CS 051G Homework Laboratory #2
Dirty Laundry

Objective: To gain experience using conditionals.

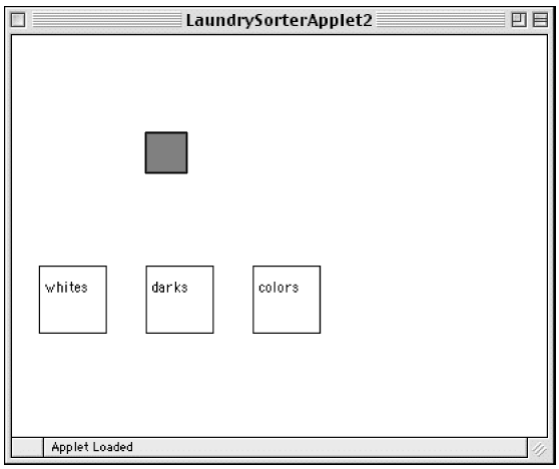
The Scenario. One thing many students have to figure out for the first time when they come to college is how to wash their clothes. Often by the time most students have figured it out, all their underwear is pink and T-shirts and other light-colored items are streaked with all sorts of interesting colors. In the hopes of helping next year's first-year students adjust more easily to college, we would like you to write a *laundry sorting simulator*.

The Approach. It is usually a good practice to develop programs incrementally. Start with a simplified version of the full problem. Plan, implement and test a program for this simplified version. Then, add more functionality until you have solved the full problem.

To encourage this approach, we have divided this lab into two parts. For the first, we will describe a laundry sorter with a very simple interface. You should plan, implement and test a program for this problem first. Then, in the second part of the assignment we will ask you to add additional functionality.

You are also encouraged to approach each of our two parts in this step-wise fashion. For example, in the first part you might begin by just writing the instructions to construct the necessary graphical objects without worrying about any of the mouse event handling. Once your program can draw the picture, you can move on to figure out how to handle events.

Part 1: The simulator should begin with three wash baskets on the screen (for our purposes they can just be rectangles or squares). One is labeled "whites", one "darks", and the last "colors". An image showing the kind of display we have in mind appears below. When the simulation begins, a color swatch will appear on the screen. The user ("laundry trainee") should then click in the corresponding basket. If the user is correct, the program should randomly select a new color for the next item and display it on the screen. For this part of the assignment you may just select among the three colors white, red, and black when creating items of clothing. If the user clicks on an incorrect basket, the original item remains in position for another try.



Design of Part 1. You will need to design an object that **inherits** graphicApplication that will display the wash baskets and the item to be sorted. Begin by laying out where all the items go on some graph paper. The picture should look more or less like the one above.

When the program begins, place all the wash baskets (with labels) on the screen. Then, add the item of clothing that is to be sorted. For simplicity you can make the first item always have color white (or you can be more ambitious and select the color randomly). The item should actually consist of two rectangles, a filled rectangle which is the appropriate color and a framed rectangle which is the same size, but lays on top of the filled rectangle to form a border (otherwise it will be awfully difficult to see a white item!)

Think Constants! When you lay out the wash baskets and item, use definitions for all the relevant values. The width and heights of wash baskets and the item to be sorted, coordinates of the upper left corner of each of these, etc., are all good candidates for constants. Examples include:

```
def basketWidth = 80
def laundryLocation = 280 @ 100
```

Using names rather than numeric values in your program will make it easier to change things around and also make your program much, much easier to read (presuming you give them good names). Of course you will also need to use definitions to provide names for key items of your program like the three laundry baskets, the filled and framed rectangles for the laundry item, etc.

Identifying the Correct Basket (*Pay attention to the following as it will make your code much, much easier!*)

Once you have done the layout and figured out how to generate new items, all you have to do is to write the code for the method onMousePress. You will need to associate some information with an instance variable that will enable onMousePress to determine which is the correct basket. A particularly clever and useful way to do this is to use an instance variable – let's call it correctBasket – that will refer to one of the laundry baskets. In particular, you will make sure it always refers to the laundry basket that is the same color as the laundry item.

Whenever you generate a new laundry item, you will associate correctBasket with the rectangle/basket in which an item of its color should be placed. That way when the user presses the mouse on a basket, onMousePress can simply check (using the contains method) to see if the rectangle currently associated with the correctBasket contains the point where the mouse was pressed. Then, onMousePress will either select a new color for the item (if the user was correct) or wait until the user presses the mouse again (if incorrect).

A Warning! One odd feature of the simple interface that may bother you a bit is a result of the fact that the program selects laundry items randomly. Because the selection is truly random it sometimes picks the same color twice in a row. When this happens and you press the mouse on the correct basket for the first item you will get the feeling that the program ignored you. Even though it has actually displayed a new item, the new item looks just like the old one, so you may think nothing changed. Don't let this trick you into thinking that your version of the program (or ours) isn't working correctly. The more advanced interface in part 2 includes counters in the display that eliminate this problem.

Generating random numbers We have provided a method named randomIntFrom()to() in the objectdraw package that helps to generate random numbers. For example, to generate a random number between 1 and 3 (inclusive), just write randomIntFrom(1)to(3). You can use a conditional statement to associate each of the numbers from 1 to 3 with a different color. For example, n is the random value, make the color of the item be white if n is 1, black if n is 2, and red if n is 3.

Design document You should bring in a design for the first part of this assignment to the lab. We have supplied an outline of the object definition, including descriptions and declarations for all of the methods you will be using in part I in LaundrySorter.grace. You should augment this with:

1. declarations and descriptive comments for definitions you will be using in part I. These should include information on their values. E.g., laundryItem will be a filled rectangle at (280,100) with width and height 80.

2. declarations and descriptive comments for instance variables you will be using in part I. (Note that for part 1 of the lab, you will only need the instance variable correctBasket and possibly another to remember the random numbers generated in choosing colors.) Indicate how these will be initialized.

3. pseudo-code (*see below*) to describe the onMousePress method in part I.

Add these declarations, comments, and pseudo-code to the supplied starter, and print it out for submission before you write any of the actual code. You will lose points if you do not complete (and submit) this design BEFORE writing the real code.

The design is an important step in the coding process! You are sketching out the code to be written before you actually write it. I promise you that thinking about the design before you start coding will make your life easier in the long run.

Along with the document above, be sure to bring a sketch showing where all of the boxes will be drawn as a consistency check for your constants. Each item in the sketch should be labeled with its dimensions and location.

Please write a description in English of what should happen in method onMousePress for Part 1 (this is what we called "pseudo-code" above). It should include sufficient detail that you can easily translate it into Grace. E.g., you might say something like "if the user presses the mouse inside the correctBasket then ...". Because onMousePress will only be called when the mouse is pressed, your description should explain what happens in response to that press.

To give you a better sense of what a design looks like, take a look at the design at the end of this assignment for the BasketBall example done in class (see the actual code in the lecture notes).

Try to convince yourself that your design is correct before you come to lab, as that will make your lab work much simpler. In particular, the trickiest part of the lab is using our hint above to make it easy to determine whether the user pressed in the correct basket, so look at this very carefully.

Writing and testing your Grace program Once you are in the lab and ready to code in Grace, copy Lab2-Laundry from the cs051G folder on your desktop to the CS51GWorkspace folder, also on your desktop. Open Firefox to www.cs.pomona.edu/~kim/minigrace and upload the file `LaundrySorter.grace` to get it showing in the edit window.

You can go ahead and click on "Build", but it will only bring up a blank window. Close it and go back to the edit window to work on your program. Be sure to write it in small pieces, and test it frequently by building it and running it. For example, you might write the code to draw the laundry

item and then make sure it shows up where you want it. Do the same with the three laundry baskets and their labels, etc.

Once you have part 1 working correctly, make sure it is commented properly. In particular, the comments inside the method body should have been replaced by actual Grace code, but the comments before the method header should remain, and you should have appropriate comments for each definition and variable declaration.

At this point, get one of your lab instructors or TAs to check it out to make sure it works properly and to give you feedback on your code. You may then proceed on to part 2. (You won't be turning in part 1, but you will use it as a starting point for part 2.)

Part 2: Once you get the basic version working, we would like you to jazz it up a bit. Here are the extensions we would like you to make:

1. Add labels (text items) at the bottom of the picture showing the number of correct and incorrect placements. This makes it clearer when the student succeeds in placing the item correctly. They should read something like "correct = nn", "incorrect = mm". The value in the first text item will be formed by using {...} to interpolate an instance variable which keeps track of the number of correct answers into the string being displayed. The other is similar.

2. For this part users should drag the items to the correct laundry basket rather than just clicking on the basket. Recall from the examples in class that you will need an instance variable to label the last mouse position before the drag so you can determine how far to drag the item. If the user presses the mouse button down outside the laundry item you should not drag the item, and it should not increase the correct or the incorrect counter.

3. Assign the item a randomly generated color by randomly choosing a color. You can do this either by using the method randomColor or randomly choose integers redNum, greenNum, and blueNum between 0 and 255 for each of the red, blue, and green components of the color. You can then create a color from those components by writing color . r(redNum)g (greenNum)b (blueNum).

   Now define criteria for determining where each color should go. A simple criterion is based on the sum of the three color components. If the sum of the component numbers is less than 230, decide it is dark, if it is greater than 600, decide it is white. Otherwise it is colored. (Remember that there are parameterless methods red, green, and blue that return the number component of each of those colors. After you get the program working you might want to experiment with other criteria.

We will let you figure out most of the details of how to add the features for the more advanced versions. One piece of advice is that for the second enhancement the code to determine whether the user got the laundry into the right basket will need to be in the onMouseRelease method, rather than the onMousePress method as it was in part 1. Instead the onMousePress will merely need to record whether or not the mouse was pressed on the laundry and to record where the mouse was pressed. The purpose of the three methods that respond to mouse events are:

- onMousePress – for when the user first clicks on the item - though remember that they might miss.
- onMouseDrag – to do the actual dragging (assuming they clicked on it originally).
- onMouseRelease – if they were dragging it, check to see if they've dropped it in the right place when the mouse is released. Update the laundry item appropriately

While we do not require you to bring a design document for this part of the program, you will find it extremely helpful to make some notes and sketch this out in advance, realizing that your work in part 1 will help you better understand how to do part 2.

Table 1: Grading Guidelines

Value	Feature
	Design (1 pt total)
1/2	Variables and definitions
1/2	Pseudo-code in onMousePress
	Style, Design, and Efficiency (10 pts total)
2 pts.	Descriptive comments
2 pts.	Good identifier names
2 pts.	Good use of definitions
2 pts.	Appropriate formatting
1 pt.	Does not generate new objects unnecessarily
	Correctness (10 pts total)
2 pts.	Generates a new color for swatch only if previous one placed correctly
2 pts.	Swatch displayed in the correct initial position; returns to original location if incorrectly sorted
2 pts.	Updates number correct and incorrect properly
2 pts.	Drags swatch properly (-1 pt if can just press to increase score instead of dragging)
2 pts.	Appropriate behavior if user does unexpected things like starting to drag outside the swatch
	Extra credit (1 pt)
1 pt.	Does not update either # correct or # incorrect if user misses all baskets

Grading Guidelines

Final remarks Be sure to do the basic version of the lab before attempting the more advanced features. Just work on adding one feature at a time, testing each thoroughly before working on the next.

Turning in your program Your program is due at 11p.m. on Monday evening. Turn in your program as you did last week. Here are the instructions again:

- First, make sure you included your name and course number in a comment at the start of the program.
- Hold the control key down while pressing on "download". Select "Save link as". Navigate to the folder called "Lab2-Laundry" in your CS51GWorkspace folder. You should now rename that folder by clicking on it and pressing return, and typing in a more descriptive name (one that identifies you and the lab you are working on, such as "Bruce-Lab2" or "Bruce-Laundry" – except replace "Bruce" by your name!). Note that dashes in names are OK, but don't include spaces or periods.

- Now open the "cs051G" folder icon on the desktop by double-clicking on it. Within the "cs051G" folder you should see a "dropbox" folder.
- Drag the folder you just created into the dropbox folder. When you do this, the computer may warn you that you will not be able to look at this folder. That is fine. Just click "OK".

If you should accidentally turn in a bad version of your program, you may drag another copy in as long as you change the name to be slightly different from the one you used before (e.g. Jane Doe - lab 2a). The new name should make it clear which is the newer version.

Good luck and have fun!

```
// Basketball program
// Drag basketball into hoop
// Author: Kim Bruce
//

dialect "objectdraw"

def Basketball: GraphicApplication = object {
    inherits graphicApplication.size(400,400)

    // Location and dimensions of hoop
    def hoopWidth = 100
    def hoopHeight = 60


    // starting position of basketball and its diameter
    def startLocn = 190 @ 300
    def ballSize = 40

    // points scored
    var score := 0

    // location mouse at most recently
    var lastMouse

    // Text showing current score
    def display = text.at(150 @ 200) with "Your score is 0" on (canvas)
    // set fontsize to 16

    // basketball hoop is framed oval at (160,50) with size (hoopWidth,hoopHeight)
    // Style: Don't need to include details of location, etc. in both comments and def
    // statement, but do include it one place or the other
    def hoop = framedOval.at(160@50)size(hoopWidth,hoopHeight)on(canvas)

    // the basketball is represented by an orange filled oval
    def ball = filledOval.at(startLocn).size(ballSize, ballSize)on(canvas)
    // make the ball orange

    // Save where mouse is depressed
    method onMousePress(point) {
        // remember where the mouse was pressed in lastMouse
    }

    // When mouse is dragged, move the ball with it
    method onMouseDrag(point) {
        // if mouse was over ball before last drag then move the
        // ball by the distance between the old and new mouse
        // positions.
        // Remember the current position in lastMouse in preparation
        // for the next drag.
    }
```

```
    // increment the score and update the text if player scores,
    // i.e., if the mouse is over the hoop when it is released
    method onMouseRelease(point) {
        // if the ball was being dragged and the hoop contains point
        // then update the score and the display showing the score.
        // Move the ball back to its starting position.
    }

    // required to pop up window and start graphics
    startGraphics
}
```