Review Sheet 1a

CS 70: Data Structures and Program Development

Tuesday, January 21, 2020

Today's Goals:

- Welcome and Introductions
- Pair Programming
- Memory Model
- Compiling
- Get started on HW

Class Resources

www.cs.hmc.edu/cs70

Pair Programming

1. Students A and B are paired. They try to compile their code, and get the error `text  corroborate.cpp:213:1: error: C++ requires a type specifier for all declarations` Seeing no obvious problems at line 213, column 1 of corroborate.cpp, the students enter `text  "C++ requires a type specifier for all declarations"` (the generic part of the error message) into Google. The first hit leads them to a Stack Overflow post explaining how someone else encountered and fixed that error. A and B realize their code has the same problem; they fix it, and the error disappears.
2. Students A and B are paired. They get out two laptops, sit next to each other, and double their coding speed by editing two different files at the same time.
3. A CS 70 homework assignment asks for an implementation of Red-Black Trees. This data structure seemed to make sense in class, but afterwards Student A realizes that some parts still aren't clear. Before starting the homework, A browses the web and reads some other high-level explanations of Red-Black Trees, being careful not to look at detailed implementation discussions or source code.
4. Students A and B are paired, and want to add a new character to the end of a string. They realize they need to learn more about the `string` class in C++, so they try the following web search: `string class c++ standard library`
5. Students A and B are paired. A chats with their classmate C about the homework, and together A and C come up with some good strategies for designing a solution, strategies which A remembers and mentions later on when A and B are doing their pair programming.
6. Students A and B are paired. Because they work on different campuses, they work on separate computers in their own dorm rooms using "screen sharing" and on-line chat to discuss and edit the same file at the same time.
7. Students A and B are paired. Before they get very far, B falls ill. Several days later, just before the assignment is due, the professors are asked for an extension (because B was too sick all week to work).
8. Students A and B are paired. They have a bug in their code they just can't figure out. In a public post on Piazza, they paste the lines of C++ code that they think are responsible and ask for help.
9. Students A and B are paired. They have a bug in their code they just can't figure out. They make sure the latest version of their code is pushed to Github (so that the instructors can see it) and then ask for help on Piazza, explaining exactly what they did, what unexpected behavior they got, and what debugging they've already tried.
10. Students A and B are paired. Their Binary Search function goes into an infinite loop on some inputs. They can trace through the code and see exactly where and why it loops; they just aren't sure how to fix the algorithm (without breaking other cases). After some discussion that doesn't go anywhere, they decide to take a break and come back the next day with rested minds and fresh eyes.

Memory Model

How does a program run?

What do you remember about HMMM?

Compiling

Source Code

`fourtwo.cpp`:

```
int main() {
  int x = 30;
  int y = 12;
  int z = x + y;
}
```

Assembly Code

`fourtwo.s`:

```
(...14 Lines Omitted for Space...)
    movl    $30, -4(%rbp)
    movl    $12, -8(%rbp)
    movl    -4(%rbp), %ecx
    addl    -8(%rbp), %ecx
    movl    %ecx, -12(%rbp)
    popq    %rbp
    retq
(...8 Lines Omitted for Space)
```

Object Code

`fourtwo.o`:

```
^?ELF^B^A^A^@^@^@^@^@^@^@^@^@^A^@>^@^A^@^@^@^@^@^@^@
^@^@^@^@^@^@^@^@^@^@^@\230^A^@^@^@^@^@^@^@^@^@@^@^@^
```

```
@^@^@@^@^H^@^A^@UH\211å1ÀÇEü^^^@^@^@ÇEø^L^@^@^@\213Mü^
CMø\211Mô]Ã^@clang version 6.0.0-1ubuntu2 (tags/RELEAS
E_600/final)^@^@^@T^@^@^@^@^@^@^@AzR^@^Ax^P^A^[L^G^H
\220^A^@^@^\^@^@^@^\^@^@^@^@^@^@^@^_^@^@^@^@A^N^P\206^BC
```

(line breaks added and more content omitted for space. . .)

Executable

`fourtwo`:

```
^?^B^A^A^@^@^@^@^@^@^@^@^@^B^@>^@^A^@^@^@\260^C@^@^@^@^@
^@@^@^@^@^@^@^@^@\220\260^X^@^@^@^@^@^@^@^@^@^@@^@8^@
^@@^@^Z^@^Y^@^F^@^@^@^D^@^@^@@^@^@^@^@^@^@@^@@^@^@^@^@
^@@^@@^@^@^@^@^@\370^A^@^@^@^@^@^@\370^A^@^@^@^@^@^@^H^@
^@^@^@^@^@^@^C^@^@^@^D^@^@^@8^B^@^@^@^@^@8^B@^@^@^@^@^
@8^B@^@^@^@^@^@^\^@^@^@^@^@^@^@^\^@^@^@^@^@^@^@^A^@^@^@^@
```

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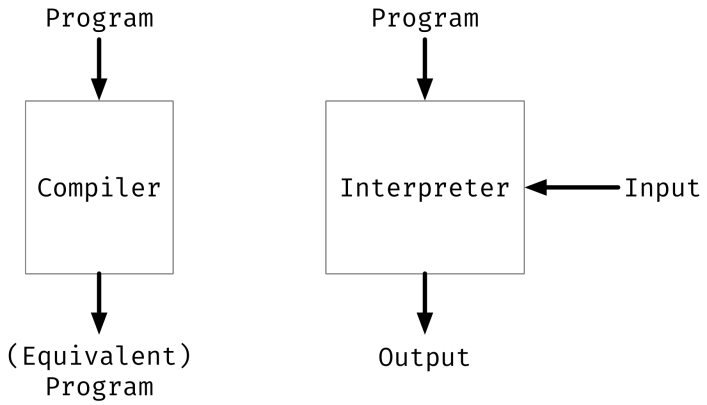
Compiling vs Interpreting

What is the difference between a *compiler* and an *interpreter*? How are they similar?



Compiler or Interpreter?

1. An *Assembler* for HMMM.
2. The "Run" button in Eclipse (when you have a Java program loaded).
3. The CPU in a laptop computer.

Running start

- Looking for partner? Post on Piazza or pair up in Lab on Friday.
- Homework 00: availabile now, due Friday – getting started with CS70 tools.
- Homework 01: available Thursday, due next Wednesday – getting started with C++.