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 myMouseClick( )
  - 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.

<table>
<thead>
<tr>
<th>Event</th>
<th>Effect on State:</th>
<th>Display (view):</th>
</tr>
</thead>
<tbody>
<tr>
<td>Start</td>
<td>Initialize value = 0</td>
<td>0</td>
</tr>
<tr>
<td>Digit: 8</td>
<td>value = 8</td>
<td>8</td>
</tr>
<tr>
<td>Digit: 3</td>
<td>value = 83</td>
<td>83</td>
</tr>
<tr>
<td>Digit: 2</td>
<td>value = 832</td>
<td>832</td>
</tr>
<tr>
<td>Backspace</td>
<td>value = 83</td>
<td>83</td>
</tr>
<tr>
<td>Op Key: '+'</td>
<td>operand = value (83)</td>
<td>save operation code (+)</td>
</tr>
<tr>
<td></td>
<td>value = 0</td>
<td>0</td>
</tr>
<tr>
<td>Digit: 4</td>
<td>value = 4</td>
<td>4</td>
</tr>
<tr>
<td>Op Key: '-'</td>
<td>value = 87</td>
<td>(value = operand + value) 87</td>
</tr>
</tbody>
</table>