**CS 273 Laboratory 4: Selection**

This laboratory will give you experience with Java's if-statements (conditionals).

**Preliminaries**

1. Open the project and run Lab4Main. It should display a primitive-looking drawing of a robot, with a set of labeled checkboxes above the robot.
2. Open the code editor for Lab4Area. This is the only class that you will be changing. (**Do not change** the other three classes!)
3. Examine the paint method. Notice the code fragment: g.fillPolygon(body);
4. Many Polygons are pre-defined for you in Lab4BaseArea.java, which you do not need to look at. Lab4Area.java currently uses these pre-defined polygons to draw the robot:

* body
* leftEye
* rightEye
* smileMouth
* leftEar
* rightEar
* leftArm
* rightArm
* leftLeg
* rightLeg

1. There are a number of other "body parts" that are also defined for you. You should use these body parts instead of creating your own. The following is the entire list that is available:

* body - the robot's body
* arms:
  + leftArm - the robot's left arm, normal length, straight
  + rightArm - right arm, normal length, straight
  + longLeftArm - left arm, long, straight
  + shortLeftArm - left arm, very short
  + longLeftArmBentUp - left arm, long, bent up
  + leftArmBentUp - left arm, normal length, bent up
  + longLeftArmBentDown - left arm, long, bent down
  + leftArmBentDown - left arm, normal length, bent down
  + longRightArm - right arm, long, straight
  + shortRightArm - right arm, short
  + longRightArmBentUp - right arm, long, bent up
  + rightArmBentUp - right arm, normal length, bent up
  + longRightArmBentDown - right arm, long, bent down
  + rightArmBentDown - right arm, bent down
* legs
  + leftLeg - left leg, straight
  + rightLeg - right leg, straight
  + rightLegBent - right leg, bent
  + leftLegBent - left leg, bent
  + rightLegBigFeet - right leg, straight, with big feet
  + leftLegBigFeet - left leg, straight, with big feet
  + rightLegBentBigFeet - right leg, bent, with big feet
* leftLegBentBigFeet - left leg, bent with big feet
* ears
  + rightEar - right ear, normal size
  + bigRightEar - right ear, big
  + leftEar - left ear, normal size
  + bigLeftEar - left ear, big
* mouths
  + smileMouth - smiling mouth
  + frownMouth - frowning mouth
  + whistleMouth - whistling mouth
* eyes:
  + leftEye - left eye, looking straight
  + leftEyeOut - left eye, looking outward (i.e., left)
  + leftEyeIn - left eye looking inward (i.e., right)
  + rightEye - right eye, looking straight
  + rightEyeOut - right eye, looking outward (i.e., right)
  + rightEyeIn - right eye, looking inward (i.e., left)

This laboratory will entirely consist of modifying the paint method in Lab4Area so that it examines one or more checkboxes and uses that information to draw a robot that is customized according to color and body-part options. Every time a checkbox is checked or unchecked, Lab4BaseArea repaints itself by calling your paint method. Your program can therefore continually keep the display of the robot consistent with the boxes that are checked.

Aim to minimize redundant code. That is, don’t have the same statements in each of your if-else statements. If you put the same code in every if statement, it’s the same as having the code once outside all of your if statements.

You can complete the following checkpoints in any order. If you get stuck on one, move on to the next.

**Laboratory**

**Part 1: Allow the user to specify an alternate color for the robot's body.**

Modify the paint method so that if any of the following boxes are checked, the robot's body is painted the corresponding color.

* Silver Body
* Green Body
* Pink Body
* Sky Blue Body

The Lab4BaseArea class provides a method, isChecked(), that allows you to test whether a particular box is checked. For example, the following code can be used to check whether the "green body" box is checked:

if (isChecked("green body"))

{

(etc...)

}

If none of the above boxes are checked, the body color should be silver. If more than one is checked, select the one nearest to the top of the above list (e.g., silver has priority over green). **Note:** Your CS203 Graphics Handout has a list of custom colors that may prove useful.

**checkpoint 1 (20 points): Have your lab instructor or assistant verify that your robot's body changes color appropriately. Let him/her examine your code.**

**Part 2: Allow the user to customize the robot's legs.**

Modify the paint method so that if the bent legs box is checked, then the robot's legs are drawn as bent rather than straight. If big feet is checked, then the robot's feet are drawn "big" rather than normal size. If both of these boxes are checked, the robot should be drawn with big feet *and* with bent legs. The robot's legs should always be green.

**checkpoint 2 (10 points): Have your lab instructor or assistant verify that your robot's legs change appropriately. Let him/her examine your code.**

**Part 3: Allow the user to customize the robot's ears.**

Modify the paint method so that if the big ears box is checked, the robot is drawn with big ears. If either of the following is checked, give the ears the corresponding color rather than pink:

* Red Ears
* Blue Ears

If both of the above color boxes are checked, make the ears *purple*. If big ears is checked along with red, blue, or both, draw big ears with the appropriate color.

**checkpoint 3 (10 points): Have your lab instructor or assistant verify that your robot's ears change appropriately. Let him/her examine your code.**

**Part 4: Allow the user to customize the robot's mouth**

Modify the paint method so that if either of the following boxes

* Frown
* Whistle

is checked, the corresponding mouth shape is drawn instead of a smile. If neither is checked, the mouth shape should be a smile.

If both boxes are checked, use the one that was checked most recently. You can test whether the "whistle" box was checked more recently than the "frown" box using the whistleMoreRecent method, as in:

    if (whistleMoreRecent())

{

...

}

There is no frownMoreRecent method. The robot's mouth should always be red (for now). Make sure you test your code by checking and unchecking each/both boxes in every combination possible.

**checkpoint 4 (15 points): Have your lab instructor or assistant verify that your robot's mouth changes appropriately. Let him/her examine your code.**

**Part 5: Allow the user to customize the robot's eyes**

Modify the paint method so that if one of

* Look Robot’s Left
* Look Robot’s Right
* Cross-Eyed

is checked, the robot's eyes look the corresponding direction rather than straight ahead. Note, that this is the robot’s left/right not your left/right. If more than one of the above boxes is checked, then:

* if cross-eyed is checked, it takes precedence over either/both of the other two
* otherwise, if look left and look right are both checked, then they cancel each other out, and the robot looks straight ahead.

The robot's eyes should always be blue (for now).

**checkpoint 5 (15 points): Have your lab instructor or assistant verify that your robot's eyes change appropriately. Let him/her examine your code.**

**Part 6: Customize the color of the robot's mouth based on the number of boxes checked**

Use cascaded if-else statements so that the robot's mouth is colored as follows (listed in order from highest to lowest precedence):

* If the total number of boxes checked is greater than 10, the mouth color should be black.
* Otherwise, if the number of boxes checked is even, the mouth color should be white. (Note:0 is an even number.)
* Otherwise if the number of boxes checked is a prime number, the mouth color should be orange. (Note: 1 is not a prime number.)
* Otherwise, the mouth color should be red.

The totalNumChecked() method returns an int that tells you how many boxes are checked.

**checkpoint 6 (15 points): Have your lab instructor or assistant verify that your robot's mouth changes color appropriately. Let him/her examine your code.**

**Part 7: Allow the user to customize the robot's arms**

If any of the following boxes are checked, draw the robot's arms as follows:

* Short Arms - draw a short-armed robot. In this case, ignore any directives about bent arms or long arms.
* Long Arms - draw a long-armed robot. In this case, any directives about bent arms should imply *long* bent arms.
* Arms Bent Down - the robot's arms should be bent down (unless Short Arms are specified).
* Arms Bent Up - the robot's arms should be bent up (unless Short Arms are specified).

If both Long Arms and Short Arms are checked, use *short arms*. If both directions of bending are checked (and Short Arms is not checked), bend the arms down.

There are three arm lengths: long, short, and “normal”. You can have bent or straight arms of “normal” or long length. Short arms can only be straight. Make sure you test all possibilities.

**checkpoint 7 (15 points): Have your lab instructor or assistant verify that your robot's arms change appropriately.**

### EXTRA CREDIT The following checkpoints are extra credit. If you choose to work on one or more, you can complete them in any order.

**EC1: Allow eyes to be green, changing body color if conflicting**

If the Green Eyes box is checked, change the color of the eyes to green. If Green Body is also checked, make the **body** color *light green* so that the eyes can still be seen against the background of the body. This is a different green for the body than if just Green Body were checked. Thus, you should test this by clicking Green Eyes and then Green Body. Assuming that works, uncheck Green Eyes to make sure the body returns back to the "normal" green.

Also, you don't want to mess up the precedence of the body changes that you implemented earlier. So, if Green Eyes and Green Body are checked, and then Silver Body is checked, the robot should have a silver body with green eyes. If Green Eyes and Green Body are checked, and then Pink Body or Sky Blue Body is checked, the robot should still have a green body with green eyes due to the prior precedence rules.

**checkpoint EC1 (5 points): Have your lab instructor or assistant verify that your robot changes appropriately. Let him/her examine your code.**

### EC2: Allow the user to override all changes to the left side of the robot

If left normal is checked, have all body parts on the left side of the robot (arm, leg, ear, eye) be drawn according to their default appearance (including coloring). For example, the left ear would be small and pink, regardless of which other boxes might be checked. The right side should still have an appearance that is consistent with the checkboxes.

**checkpoint EC2 (5 points): Have your lab instructor or assistant verify that your robot changes appropriately.**