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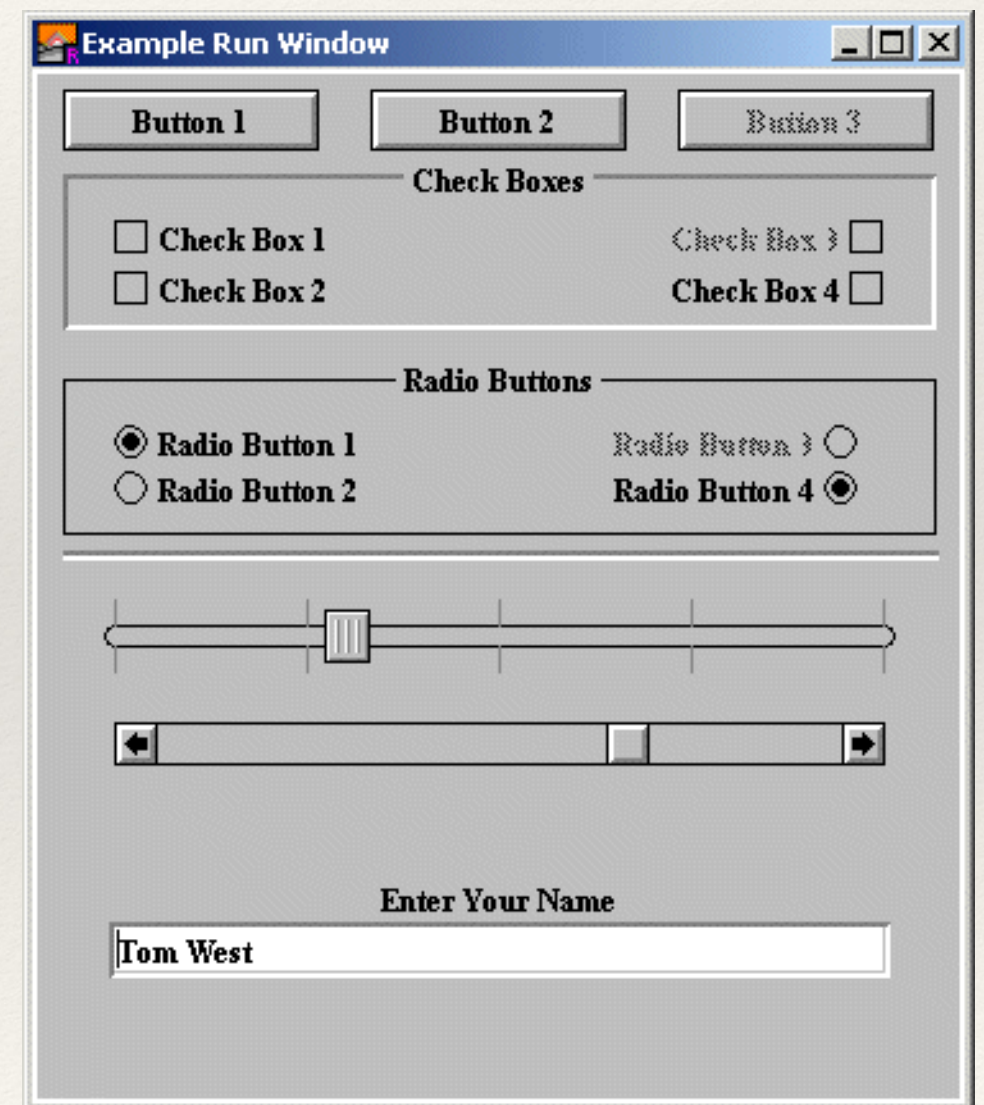
# GUI Interfaces

Elements of Graphics  
CS324e



# Widgets

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



(<http://compsci.ca>)



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# Buttons

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- ❖ 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



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# Buttons Example

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# Check Boxes

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- ❖ 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:

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



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# Radio Buttons

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- ❖ 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**



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# Question

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- ❖ What data structures can help make a radio button aware of the other radio buttons in the group?



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# Scrollbars (Sliders)

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- ❖ 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



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# Seem Familiar?

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- ❖ 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...



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# Other GUI Libraries

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- ❖ 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]



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# Hands-on: Creating Widgets

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❖ 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