Question 1: __________ (15)
Question 2: __________ (25)
Question 3: __________ (20)
Question 4: __________ (20)
Question 5: __________ (20)
TOTAL: __________ (100%) * 2 = __________ Points
Refer to the attached handout for problems 1 and 2.

1. (15 points)
   A city classifies its museums and restaurants as types of attractions that might be of interest to out-of-town visitors. All attractions have an address. Museums also have a name (like "Worcester Art Museum") and an entrance fee. Restaurants have the type of food they serve (such as "Italian", "vegetarian", etc.) and whether or not they provide a children’s menu.

   Attractions are required (by an interface) to provide a method that returns true if the attraction is family-friendly (i.e. a good place to take the kids).

   (a) Describe one place in the given code where overriding occurs.

   (b) Describe one place in the given code where overloading occurs.

   (c) Describe one place in the given code where inheritance occurs.
2. (25 points) Here is a main method that uses the class definitions on the attached handout. For each of the starred (***) statements below, write OK if the statement will compile with no errors, or write ERROR if the statement will generate a compilation error. If you write ERROR, give a one-sentence explanation of the cause of the error.

```java
public class AttractionDemo {

    public static void main(String[] args) {

        Family mcdonalds = new Restaurant("Park Ave", "hamburgers", true);
        // ** OK or ERROR? write your answer here

        Museum m = new Museum("Salisbury St", "WAM", 10);
        if (m.isFamilyFriendly()){
            System.out.println("bring the kids");
        }
        // ** OK or ERROR? write your answer here

        Restaurant sahara = new Restaurant("Highland St", "Middle Eastern");
        // ** OK or ERROR? write your answer here

        Attraction attr = new Attraction("100 Institute Road");
        // ** OK or ERROR? write your answer here

        Attraction ecotarium = new Museum("Airport Dr", "Ecotarium", 12);
        // ** OK or ERROR? write your answer here

    }
}
```
3. (20 points) The following class is defined:

```java
/*
 * represents a Student and the student’s quiz grades
 */

public class Student{
    private String name;
    private ArrayList<Integer> quizGrades;

    public Student (String name){
        this.name = name;
        this.quizGrades = new ArrayList<Integer> ();
    }

    // adds a quiz grade to this student’s list of quiz grades
    public void addGrade (int grade){
        this.quizGrades.add(grade);
    }

    // returns this student’s list of quiz grades
    public ArrayList<Integer> getQuizGrades(){
        return this.quizGrades;
    }
}
```

In a main method, you want to determine how many of a student’s quiz grades are 0. You write the following code:

```java
Student s = new Student ("Hamel");
(...code that populates the student’s list of quiz grades goes here...)

ArrayList<Integer> quizzes = s.getQuizGrades();
int numberOfZeros = 0;
for (Integer i: quizzes){
    if (i == 0){
        numberOfZeros++;
    }
}
```

This code works, but it violates some of the principles of encapsulation. You decide to fix it.
(a) (12 points) What changes would you make to the Student class to improve encapsulation? If you need to add any methods or fields to the Student class, you should write the java code for those methods and fields here:

(b) (8 points) In light of the changes you made in part (a), what changes would you make to the main method?
4. (20 points) Choose the best answer for each of the following questions.

(a) What is the purpose of the throw statement?
   i. It is used to pass arguments to another method.
   ii. It is used to detect an error situation.
   iii. It is used to pass control to an error handler when an error situation is detected.
   iv. It is used to discard erroneous input.

(b) Consider the following code snippet:

   ```java
   throw new IllegalArgumentException("This operation is not allowed");
   ```

Which of the following statements about this code is correct?
   i. This code constructs an object of type `IllegalArgumentException` and throws the object.
   ii. This code throws an existing `IllegalArgumentException` object.
   iii. This code constructs an object of type `IllegalArgumentException` and reserves it for future use.
   iv. This code will not compile.

(c) Which of the following statements about handling exceptions is true?
   i. If an exception has no handler, the error will be ignored.
   ii. Statements that may cause exceptions should be placed inside a catch clause.
   iii. Statements to handle exceptions should be placed inside a try clause.
   iv. If an exception has no handler, the program will be terminated.
(d) If the current method in a program will not be able to handle an exception, what should be coded into the method?

i. the `throws` clause should list the name of the method to which the exception should be passed.

ii. The method declaration should be enclosed in a `try/catch` block.

iii. The method should include a `try/catch` block for all possible exceptions.

iv. The `throws` clause should list the names of all exceptions that the method will not handle.

(e) i. When a program throws an exception within a method that has no `try/catch` block, which of the following statements about exception handling is true?

ii. Execution will continue with the next statement in the method.

iii. The current method terminates immediately.

iv. The current method must decide whether to continue or terminate.

v. The user must decide whether to continue or terminate the program.
5. (20 points) Here is a program that creates a window with a button:

```java
package exam2B15;
import java.awt.EventQueue;
import javax.swing.JFrame;
import javax.swing.JButton;
import java.awt.event.ActionListener;
import java.awt.event.ActionEvent;
import java.awt.event.ActionEvent;

public class ExamEvents implements Runnable{
    public static int x = 0;

    public static void main(String[] args) {
        EventQueue.invokeLater(new ExamEvents());
    }

    public void run(){
        JFrame win = new JFrame();
        win.setSize(300, 200);
        win.setDefaultCloseOperation(JFrame.EXIT_ON_CLOSE);

        JButton button = new JButton("Click");
        button.addActionListener(new C());
        win.add(button);

        win.setVisible(true);
    }

    private class C implements ActionListener{
        public void actionPerformed(ActionEvent e){
            x++;
            System.out.println (x);
        }
    }
}
```

(a) (5 points) The program contains an anonymous object. Circle it.
(b) (5 points) The program contains an inner class. Why does it make sense to define C as an inner class as opposed to defining C as a separate class?

(c) (10 points) In a sentence or two, explain how the program would respond to button clicks.

(end of exam)