CIT/CSE 230
PROGRAMMING PROJECT 4

1. Traffic Control

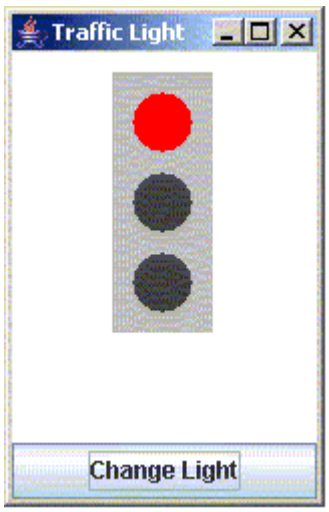
In this exercise you will develop a traffic light application. The application draws three lights *red* (top), *yellow* (middle), and *green* (bottom) that are turned on in the sequence when a change button is clicked. The application consists of three classes: *TrafficControlPanel*, *TrafficLight*, *TrafficLightPanel*. *TrafficLight* is the driver class that creates an object of *TrafficControlPanel* when the application is executed. *TrafficControlPanel* waits for an event to occur and change the state of the traffic light when an event is received. *TrafficLightPanel* draws the traffic light and changes the light when an object of *TrafficControlPanel* is created. A panel of *TrafficLightPanel* should be placed in a panel of *TrafficControlPanel*, that is, a traffic control panel is a nested panel.

1. Implement the traffic light application. In the implementation, place the traffic light in the middle and the button at the bottom of the panel (**Hint**: use BorderLayout.CENTER to add the light panel and BorderLayout.SOUTH for the button). When the application is executed, the initial state of the traffic light should be *red*. Implement the *TrafficControlPanel* class with an inner listener class named *ChangeListener* as shown in section 4.7. Complete file *TrafficLightPanel.java*. Set the color of lights to *darkgray* when they are turned off. You will need to use *if* or *switch* statements to determine the light to turn on.

2. An inner class is used to facilitate communication between two classes when they have an intimate relationship. Make the inner class (*ChangeListener*) a regular class by taking it out from *TrafficControlPanel* and observe the complication involved in making them communicate and the intimacy of the two classes.

```
//*********************************************************************
//  TrafficLightPanel.java
//*********************************************************************

import javax.swing.*;
import java.awt.*;

public class TrafficLightPanel extends JPanel
{
   private int currentState = 0;
   private final int NUM_LIGHTS = 3; // the number of lights
   private final int X = 50, Y = 10, WIDTH = 50, HEIGHT = 130; //box
   size
   private final int DIAMETER = 30; // light diameter
   private final int X_OFFSET = 10, Y_OFFSET = 10; // offsets to
   position the lights in the box
   private final int PANEL_WIDTH = 150, PANEL_HEIGHT = 230; // the size
   of a traffic control panel

   //-----------------------------------------------------------------
   //  Creates the traffic light panel
   //-----------------------------------------------------------------
   public void TrafficLightPanel()
   {
      setPreferredSize(new Dimension(PANEL_WIDTH, PANEL_HEIGHT));
   }

   public void paintComponent(Graphics page)
   {
      super.paintComponent(page);
      int lightOn = currentState % NUM_LIGHTS;
      setBackground(Color.white);
      page.setColor(Color.lightGray);
      page.fillRect(X, Y, WIDTH, HEIGHT);

      // add code to determine the light to turn on and turn on the
      light

   }

   public void change()
   {
      currentState++;
      repaint();
   }
}
```

Example screen:



Deliverables

- A printout of the complete program and the final execution in question 1.
- A printout of the ChangeListener and TrafficControlPanel classes and the final execution in question 2.

2. Counting Characters

The file *Count.java* contains the skeleton of a program to read in a string (a sentence or phrase) and count the number of blank spaces in the string. The program currently has the declarations and initializations and prints the results. All it needs is a loop to go through the string character by character and count (update the *countBlank* variable) the characters that are the blank space. Since we know how many characters there are (the *length* of the string) we use a count controlled loop—*for* loops are especially well-suited for this.

1. Add the *for* loop to the program. Inside the for loop you need to access each individual character—the *charAt* method of the String class lets you do that. NOTE: You could also directly use phrase.charAt(i) in your if (without assigning it to a variable).

2. Test your program on several phrases to make sure it is correct.

3. Now modify the program so that it will count several different characters, not just blank spaces. To keep things relatively simple we'll count the a's, e's, s's, and t's (both upper and lower case) in the string. You need to declare and initialize four additional counting variables (e.g. *countA* and so on). Your current *if* could be modified to cascade but another solution is to use a *switch* statement. Replace the current *if* with a switch that accounts for the 9 cases we want to count (upper and lower case a, e, s, t, and blank spaces). The cases will be based on the value of the *ch* variable.

4. Add statements to print out all of the counts.

5. It would be nice to have the program let the user keep entering phrases rather than having to restart it every time. To do this we need another loop surrounding the current code. That is, the current loop will be nested inside the new loop. Add an outer while loop that will continue to execute as long as the user does NOT enter the phrase *quit*. Modify the prompt to tell the user to enter a phrase or *quit* to quit. Note that all of the initializations for the counts should be inside the while loop (that is we want the counts to start over for each new phrase entered by the user). All you need to do is to add the while statement (and think about placement of your reads so the loop works correctly). Be sure to go through the program and properly indent after adding code—with nested loops the inner loop should be indented.

Deliverables

- A printout of the complete program and the final execution.

```
// ********************************************************
//   Count.java
//
//   This program reads in strings (phrases) and counts the
//   number of blank characters and certain other letters
//   in the phrase.
// ********************************************************

import java.util.Scanner;

public class Count
{
  public static void main (String[] args)
  {
      String phrase;    // a string of characters
      int countBlank;   // the number of blanks (spaces) in the phrase
      int length;       // the length of the phrase
      char ch;          // an individual character in the string

      Scanner scan = new Scanner(System.in);

      // Print a program header
      System.out.println ();
      System.out.println ("Character Counter");
      System.out.println ();

      // Read in a string and find its length
      System.out.print ("Enter a sentence or phrase: ");
      phrase = scan.nextLine();
      length = phrase.length();

      // Initialize counts
      countBlank = 0;

      // a for loop to go through the string character by character
      // and count the blank spaces

      // Print the results
      System.out.println ();
      System.out.println ("Number of blank spaces: " + countBlank);
      System.out.println ();
    }
}
```

2. Loan Calculation

Download www.secs.oakland.edu/~l2lu/230/LoanCalculation.zip and unzip it. You will find a sub-directory named Step3 which contains source codes for LoanCalculator and Loan classes that resulted from the third step during the top-down development of the application. Finish the last two steps. For each step, provide your design, source code and snapshots from test runs.

PROJECT 4 DELIVERABLES

Submit **hard and soft copies to lab assistant**.

- A cover page with the project number, due date, and the names of your Project Team Members.
- Deliverables from exercises 1--3.
- This page, with the appropriate signature and date, indicating that the project has been completely and correctly demonstrated in lab.

LABORATORY SIGNATURE

PROJECT TEAM MEMBERS:

STUDENT NAME _____

STUDENT NAME _____

STUDENT NAME _____

_____ _____

LAB INSTRUCTOR SIGNATURE **DATE**