Widgets

- Interactable objects within a GUI:
  - Buttons
  - Check boxes
  - Radio buttons
  - Sliders

(http://compsci.ca)
Buttons

- Allow for functionality upon mouse click
- Must be aware of mouse position and button boundary
- Circles and rectangles have accessible formulae to determine boundaries
  - Circles check based on radius from center position
  - Rectangles check based on width/height distance from corner (or center) position
Buttons Example
Connecting Buttons to Events

- We can notify buttons when the mouse is pressed or released
- This in turn can update the program’s state

```java
boolean circlePressed = false;
boolean rectPressed = false;

void mousePressed() {
    if (circle.isPressed())
        circlePressed = true;
    if (rect.isPressed())
        rectPressed = true;
}
```
How Can We Reset Button Values?

```cpp
bool circlePressed = false;
bool rectPressed = false;

void mousePressed() {
    if (circle.isPressed())
        circlePressed = !circlePressed;
    if (rect.isPressed())
        rectPressed = !rectPressed;
}
```
Check Boxes

- Specialized button with an “on” and “off” state
- Boolean to track if button is checked or not
- Swapping can happen within the CheckBox class itself:

```java
isPressed(float mx, float my) {
    if (dist(mx, my, x, y) < r) {
        isChecked = !isChecked;
    }
}
```
Radio Buttons

- Specialized version of check boxes
- Only one radio button can be “on” at a given time
- When one radio button in a group is set to “on”, the others are set to “off”
  - Each radio button in group must have a reference (e.g. be aware of) the other radio buttons
- Each radio button in group must have an id
Question

- What data structures can help make a radio button aware of the other radio buttons in the group?
Scrollbars (Sliders)

- Users can select based on a range of values
- Minimum and maximum values correspond to the ends of the slider
- Thumb, or current position, controls the assigned value
- Allows for a “continuous” range of values
Seem Familiar?

- Slider’s current return value based on a linear interpolation between the end positions of the slider
  - Calculate slider button’s relative position (0 - 1)
  - Use position value to interpolate between slider values
- Works for non-linear sliders (e.g. knobs) as well with some modification…
Other GUI Libraries

- Existing libraries and frameworks simplify GUI creation process
  - Guido: framework for GUI component creation
  - controlP5: provides GUI components
  - G4P: provides GUI components and builder
- Sketches -> Import Library -> Add Library -> [name]
Hands-on: Creating Widgets

Today’s activities:

1. Extend your base button class to create check boxes
2. Extend your base button class to a group of radio buttons
3. Create either a scrollbar that updates the x or y position along an image, or create a slider that changes the background color of the sketch