

## CMSC 131: Chapter 15 (Supplement)

### GUI Programming Concepts

#### Event Driven Programming and Callbacks

When programming with GUIs the classical text-based input loop **does not apply**.

**Callback:** A method that is called when the user performs some action. Possible actions include:

- **mouse button** press or release
- **keyboard key** press
- **mouse has moved** (for dragging)

**How it works:** Your program informs the system:

- Which **input events** you are interested in listening for.
- For each such input event, which **method** of yours is to be called.
  - **mouse click event:** call `myMouseClicked()`
  - **keyboard key pressed:** call `myKeyboard()`
- The **parameters** to these callback methods provide information (e.g. which mouse button was pressed, which keyboard key hit).

#### Event Driven Programming and Callbacks

**How it works:** the "Event loop"

- Your program **sets up the callbacks** and then **goes to sleep**, and waits for the user to do something.
- When an **event** occurs, the **callback** method you specified is called automatically by the system.
- **Note:** You have **no idea** which of your callbacks will be called next, so you must be ready for any possibility.
- Each callback **updates the model** (the underlying data) appropriately and **returns immediately**, waiting for the next event.

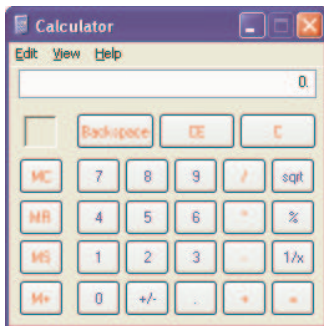
## Example: Simple Integer Calculator

### Simple Calculator:

**State (Model):** Need to save internal information such as the **current value** entered, the **last operation** entered, the contents of the **memory**.

### Events and Callbacks:

- **Digit key:** `digitKey( int value )`
- **Operation key:** `opKey( char op )`  
Operations: '+', '-', '=', ...
- **Clear key:** `clear( )`
- **Backspace key:** `backspace( )`
- ...



## Example: Simple Integer Calculator

### Simple Calculator: Sample event sequence.

| Event:      | Effect on State:                                             | Display (view): |
|-------------|--------------------------------------------------------------|-----------------|
| Start       | Initialize value = 0                                         | 0               |
| Digit: 8    | value = 8                                                    | 8               |
| Digit: 3    | value = 83<br>(value = value*10 + 3)                         | 83              |
| Digit: 2    | value = 832<br>(value = value*10 + 2)                        | 832             |
| Backspace   | value = 83<br>(value = value / 10)                           | 83              |
| Op Key: '+' | operand = value (83)<br>save operation code (+)<br>value = 0 | 0               |
| Digit: 4    | value = 4<br>(value = value*10 + 4)                          | 4               |
| Op Key: '=' | value = 87<br>(value = operand + value)                      | 87              |