13     }else{
14         std::cout << "Unable to open file";
15     }
16
17     return 0;
18 }
```

Listing 2: Create a file and output

Filo I/O - Input (Reading lots of data)

- So now we can imagine that if we read in a lot of information (e.g. a university database of students), we can do so more efficiently.
- We would simply store the student information in a file, and then read it line by line.

Memory

More on Memory

- As we learn about data structures like the array, we need to learn a little more about computer memory.
- What does it look like, and how exactly is the information stored.
- (To the chalkboard!)

Arrays are statically allocated

- This means that we decide how much space we need to store information when we compile our program.
- Often because this happens at compile-time, our compiler can give us some helpful hints and warnings.
- If we want to resize our array (make it bigger or smaller), we can use the vector type, which we will learn about next class.

Multi-dimensional Arrays

Power of Arrays

Arrays are a powerful abstraction that allows us to store information in contiguous pieces.

Nested For-loops

This sample prints out a simple grid

```
1 #include <iostream>
2
3 int main(){
4     // Use nested for-loops to print out a grid
5     for(int i =0; i < 4; ++i){
6         for(int j =0; j < 4; ++j){
7             std::cout << "(" << i << "," << j << ") ";
8         }
9         std::cout << "\n";
10    }
11
12    return 0;
13 }
```

Listing 3: Print out a grid

Multi-dimensional array

This sample prints out a simple grid

```
1 #include <iostream>
2
3 int main(){
4     // Notice the second dimension.
5     // This gives me 4 rows with 4 columns
6     int picture[4][4];
7
8     int counter = 0;
9     for(int i =0; i < 4; ++i){
10        for(int j =0; j < 4; ++j){
11            picture[i][j] = counter;
12            counter++;
13        }
14    }
15
16    for(int i =0; i < 4; ++i){
17        for(int j =0; j < 4; ++j){
18            std::cout << picture[i][j] << " ";
19        }
20        std::cout << "\n"; // newline after we iterate through each row
21    }
22
23    return 0;
24 }
```

Listing 4: Print out a grid

In-Class Activity

`http:
//www.mshah.io/comp/11/activities/activity6/activity6.pdf`

Activity Discussion

Review of what we learned

- (At least) Two students
- Tell me each 1 thing you learned or found interesting in lecture.

5-10 minute break

To the lab!

Lab: <http://www.mshah.io/comp/11/labs/lab5/lab5.pdf>

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¹You should have gotten an e-mail and hopefully setup an account at <https://www.eecs.tufts.edu/~accounts> prior to today. If not—no worries, we'll take care of it during lab!