Name: ______________________________

CSSE 220—Object-Oriented Software Development

Exam 2, January 30, 2014

This exam consists of two parts. Part 1 is to be solved on these pages. There is an additional blank page at the end of Part 1 if you need more room. Part 2 is to be solved using your computer. You will need network access to download template code and upload your solution for part 2. Please disable IM, email, and other such communication programs before beginning the exam.

Resources for Part 1: You may use a single sheet of $8\frac{1}{2} \times 11$ inch paper with notes on both sides.

Resources for Part 2: Open book, notes, and computer. Limited network access. You may use the network only to access your own files, the course Moodle site and web pages, Piazza (though don't post/respond to questions), the textbook's site, Oracle's Java website, and Logan Library's Safari Tech Books Online. Any communication with anyone other than the instructor or a TA during the exam may result in a failing grade for the course.

Parts 1 and 2 are included in this document. You should read over all of the questions before beginning work, but...

You must turn in part 1 before accessing the resources for part 2.

Problem	**Poss. Pts.**	**Earned**
1	6	______
2	12	______
3	12	______
4	4	______
5	7	______
6	17	______
7	12	______
Paper Part Subtotal	**70**	______
C1. Counter	15	______
C2. Recursion problems	15	______
Computer Part Subtotal	**30**	______
Total	100	______

Part 1—Paper Part

1. (6 points)

Explain (briefly, in a sentence or two at most) what it means if an object oriented system has high coupling. Is it a good or bad thing?

Explain (briefly, in a sentence or two at most) what it means if an object has high cohesion. Is it a good or bad thing?

2. (12 points) This problem is a design exercise. First read the problem description below, then answer the questions.

Design a program to track details of a soccer league. The league has players, organized onto teams, that play each other in a series of matches. Each player registers certain days they can't play, then the program creates a schedule of matches that works for all the players.

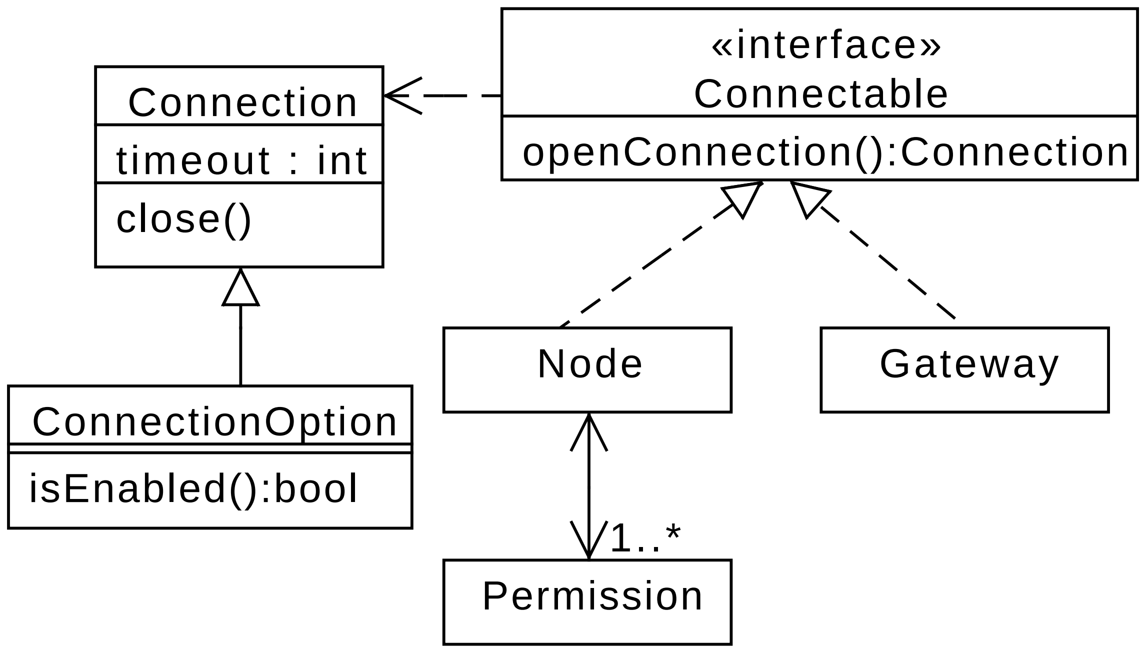
a. List at least **three** *candidate classes* that you might use in implementing a solution to the problem:

b. Pick one of your candidate classes, **circle it above** and briefly describe three responsibilities that it might have:

   -
   -
   -

c. Still considering your chosen class from part b, with what other classes might it need to collaborate?

3. (12 points) Use this UML class diagram to answer the subsequent questions.



a. Circle true or false for each of the following statements.

T F ConnectionOption inherits the field timeout from Connection

T F ConnectionOption contains a field of type Connection

T F Connection inherits the method isEnabled from ConnectionOption

T F ConnectionOption inherits the method close from Connection

b. Because of 1..* on the line between Node and Permission, if you looked at the code you would most expect to see (circle your answer):

(a) Permission objects have an ArrayList of Nodes

(b) Node objects have an ArrayList of Permissions

(c) Node objects have a single field of permission type

(d) Node objects may inherit from Permission

(e) None of the above statements can be true, given this diagram

d. Given the diagram and your knowledge of objects, which of these classes must have the method openConnection()?

4. (4 points) Consider this code. Note that the Data class has a field size.

```
class SpecialData extends Data {
    public void setSize(int newSize) {
        this.size = newSize;
    }
}
```

Under what circumstances would this code compile?

a. This code will never compile

b. This code would always compile

c. This code would compile if the field size is declared private

d. This code would compile if the field size is declared protected

5. (7 points) Imagine you came across this code in a functioning program:

```
//Adapter is an interface
Adapter reader = new BookReader();
reader.process(otherObject);
```

Which of the following statements are true, given that the above code compiles.

T F BookReader might be an abstract class

T F BookReader might be an Interface

T F The method process must be listed in the Adapter interface

T F If you had a function that took a Adapter as a parameter, you could pass a BookReader object and the code would compile

T F If you had a function that took a BookReader as a parameter, you could pass a Adapter object and the code would compile

T F The first place to look for the code that runs when process is called on the second line is in BookReader.java

T F BookReader (or one of its superclasses) must implement the Adapter interface

6. Consider the following related declarations:

```
class A {
    public void talk() {
        System.out.print("A");
    }
    public void talk2() {
        System.out.print("A2");
    }
}

class B extends A {
    public void talk() {
        System.out.print("B");
    }
    public void say() {
        System.out.print("B2");
    }
}
```

```
class C {
    private A myVar;
    public C() {
        myVar = new A();
    }
    public void cough() {
        System.out.print("C");
    }
}
```

a. (4 points) Draw a UML diagram to represent the given interface and classes (include all methods):

b. Continuing the same problem, suppose we declare and initialize these variables:

```
A a1 = new A();
A a2 = new B();
B b1 = new B();
C c1 = new C();
```

(13 points) For each line of code below, **circle** what would be output. If a line would work correctly but not output anything, select nothing. If a line would give an error, then circle the type of error. Consider each line separately. That is, if a line would give an error, then assume that line doesn't affect any others.

Code	Output Choices (circle one in each line)							
b1.talk();	A	B	C	A2	B2	*nothing*	*runtime error*	*compile error*
a2.talk();	A	B	C	A2	B2	*nothing*	*runtime error*	*compile error*
a2.talk2();	A	B	C	A2	B2	*nothing*	*runtime error*	*compile error*
b1.talk2();	A	B	C	A2	B2	*nothing*	*runtime error*	*compile error*
C c2 = b1;	A	B	C	A2	B2	*nothing*	*runtime error*	*compile error*
a1.say();	A	B	C	A2	B2	*nothing*	*runtime error*	*compile error*
a2.say();	A	B	C	A2	B2	*nothing*	*runtime error*	*compile error*
((B) a1).say();	A	B	C	A2	B2	*nothing*	*runtime error*	*compile error*
((B) a2).say();	A	B	C	A2	B2	*nothing*	*runtime error*	*compile error*
c1.cough();	A	B	C	A2	B2	*nothing*	*runtime error*	*compile error*
b1.cough();	A	B	C	A2	B2	*nothing*	*runtime error*	*compile error*
A a3 = b1;	A	B	C	A2	B2	*nothing*	*runtime error*	*compile error*
B b2 = a2;	A	B	C	A2	B2	*nothing*	*runtime error*	*compile error*

7. (12 points) For this problem use the frame technique we practiced in the course and the class declaration at left. Trace the execution of the call trans("ABCCDA") in main() and answer the question at the bottom of the page. A frame template is provided for your reference.

```
 1  public class Exam2Fun {
 2      public static String trans(String in) {
 3          if(in.length() <= 1) return in;
 4                  int end = in.length()-1;
 5          String chopEnds = in.substring(1,end);
 6          char s = in.charAt(0);
 7          String result = trans(chopEnds);
 8          if(s == in.charAt(end)) {
 9              return s + result + s;
10          } else {
11              return result;
12          }
13      }
14  }
```

```
public static void main(String[] args) {
    Exam2Fun obj = new Exam2Fun();
    System.out.println(obj.trans("ABCCDA"));
}
```

methodName, line number	**scope box**
parameters and local variables	

For the code above, *what would the final output be*? ____________________________

Use this page for additional workspace if you need it.

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Part 2—Computer Part

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before accessing the resources for part 2.

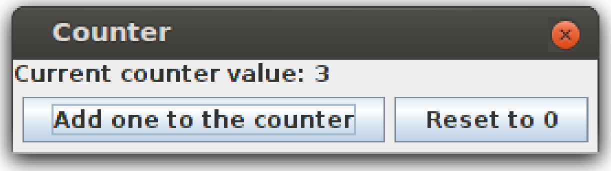
Instructions. You must actually get these problems working on your computer. Almost all of the credit for this problem will be for code that actually works. There are several different small methods to write, so you can get a lot of partial credit by getting some of them to work. If you get every part working, comments are not required. If you do not get a method to work, comments may help me to understand enough so I can give you (a small amount of) partial credit.

After you have handed in part 1, **begin part 2 by checking out the project named *Exam2–201410* from your course SVN repository**. (Ask for help immediately if you are unable to do this.)

When you have finished the problems, and more frequently if you wish, you should **submit your code by committing it to your SVN repository**. We will check commit logs, so you must be careful not to commit anything after the end of the exam. For grading, we will ensure that the included JUnit tests have not been changed.

Problem Descriptions

C1. (15 points) For this problem, I want you to make a simple Java counter.



Pressing the left button increases the counter by one; pressing the right button resets the counter to zero. A starting point for your code is in Counter.java. You can feel free to add additional classes as you need.

8 points of your grade depends on your ability to get the buttons displaying in the right configuration. 7 points is for the counter to add and reset correctly.

C2. (15 points) The class RecursionProblems contains 3 recursion problems (test cases are also included). These problems must be solved with recursion - a working solution with loops is only worth 1/5 of the credit.