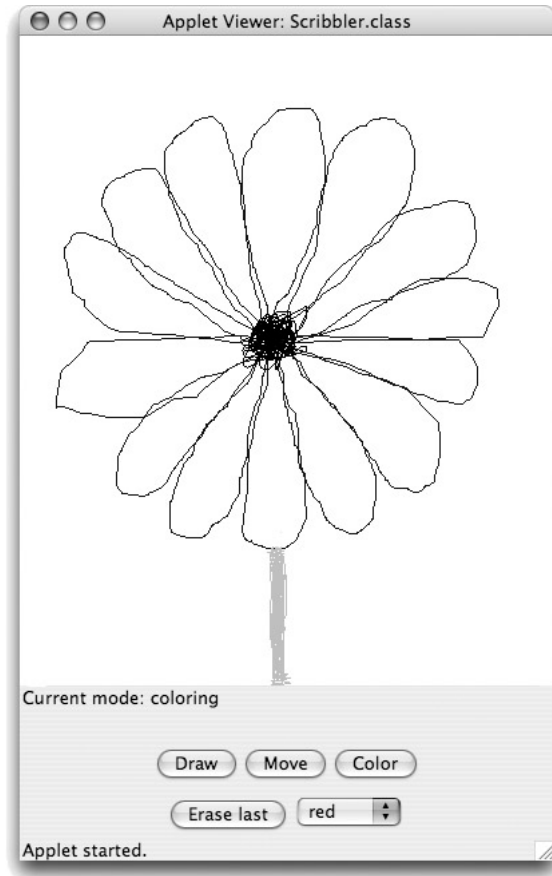


## CS 134 Programming Exercise 7: Scribbler

**Objective:** To gain more experience using recursion and recursive data structures.

This week, you will be implementing a program we call “Scribbler.” You have seen a simple version of this program in class as a demo. In lab we would like you to extend the program from class to include the ability to move or color any of the scribbles that have been drawn rather than just the last one.

With the first test program behind us, we return to the expectation that you will prepare a design for this program before you come to lab. You should come to lab with a design for steps 1 and 2 in the “How to Proceed” section.



See the online version of this handout for instructions on obtaining a copy of the starter folder. In addition, in the online version, the picture of the program window shown above is replaced by a working version of the Scribbler. You may want to visit the web page after you read the handout so that you can experiment with the program to clarify any details that are not clear to you. The Scribbler program has three modes: Draw mode, Move mode, and Color mode. The program starts in Draw mode. Draw mode, Move mode, and Color mode are selected by pressing buttons, and the color used by Color mode is selected by choosing a color from a JComboBox filled with color names. The modes behave as follows:

**Draw mode:** Drag to draw a new scribble on the canvas.

**Move mode:** Reposition a scribble by pressing the mouse on it and dragging.

**Color mode:** Click on any scribble to change its color to that selected in the color menu.

The program also has an “Erase Last” button that will erase the most recently drawn scribble. Pressing the button repeatedly will erase scribbles in the reverse order of which they were drawn.

**How to Proceed** The starter for this lab is a working Scribbler, but it has only the Draw mode and a simplified Move mode that is capable of moving only the most recently drawn scribble. You will need to add code that will manage your scribbles to allow the various modes and the “Erase last” button to work correctly.

There are a number of step-by-step approaches you could take to solve this problem, but it is important that you have a plan, and that you add functionality one step at a time. Here is one possible ordering of the tasks. We recommend that you develop and test your program incrementally – make sure you have a working implementation at each step before moving on to the next.

1. Implement a simplified Color mode. This is similar to Move mode, except that you set the color of the scribble that contains the mouse point instead of moving it. To do this, you will have to add a `setColor` method to the `ScribbleInterface` interface, and the `NonEmptyScribble` and `EmptyScribble` classes. Initially, you will only be able to set the color of the most recently drawn scribble.
2. Implement a simplified Erase mode. Here, you respond to the “Erase last” button’s `actionPerformed` event by deleting the most recently drawn scribble from the canvas. For now, you will only be able to erase the most recently drawn scribble. A second button press will do nothing.
3. Since you need to keep track of a number of scribbles, you will need to define classes representing a collection of scribbles. The interface for these classes will be called `ScribbleCollectionInterface`, and the classes implementing that interface will be named `EmptyScribbleCollection` and `NonEmptyScribbleCollection`. This interface and classes will be similar to the stacks used in Wood-Stack and ball lists in the ChainReaction.

Just as we do not know how many line segments will make up a scribble when we start to draw one, we will not know how many scribbles will be drawn and stored in a scribble collection. In your `Scribbler` class you will need a variable with type `ScribbleCollectionInterface` that will be initialized with an object created from `EmptyScribbleCollection`. You will add new scribbles to it using the constructor from `NonEmptyScribbleCollection` as they are drawn. Consider carefully what methods your scribble collection needs to support the functionality of the four modes. We have provided the skeleton of a `ScribbleCollectionInterface` interface, and `NonEmptyScribbleCollection` and `EmptyScribbleCollection` classes.

- Draw mode needs to add a new scribble to the scribble collection after the dragging is done.
- The “Erase last” button needs to remove the most recently drawn scribble from the canvas and remove it from the scribble collection. This means there is now a new “most recently drawn” scribble, and a second press would remove that one, and so on. Be careful in the case when there are no scribbles left.
- Move mode and Color mode need to determine if a mouse click takes place on *any* of the scribbles on the canvas, not just the most recently drawn. This requires that your scribble collection classes be able to search through all of the scribbles until either a scribble is located that contains the click point, or it is determined that none of the existing scribbles contain the point. Once you have determined which scribble contains the click point, you can move or color that scribble as you did in the simplified versions of these modes.

**Submitting Your Work** The lab is due at 11 PM on Wednesday for those in the Monday lab, 11 PM Thursday for those in the Tuesday lab. When your work is complete you should deposit in the appropriate dropoff folder a folder created by exporting your work from Eclipse. Make sure the folder name includes your name and the phrase “Lab 7”. Also make sure that your name is included in the comment at the top of each Java source file.

Before turning in your work, be sure to double check both its logical organization and your style of presentation. Make your code as clear as possible and include appropriate comments describing major sections of code and declarations.

| Value                                      | Feature  |
|--|--|
| <b>Design preparation (3 points total)</b> |  |
| 1.5 points                                 | Simplified color mode  |
| 1.5 points                                 | Erase mode   |
| <b>Style (5 points total)</b>              |  |
| 2 points                                   | Descriptive comments   |
| 1 point                                    | Good names   |
| 1 point                                    | Good use of constants  |
| 1 point                                    | Appropriate formatting   |
| <b>Design (6 points total)</b>             |  |
| 1 point                                    | Good use of boolean expressions, loops, conditionals                       |
| 1 point                                    | Not doing more work than necessary   |
| 2 points                                   | Appropriate methods in <code>NonEmptyScribbleCollection</code>             |
| 2 points                                   | Appropriate recursive structure in <code>NonEmptyScribbleCollection</code> |
| <b>Correctness (6 points total)</b>        |  |
| 1 point                                    | Drawing the GUI components correctly                                       |
| 1 point                                    | Switching among modes correctly  |
| 1 point                                    | Draw mode adds correctly to the scribble collection                        |
| 1 point                                    | Move mode works correctly  |
| 1 point                                    | Color mode works correctly   |
| 1 point                                    | Erase button works correctly   |

**Sketch of classes provided for this program** We are providing several classes and interfaces to help you get started. We include here printouts of the main program and the classes and interface for a single scribble. These are very similar to the Scribbler examples from lecture. Here is the code from the basic `Scribbler` class. You may need to add additional methods to it:

```
// A very simple drawing program.
public class Scribbler extends WindowController
    implements ActionListener {

    // user modes
    // using ints rather than boolean to allow for extension to
    // other modes
    private static final int DRAWING = 1;
    private static final int MOVING = 2;
    private static final int COLORING = 3;
```

```

// empty scribble as placeholder when nothing there.
private static final EmptyScribble empty = new EmptyScribble();

// the current scribble
private ScribbleInterface currentScribble;

// the collection of scribbles
private ScribbleCollectionInterface scribbles;

// stores last point for drawing or dragging
private Location lastPoint;

// whether the most recent scribble has been selected for moving
private boolean draggingScribble;

// buttons that allow user to select modes
private JButton setDraw, setMove, setErase, setColor;

// Choice JButton to select color
private JComboBox chooseColor;

// new color for scribble
private Color newColor;

// label indicating current mode
private JLabel modeLabel;

// the current mode -- drawing mode by default
private int chosenAction = DRAWING;

// create and hook up the user interface components
public void begin() {

    setDraw = new JButton("Draw");
    setMove = new JButton("Move");
    setColor = new JButton("Color");

    JPanel buttonPanel = new JPanel();
    buttonPanel.add(setDraw);
    buttonPanel.add(setMove);
    buttonPanel.add(setColor);

    chooseColor = new JComboBox();
    chooseColor.addItem("red");
    chooseColor.addItem("blue");
    chooseColor.addItem("green");
    chooseColor.addItem("yellow");

    setErase = new JButton("Erase last");
    JPanel choicePanel = new JPanel();
    choicePanel.add(setErase);

```

```

choicePanel.add(chooseColor);

JPanel controlPanel = new JPanel(new GridLayout(3,1));
modeLabel = new JLabel("Current mode: drawing");
controlPanel.add(modeLabel);
controlPanel.add(buttonPanel);
controlPanel.add(choicePanel);

getContentPane().add(controlPanel, BorderLayout.SOUTH);

// add listeners
setDraw.addActionListener(this);
setMove.addActionListener(this);
setErase.addActionListener(this);
setColor.addActionListener(this);

// make the current scribble empty
currentScribble = empty;

validate();
}

// if in drawing mode then start with empty scribble
// if in moving mode then prepare to move
public void onMousePress(Location point) {
    if (chosenAction == DRAWING) {
        // start with an empty scribble for drawing
        currentScribble = empty;

    } else if (chosenAction == MOVING) {
        // check if user clicked on current scribble
        draggingScribble = currentScribble.contains(point);
    }

    // remember point of press for drawing or moving
    lastPoint = point;
}

// if in drawing mode, add a new segment to scribble
// if in moving mode then move it
public void onMouseDrag(Location point) {
    if (chosenAction == DRAWING) {
        // add new line segment to current scribble
        Line newSegment = new Line(lastPoint, point, canvas);

        currentScribble =
            new NonEmptyScribble(newSegment, currentScribble);
    } else if (chosenAction == MOVING) {
        if (draggingScribble) { // move current scribble
            currentScribble.move(point.getX() - lastPoint.getX(),
                point.getY() - lastPoint.getY());
        }
    }
}

```

```

    }
}
// update for next move or draw
lastPoint = point;
}

public void onMouseRelease(Location point) {
    // Add code when have collection of scribbles
}

// Set mode according to JButton pressed.
public void actionPerformed(ActionEvent e) {
    if (e.getSource() == setDraw) {
        chosenAction = DRAWING;
        modeLabel.setText("Current mode: drawing");
    } else if (e.getSource() == setMove) {
        chosenAction = MOVING;
        modeLabel.setText("Current mode: moving");
    }
}
}
}

```

Here is the starting code for ScribbleInterface:

```

public interface ScribbleInterface {
    // returns whether point is contained in scribble
    public boolean contains(Location point);

    // move scribble by dx in x-direction and dy in y-direction
    public void move(double dx, double dy);
}

```

Here is the starting code for NonEmptyScribble:

```

// A class to represent a non-empty scribble

public class NonEmptyScribble implements ScribbleInterface {
    private Line first; // an edge line of the scribble
    private ScribbleInterface rest; // the rest of the scribble

    public NonEmptyScribble(Line segment, ScribbleInterface theRest) {
        first = segment;
        rest = theRest;
    }

    // returns true iff the scribble contains the point
    public boolean contains(Location point) {
        return (first.contains(point) || rest.contains(point));
    }

    // the scribble is moved xOffset in the x direction
}

```

```
    //    and yOffset in the y direction
    public void move(double xOffset, double yOffset) {
        first.move(xOffset, yOffset);
        rest.move(xOffset, yOffset);
    }
}
```

Here is the starting code for EmptyScribble:

```
/* Class representing an empty scribble */
public class EmptyScribble implements ScribbleInterface {
    public EmptyScribble() {}

    // point is never in an empty scribble!
    public boolean contains(Location point) {
        return false;
    }

    // nothing to move, so do nothing!
    public void move(double dx, double dy) {}
}
```

The start up code for the collection interface and classes is omitted here.