Name ___________________________________________ Login name ________________________

• Turn off your cell phone to avoid losing a letter grade when it rings.

• Use the amount of space provided to gauge how much you should write. Brevity is the soul of points. Points are not related to wit.

• Legibility counts, so be neat. If your writing is smaller than the typeface of this exam, I may deduct points.

• Points may be deducted for irrelevant, meaningless, or contradictory statements (and of course, just plain false statements). Draw a face to represent how you feel about eating arugula.

• Please be sure to answer the question I asked!

• Do not complicate an example. Do not make up features of an example unless directed to do so.

• I am here to answer questions. Read the instructions at least twice before asking me about a problem, but do not hesitate to ask - the worst that can happen is I say I cannot answer.
Short Answer

1. (6 pts) As discussed in class, what are the two main reasons to draw UML Use Case diagrams?

2. (4 pts) An application has thousands of instances of a class, and almost all of them are identical. Which design pattern discussed in class might make the code more efficient?

3. (4 pts) The principle of modularity suggests that programs should be in convenient pieces for easy re-use, debugging, and maintenance. Which design pattern discussed in class suggests a way to decompose some applications?

4. (6 pts) A typical implementation of the ____________ pattern in Java would use a ____________ constructor and a ____________ method.

5. (6 pts) Xenon writes a simple Boat class that should be ordered based on a single String data attribute, **name**. Should Xenon implement Comparable or Comparator? Explain very briefly.

6. (4 pts) As discussed in class, what is the principal aspect (or dimension) of a program that is represented in a Sequence Diagram that is not represented in the other two?

Do not write answers below this line.
7. (6 pts) As discussed in class, what is possible using the first definition that is not possible with the second definition?

    void someMethod(Collection c){...}

    versus

    void someMethod(ArrayList a){...}

8. (6 pts) Drawing with software makes it easy to make updates to drawings. As discussed in class, why should storyboards not be drawn with software and displayed on a computer screen?

9. (12 pts) The following code works correctly. What improvement(s) could you make to the main() if you know that the classes are designed by a programmer who understands polymorphism? Your answers should be Java code, and arrows to show where it goes or what it replaces.

    public static void main(String[] args){
        Animal a = null;
        switch (1 + (int)(Math.floor(Math.random() * 3))){
            case 1: a = new Cow(); break;
            case 2: a = new Dog(); break;
            case 3: a = new Fish(); break;
        }
        if (a instanceof Dog)
            System.out.println( ((Dog)a).getNoise() );
        else if (a instanceof Cow)
            System.out.println( ((Cow)a).getNoise() );
        else if (a instanceof Fish)
            System.out.println( ((Fish)a).getNoise() );
        return;
    }
10. (12 pts) To move, canoes and kayaks are paddled, while dories are rowed. However, all three move in the water.

Represent the preceding two sentences in a UML-style class hierarchy that has five or six nodes. Be sure to denote whether a node is a class, abstract class, or interface. Be sure to show locations of the method declarations and definitions that are required by the first two sentences.

```java
import java.util.*;

public class C {
    public static void main(String[] args) {
        Set<String> s = new HashSet<String>();
        for (String a : args)
            if (!s.add(a))
                System.out.println("here: " + a);
        System.out.println(s.size() + " there: " + s);
    }
}
```

Read the above code and think about input that will demonstrate what it can do.

11. (5 pts) Show how to run this program in the shell or command line with that input:

12. (5 pts): Explain how the output would be different from the input:

Do not write answers below this line.
public class Duple implements Iterable{

    static Integer[] data = {1,7};

    public Iterator iterator(){
        ____________________________
    }

    private class MyIter implements Iterator{
        private int curr;
        MyIter(){curr = 0;}

        public boolean _____________________{return true;}

        public Object _______________{
            Object o = data[curr];
            curr = (curr + 1) % data.length;
            return o;
        }

        public void ____________________ {
            throw new RuntimeException("don’t do this");
        }
    } //end MyIter

    public static void main(String[] args) {
        //Declare a new Duple and its iterator.

        ________________________________
        ________________________________

        //Use the iterator to print the first twenty numbers of the
        //sequence. You may not need every line.

        ________________________________
        ________________________________
        ________________________________
        ________________________________
        ________________________________
        
    }
}