



# Introduction to Scientific Computing and Problem Solving

## Lecture 16 Graphical User Interfaces (GUI)

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## Handle Graphics



- All graphics objects in MATLAB are part of a "system"
  - Functions control properties impacting appearance
  - Use `get` and `set` to manipulate
- User-defined data
- Finding objects
- Positioning objects

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## Assignments

- Review lecture slides, diaries, and m-files.
- MATLAB exam goes out 4/3 and is due 4/10.
- ~~Lab 7 begins 3/30.~~ Lab 7 cancelled
- You can always check assignments on the course web site.
- Grades now posted [www.cs.brown.edu/courses/csci0040](http://www.cs.brown.edu/courses/csci0040) on MyCourses. [mycourses.brown.edu](http://mycourses.brown.edu)



## Graphical User Interfaces (GUI)

- A familiar environment of pushbuttons, toggle buttons, lists, menus, text boxes, etc.
- Allows user to focus on the application and not the mechanics of using it.
  - Simplifies user input
  - Avoids complicated command line syntax
- Harder for the programmer because the program must be prepared for mouse clicks and other *events* at any time.

## GUI Elements

- **Components**
  - Pushbuttons, labels, boxes, menus, sliders, axes, etc.
  - `uicontrol`, `uimenu`, `uicontextmenu`, `uitoolbar`, `axes`
- **Containers**
  - Hold components
  - Figure, panel, button group
  - Commands `figure`, `uipanel`, `uibuttongroup`
- **Callbacks**
  - Code executed as a response to an event
  - Needed for every GUI component with a function

## Example 16-1 Getting the Time



1. Run *GUIDE* (Graphical User Interface Development Environment)
2. Select push button tool and locate
3. Using Property Inspector, change String property to "Time"
4. Save as `time.fig`
5. Add callback function code

## What Just Happened Here?

- We designed how the GUI should look.
- MATLAB wrote an m-file for us.
- We added some code to handle an event. In this case the callback for the pushbutton.
- The m-file handles most of the details when the button is pushed except the specific actions we are looking for: displaying the time.

## Gallery of GUI Components

- Static text fields
- Edit boxes
- Pushbuttons
- Toggle buttons
- Checkboxes and radio buttons
- Popup menus
- List boxes
- Sliders

```
m-files: editbox,  
togglebutton,  
checkbox,  
radiobutton,  
popupmenu,  
listbox
```

## Example 16-1 Temperature Conversion

1. Layout 2 text fields, 2 edit boxes, and one slider
2. Set Tag properties: `Label1`, `Label2`, `Edit1`, `Edit2`, and `slider1`
3. Store string property values "Degrees F" and "Degrees C"
4. Set slider maximum to 100
5. Store initial values in string property for edit fields and value property for slider (32°F and 0°C)
6. Set Name property of figure to 'Temperature Conversion'
7. Save as `temp_conversion.fig`

`temp_conversion.fig`

## Example 16-1 Temperature Conversion



- Note the callback functions in the `.m` file
- Write conversion functions `to_c` and `to_f`
- Write callback functions for `Edit1`, `Edit2`, and `slider1`
  - Respond to both edit boxes and slider
  - Convert strings in edit boxes to numbers
  - Limit user entries to 0-100°C and 32-212°F

`m-files: temp_conversion, to_c, to_f`

## Organizing Components

- Panels
  - Container for other elements that move as a group
- Button groups
  - Insure no more than one radio button or toggle is selected at a time
- Dialog boxes
  - Display information (e.g., warning) or get input

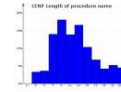
## Example 16-2 Plotting Data Points



- Using *GUIDE*, create axes
- Create File menu
- Create context menu for line styles
- Save as `plot_line.fig`

m-files: `plot_line.fig`, `plot_line.m`

## Example 16-3 Histogram GUI

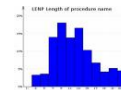


- Write a program that opens a file and calculates a histogram of the data.
  - It should display the mean, median, and standard deviation.
  - The user should be able to change the number of bins.
- Design the GUI with GUIDE and save as `histGUI.fig`

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## Example 16-3 (cont.) Histogram GUI



- Write code for `histGUI_OpeningFcn` to initialize the background color and the number of bins.
- Write callbacks for **F**ile Open and **E**xit.
- Write callback for number of bins edit box.
- Write callback for edit box (**N**Bins)

m-files: `histGUI.fig`, `histGUI.m`

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