CS-2303 System Programming Concepts WPI, A-term 2017  
Professor Mike Ciaraldi Quiz #5 (20 points)  
Quiz date: Thursday, September 28, 2017 ANSWER KEY

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| --- | --- | --- |
| Question | Possible | Points |
| 1 | 5 |  |
| 2 | 5 |  |
| 3 | 5 |  |
| 4 | 5 |  |
| Maximum | 20 |  |

NAME:

WPI E-mail ID:

READ THESE INSTRUCTIONS BEFORE STARTING THE QUIZ.

This is an closed-book quiz, open-notes quiz. You can consult any of the class handouts, and anything you wrote yourself. You cannot consult tests from previous versions of the course. You are not allowed to use any electronic or communications device during the quiz, without special permission.

This quiz is worth 20 points.

Answer questions in the spaces provided on the quiz itself. Take the number of points assigned to each question and the amount of space provided for your answer as a measure of the length and difficulty of the expected solution.

Be sure to answer the question which is actually being asked, in a way which demonstrates that you understand the meaning of the question and the answer. For example:

* If the question asks you to say what happens and why, you have to tell both to get full credit.
* If the question asks you to explain something in general and to give an example, you have to do both to get full credit.
* If the question asks how many bytes, answer with the number of bytes, not the number of bits, kilometers, or Volts.

*Remember, the graders know the answers to these questions. What you write has to show that* ***you*** *understand the question and its answer.*

A *program fragment* is a section of code which is part of a complete program. You can make any reasonable assumptions about the rest of the program.

All questions apply to C unless otherwise indicated.

This quiz will end at 8:20 pm. *It is* STRONGLY *suggested that you read the entire quiz before attempting to answer any questions. Also, re-read all the parts of any one question before you start answering it, so you put your answers in the right place.*

1. **Visibility [**5 points total]

Suppose you have two classes A and B, defined like this:

**class A {**

**public:**

**int c;**

**protected:**

**int d;**

**private:**

**int e;**

**}**

**class B: public A { // B is a subclass of A**

**protected:**

**int f;**

**private:**

**ing g;**

**}**

* 1. Can objects of class B access field c in objects of class A? Why or why not? (Note: “Because that is the way C++ works” is not a sufficient answer. You must cite the rule which applies.) [1 point]

*Answer:: Yes, because public fields can be accessed from any class*.

* 1. Can objects of class B access field d in objects of class A? Why or why not? [1 point]

*Answer: Yes, because protected fields can be accessed from subclasses (and from the class itself, but that it not important for this answer.)*

* 1. Can objects of class B access field e in objects of class A? Why or why not? [1 point]

*Answer: No, because private fields can only be accessed from objects of the same class in which they are defined.*

* 1. Can objects of class A access field f in objects of class B? Why or why not? [2 points]

*Answer: No, because protected fields can only be accessed from objects of the same class in which they are defined, and its subclasses, not the other way around.*

1. **Overloading** [5 points total]
   1. In programming languages, what does *overloading of a symbol* mean in general? [3 points]

*Answer: Overloading of a symbol means that the same symbol has more than one meaning.*

* 1. The ‘.’ (period or dot) is an example of a symbol which is overloaded in C++. Explain why this specific symbol is considered overloaded, and how the compiler knows how to process it. [2 points]

*Answer: The dot can either be the decimal point in a number, or can indicate that you want to access a field inside a struct, or a field or method in an object. The compiler can tell which one you meant by using context. That is, if the dot is next to digits, it must be the decimal point; if it is next to the names of variables, fields, or methods, it must mean that you want to access something inside.*

1. **C++ Object Instantiation** [5 points]
   1. Why must your code never use malloc() to instantiate an object? [1 point]

*Answer: That would not invoke the constructor, so the object might not get properly initialized.*

* 1. Why do you not need to call malloc() inside the constructor you write, to allocate space for the object?

*Answer: The system does this for you, before running the code you wrote in the constructor.*

* 1. Why must your code never use free() to de-allocate an object? [1 point]

*Answer: That would not invoke the destructor (if it exists), so the object might not get properly cleaned up.*

* 1. Suppose you have C++ code like the following, which declares a local variable: At what pointin timedoes the constructor for the object in x get invoked (i.e. called)? At what point in time does the destructor get invoked? Note: Your answer needs to be more specific than “When the object gets instantiated / deleted”) [2 points]

**int foo(void) {**

**C x; // C is a class previously defined**

**…**

**}**

*Answer: When the function foo() is invoked, the object in variable x gets automatically instantiated (because it is a local variable), which invokes the constructor. When function foo() exits, the object in x gets automatically deleted, which invokes the destructor.*

1. **Interface vs. Implementation** [5 points]

In C++, we typically say that the interface of a function is declared in a .h file, and the implementation is defined in a .cpp file.

* 1. What do we mean by the interface in this case, and why is it appropriate that it be in a header file? [3 points]

*Answer: The interface just means how the function interacts with the rest of the program, specifically what its signature (calling sequence) is. When some other function wants to call this function, this information is all the compiler needs to know to generate code for calling the function, Since it is in a header file, you can just #include that header file so the compiler will see it.*

* 1. Suppose you have written a library of classes and/or functions. What do you do if you want other people to be able to write programs which use your library, but you don’t want them to be able to see the source code of your implementation? In other words, what do you have to give them? [2 points]

*Answer: Just give them the compiled .o files they can link their programs with, plus the .h files they can #include. Note: To get full credit you had to mention both kinds of files.*