Your Name (printed): ____________________________
Signature for Honor Code Pledge: ____________________________

Rules

The exam is closed book, closed notes. You may not use the computer.
Write all answers on the exam sheets. If you need additional space, ask for more paper.
Be sure to put your name on any loose pages and to clearly label your answers with the question number.
It is better to give part of an answer than to leave a question blank.
1. [5 points] In the empty frame window below, sketch the result of executing the following Java program. Use the numbers along the edges of the frame as guidelines for placements of the objects. Indicate the colors of the objects.

```java
import wheels.users.*;
import java.awt.Color;

public class Exam1 extends Frame {

    private Rectangle _blueRect;
    private Ellipse _redEllipse;
    private Rectangle _greenRect;

    public Exam1() {
        _blueRect = new Rectangle(Color.BLUE);
        _blueRect.setLocation(0,0);
        _blueRect.setSize(200,100);
        _redEllipse = new Ellipse(Color.RED);
        _redEllipse.setLocation(200,0);
        _redEllipse.setSize(100,200);
        _greenRect = new Rectangle(Color.GREEN);
        _greenRect.setLocation(0,100);
        _greenRect.setSize(100,100);
    }

    public static void main(String[] args) {
        Exam1 picture = new Exam1();
    }
}
```
2. [5 points] Write the constructor that produces the output in the following frame window, assuming the rest of the Java program appears as shown below. The bounding rectangle of the conversation balloon is 50 pixels to the right of and 100 pixels below the upper left corner of the frame. The line is green and it touches the bounding rectangle of the bubble. The black square is 100 pixels long on each side, is in the default location in the frame, and is rotated by 45 degrees.

```java
import wheels.users.*;
import java.awt.Color;

public class Exam2 extends Frame {
    private ConversationBubble _bubble;
    private Rectangle _rect;
    private Line _line;

    public static void main(String[] args) {
        Exam2 picture = new Exam2();
    }
}
```
3. [5 points] Draw the UML diagram for a class that has two instance variables. You may name these anything you wish, but follow the book’s naming conventions for instance variables. One of the instance variables is a Color, the other one is an int.

The class also has a constructor with no parameters and an accessor and a mutator method for each instance variable. Each mutator method has one parameter which is the same type as that of the instance variable being modified. Name these methods “get...” for the accessors and “set...” for the mutators, e.g., “getColor” and “setColor”.

4. [5 points] True/False

(a) The Java compiler requires that all names of classes be capitalized; failure to do so will produce an error.

(b) Local variables are always declared as “private”

(c) Every program that uses the “wheels.users” package must contain an “import wheels.users.*;” command.

(d) There is no constructor in the ConversationBubble class that allows the programmer to specify the location of the conversation bubble.

(e) Two different classes may use the same instance variable names, even if both classes are used in the same application.
5. [10 points] Short answer.

(a) What does the keyword “private” mean?

(b) Suppose instance variable “_ellipse” is of class Ellipse. Inside one of your methods, you wish to determine the angle by which the ellipse has been rotated and save this angle in an integer local variable named “angle.” Write a single Java statement (or at most two) that will do this. You will need to declare the variable angle.

(c) What does “encapsulation” mean with respect to object-oriented programming?

(d) Suppose a method is defined as follows:

```java
public void SetProperty(Widget x) {
    _prop1 = x;
}
```

How should the variable “_prop1” be declared so that this method makes sense?

(e) What is a return value? Give an example of a simple method that uses it.

6. [5 points] Suppose a class has two instance variables named “_rect1” and “_rect2”, both of class Rectangle. Write the Java statements needed to set the size (i.e., the width and height) of _rect2 equal to the size of _rect1. You may declare any additional local variables that you need.
7. [5 points] Write a constructor for the following class that permits the user to create a new instance of “_ellipse” and to initialize the color and the location of the location to any specified value. An example of the constructor’s use is shown in the `main` method.

```java
import wheels.users.*;
import java.awt.Color;

public class Exam3 extends Frame {
    private Ellipse _ellipse;

    // your constructor goes here:

    public static void main(String[] args) {
        Exam3 newObject = new Exam3(Color.GREEN,100,200);
    }
}
```

8. [5 points] In words, explain what the following statements do. You may assume that all of the necessary `import` statements and variable declarations have taken place, that `_rnd` is an object of class `Random`, and that any other objects are appropriately declared and defined.

```java
...
    _rectangle.setColor(Color.BLACK);
    int x = _rnd.nextInt(1000);
    try {Thread.sleep(x);} catch(Exception e) {}
    _rectangle.setColor(Color.RED);
    ...
```

9. [5 points] Explain the different kinds of properties that an object can have (e.g., components) and illustrate each with an example.

OPTIONAL (not graded): What did you think of this test? (Feel free to comment on anything — fairness, length, coverage, difficulty, or anything else.)