[**You may use a single side of an** 8.5×11 **in sheet of paper for reference.**] Show all of your work clearly in the space provided. Be sure to **read each problem carefully**. Note that the exam is double sided. Look over the entire exam before starting. Be sure to pace yourself.

1. (15 points) Indicate which line in the code below the following concept is represented. If the concept is not represented in the code, place an **X** in the blank instead of a line number.

____ Constructor

____ Array

____ Instance variable

____ Class method

____ Class constant

____ Javadoc comment

____ Helper method

____ UML

____ Visibility modifier

____ Local variable

____ Mutator

____ Accessor

____ Pre-increment

____ Post-increment

____ Object

```
1  public class ExamII {
     public static void main(String[] args) {
3      Student ed = new Student("Ed");
       System.out.println("Hi there " + ed.getname());
5    }
   }
7
   // Class that represents a student
9  public class Student {
     private String name;
11   private final int id;
     private static int numStudents = 0;
13
     public Student(String name) {
15     this.name = name;
       id = ++numStudents;
17   }

19   public String getName() {
       return name;
21   }

23   public void setName(String name) {
       this.name = name;
25   }
   }
```

2. (10 points) Draw the UML class diagram for the Student class above.

3. (5 points) Describe the role of the keyword `this`.

4. (5 points) What is meant by information hiding?

5. (5 points) Describe one refactoring technique in IntelliJ.

6. (15 points) Implement a method, sum() that accepts an array of `double`s and returns the sum of all the values in the array.

7. (15 points) Implement a method, hasDuplicates(), that accepts an array list of integers and returns true if and only if the list contains an integer value at least twice.

8. (30 points) Implement the Timer class used in the following program so that it produces the output shown below. You should include everything in the Timer.java except for import statements and comments.

```
public static void main(String[] args) {
  Timer[] timers = new Timer[4];
  timers[0] = new Timer();
  System.out.println("Timer 1: " timers[0].display());
  timers[1] = new Timer(15);
  System.out.println("Timer 2: " timers[1].getMinutes() + " minutes");
  timers[2] = timers[0].plus(timers[1]);
  timers[3] = timers[1];
  System.out.println("Timer 3: " timers[2].display());
  timers[0].clear();
  timers[1].addMinutes(1);
  timers[2].addSeconds(25);
  System.out.println("Timer 1: " timers[0].display());
  System.out.println("Timer 2: " timers[1].display());
  System.out.println("Timer 3: " timers[2].display());
  System.out.println("Timer 4: " timers[3].display());
}
```

```
Timer 1: 60 seconds
Timer 2: 0.25 minutes
Timer 3: 75 seconds
Timer 1: 0 seconds
Timer 2: 75 seconds
Timer 3: 100 seconds
Timer 4: 75 seconds
```

8. continued...