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GUI Interfaces

Elements of Graphics
CS324e

Graphical User Interface

- ❖ Computer interface with a visual component
- ❖ Direct interaction with the screen rather than interactions via command line
- ❖ Designed for easier, more intuitive experience
- ❖ Based on event-driven programming

Uses

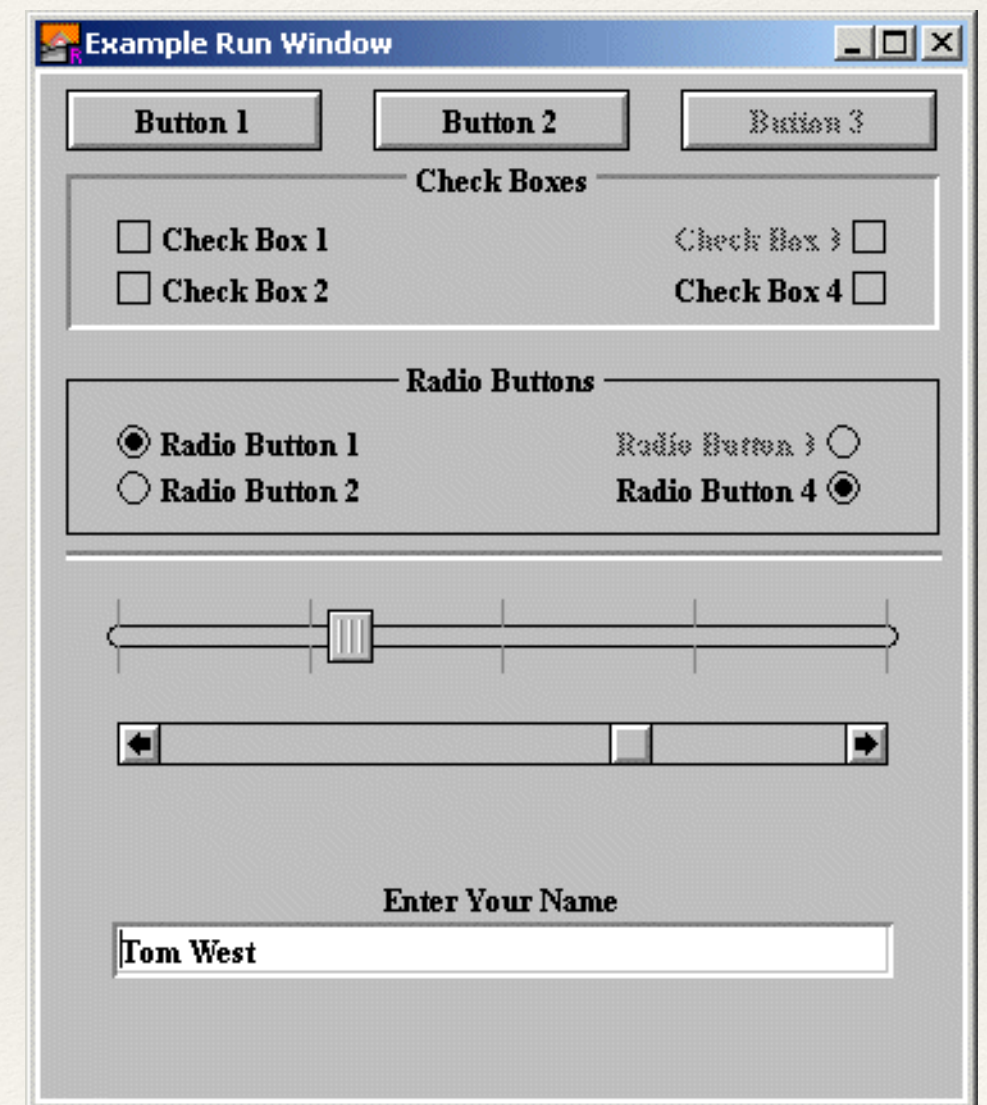
- ❖ Text editors
- ❖ Web browsers
- ❖ Music controls
- ❖ Video games
- ❖ Many, many more...



(iMovie)

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

Button Demo

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:

```
bool IsPressed(float mx, float my) {  
    if (_bounds.Contains(new Vector2(mx, my)))  
    {  
        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
 - ❖ Gum
 - ❖ EmptyKeys
 - ❖ GeonBit.UI
- ❖ Can import one or more of these libraries
- ❖ MonoGame resources info:
 - ❖ <https://monogame.net/resources/>

Hands-on: Creating Widgets

❖ Today's activities:

1. Take the GUI demo code and modify it to your liking
2. Extend the Button class to create check boxes
3. Extend the Button class to a group of radio buttons
4. 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 canvas