MATLAB
User Interfaces

Week 9

Not covered in the book

Graphical User Interface

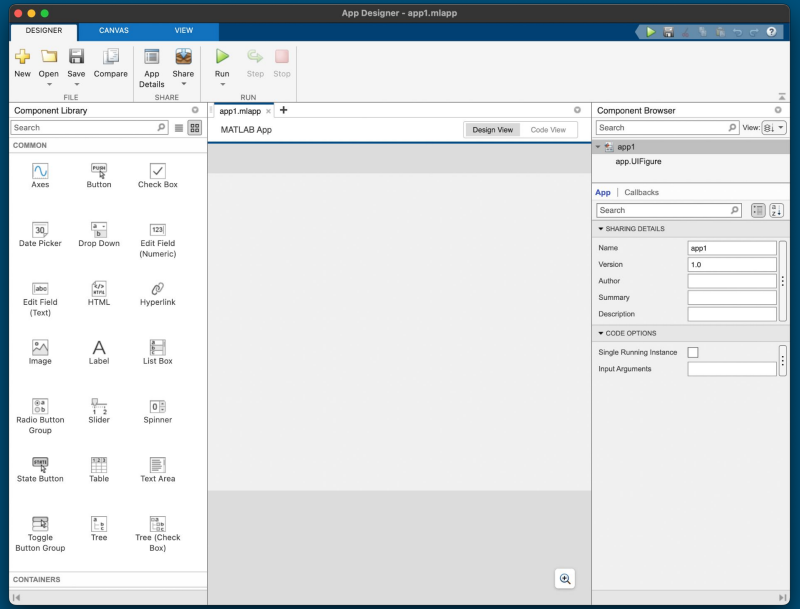
- User interaction thus far has been limited to input() function calls
- Graphical User Interfaces (GUIs) are a more sophisticated means of interaction including
  - Buttons
  - Text fields
  - Drop downs
  - etc.

APPDESIGNER

- MATLAB has a tool called APPDESIGNER (Formerly GUIDE - Graphical User Interface Development Environment)
- APPDESIGNER is used to create GUIs
- To open APPDESIGNER, simply type appdesigner in the command window

APPDESIGNER

- The appdesigner command opens a figure window which contains all of the tools necessary for developing a GUI.
- APPDESIGNER generates a .mlapp file



GUI .mlapp File

- Allows you to run the GUI
- Contains the functions required to launch and control the GUI
- Contains mostly *callback* functions
  - Subfunctions within the file
  - Written mostly by you
  - Determine what action is taken when a user interacts with the GUI

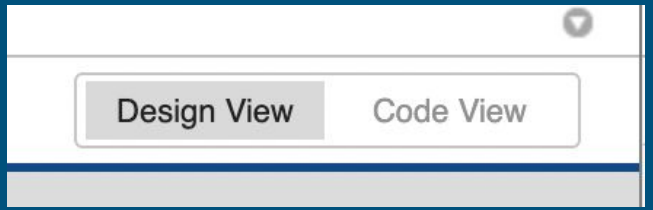
Example

As an example, let’s get the current time

- Run appdesigner from the command line
- Place a push button in the layout area
  - Click and drag or click and then draw with the crosshairs cursor
- Select the button to view its **Properties**
- Change the button’s **Text** property to ‘**Time**’
  - You should see the text on the button change to **Time**
- Change the button’s **Name** to ‘**btnGetTime**’

Example

- Select the “Callbacks” tab from the **Component Browser** (be sure the button is still selected)
- Click the dropdown for “**ButtonPushedFcn**”
- Select “**<Add ButtonPushedFcn Callback>**”
  - This will automatically open “Code View” and create a function for you.
  - The function created will be called “**btnGetTimePushed**” and accepts two arguments
  - We will not be editing any of the arguments
- At any time, you can switch between Design View and Code View using the toggle buttons in the upper right.



Example

Now let’s review some functions we will use in our logic

- datetime (formerly clock) provides the current date and time in vector form
    - hour, minute, second will be used to extract the specific components we want
- sprintf allows us to use a format specification to create a string like fprintf

Example

```
% get the current date and time
date = datetime("now");
% Extract the time elements and convert them to a string
time = sprintf("%02.0f:%02.0f:%02.0f", hour(date), minute(date), second(date));
% Set the String property of btnGetTime programmatically
app.btnGetTime.Text = time;
```

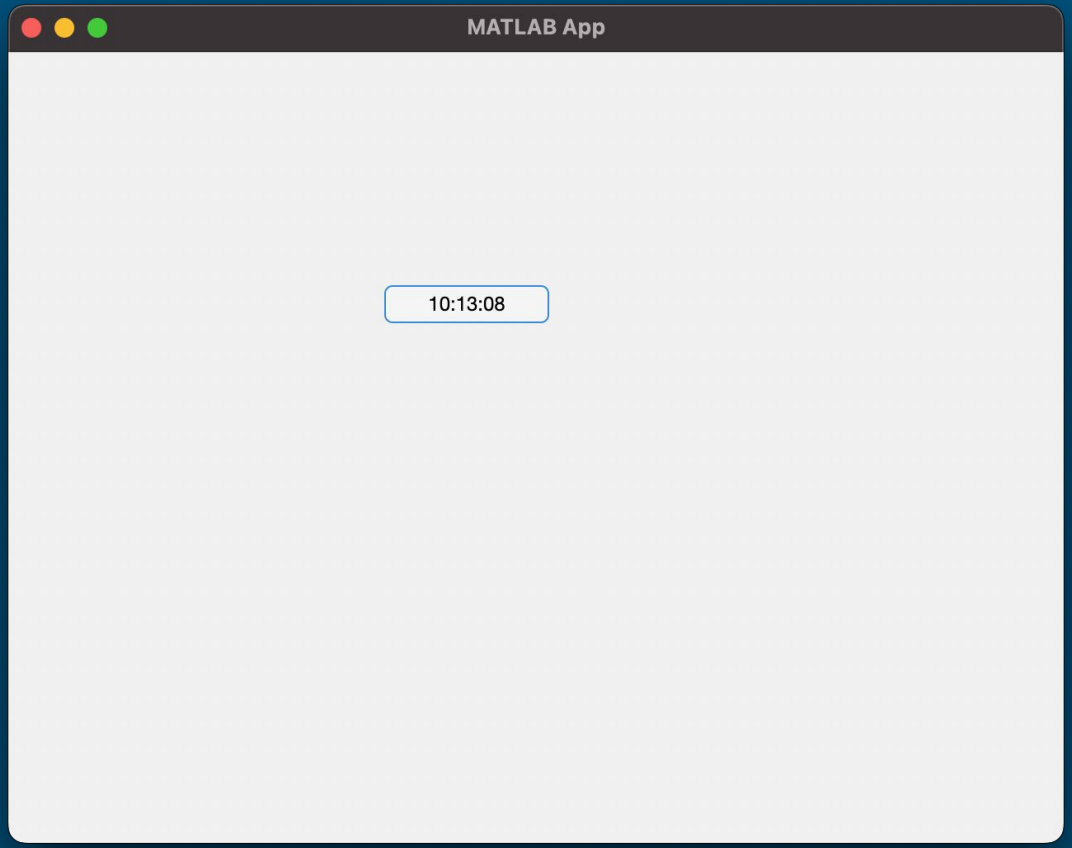
- Store the date
- Extract the hour, minute, and second portions
- Programmatically set the '**Text**' property to the current time

Example

- Save your GUI layout as something like '**TimeGUI**'
- You should see the new **TimeGUI.mlapp** file

Example

Now run the app and click the button



General Form for GUI Objects

A handle is a reference to an object, a property is simply a property like “Value”

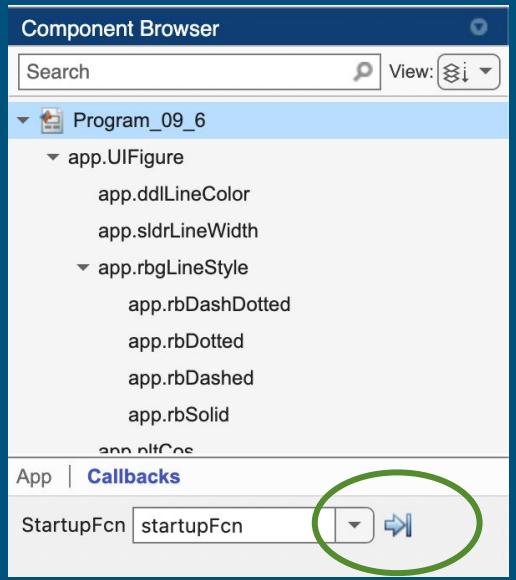
- app - The application as a whole (handle)
- app.element - Some element of the application (handle)
- app.element.Value - The value of some element (text, input, selection, etc)

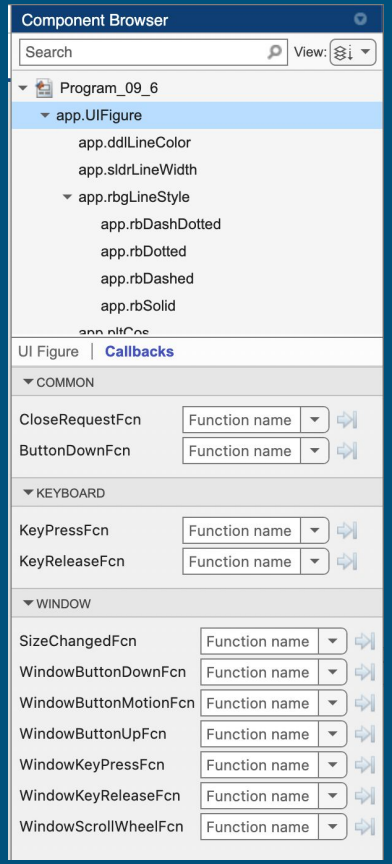
- NOTE:
  - Properties will generally be in text form (may need to be converted to numerical form)

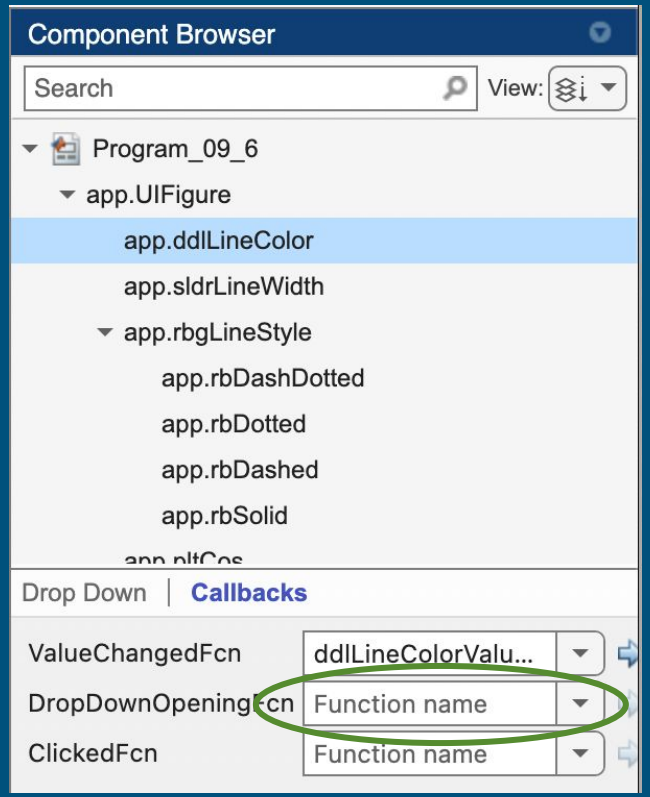
Callbacks

- Essentially functions called after some event
- Most every object has one or more
  - Button Pressed
  - Selection Changed
  - App startup
  - App shutdown

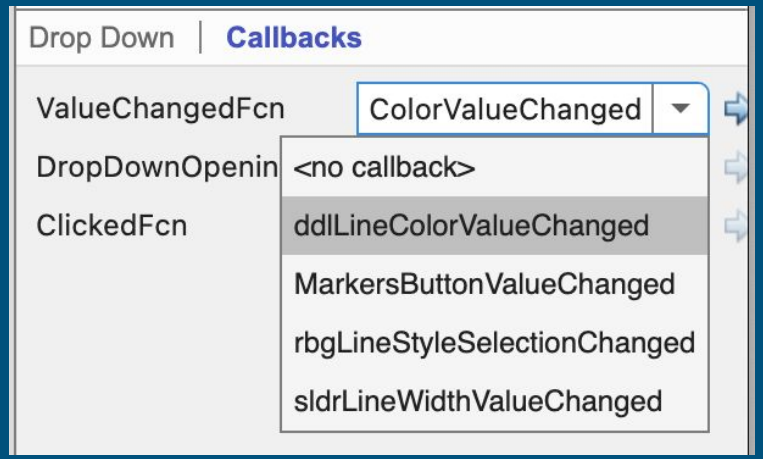
CallBacks

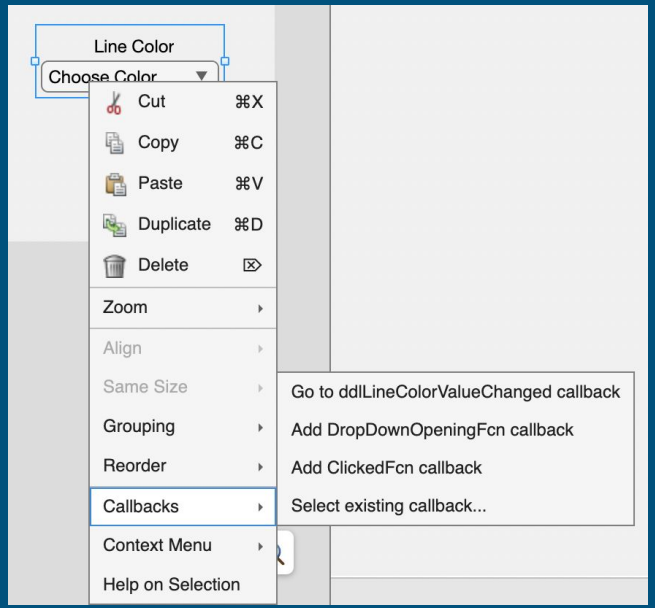

Component Browser
Search
View:
Program_09_6
app.UIFigure
app.ddlLineColor
app.sldrLineWidth
app.rbgLineStyle
app.rbDashDotted
app.rbDotted
app.rbDashed
app.rbSolid
App | Callbacks
StartupFcn
startupFcn


Component Browser
Search
View:
Program_09_6
app.UIFigure
app.ddlLineColor
app.sldrLineWidth
app.rbgLineStyle
app.rbDashDotted
app.rbDotted
app.rbDashed
app.rbSolid
UI Figure | Callbacks
COMMON
CloseRequestFcn
Function name
ButtonDownFcn
Function name
KEYBOARD
KeyPressFcn
Function name
KeyReleaseFcn
Function name
WINDOW
SizeChangedFcn
Function name
WindowButtonDownFcn
Function name
WindowButtonMotionFcn
Function name
WindowButtonUpFcn
Function name
WindowKeyPressFcn
Function name
WindowKeyReleaseFcn
Function name
WindowScrollWheelFcn
Function name


Component Browser
Search
View:
Program_09_6
app.UIFigure
app.ddlLineColor
app.sldrLineWidth
app.rbgLineStyle
app.rbDashDotted
app.rbDotted
app.rbDashed
app.rbSolid
Drop Down | Callbacks
ValueChangedFcn
ddlLineColorValu...
DropDownOpeningFcn
Function name
ClickedFcn
Function name

Callbacks


Drop Down
Callbacks
ValueChangedFcn
ColorValueChanged
DropDownOpenin
ClickedFcn
<no callback>
ddlLineColorValueChanged
MarkersButtonValueChanged
rbgLineStyleSelectionChanged
sldrLineWidthValueChanged


Line Color
Choose Color
Cut ⌘X
Copy ⌘C
Paste ⌘V
Duplicate ⌘D
Delete
Zoom
Align
Same Size
Grouping
Reorder
Callbacks
Context Menu
Help on Selection
Go to ddlLineColorValueChanged callback
Add DropDownOpeningFcn callback
Add ClickedFcn callback
Select existing callback...

Local Functions

- Apps have local functions too
- Again, generally helper tools
- Used to eliminate repetition (updatePlot(), clearForm(), etc)

“Workspace”

- GUIs do not have a “workspace”
- Custom data can be stored in “UserData”
- Most objects have a UserData property
  - UserData is a struct, to add data, just use the . operator
- app.pltLinear.UserData.x = 0:100
- app.pltLinear.UserData.y = 0:100
- app.pltLinear.UserData.whatevs = “Whatevs”

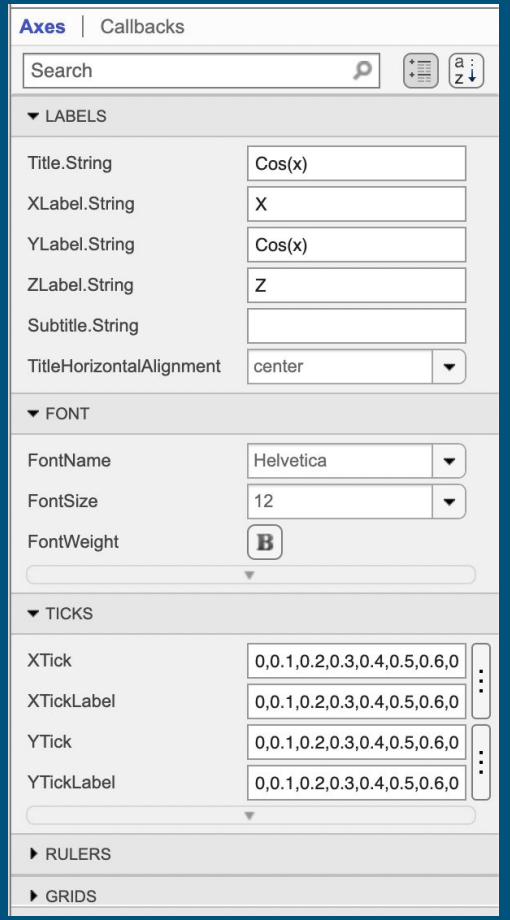
Functions need a “handle”

- Most of the functions we’ve used have no handle
  - plot(x,y)
  - xlabel(“text”)
  - etc
- With GUIs, we need to provide the handle
  - plot(app.pltLinear, x, y)
  - xlabel(app.pltLinear, “text”)
  - etc

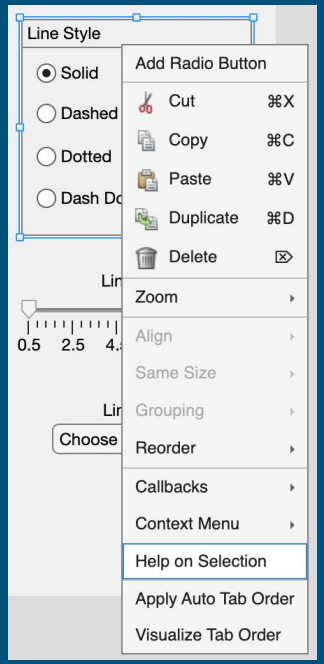
Search around

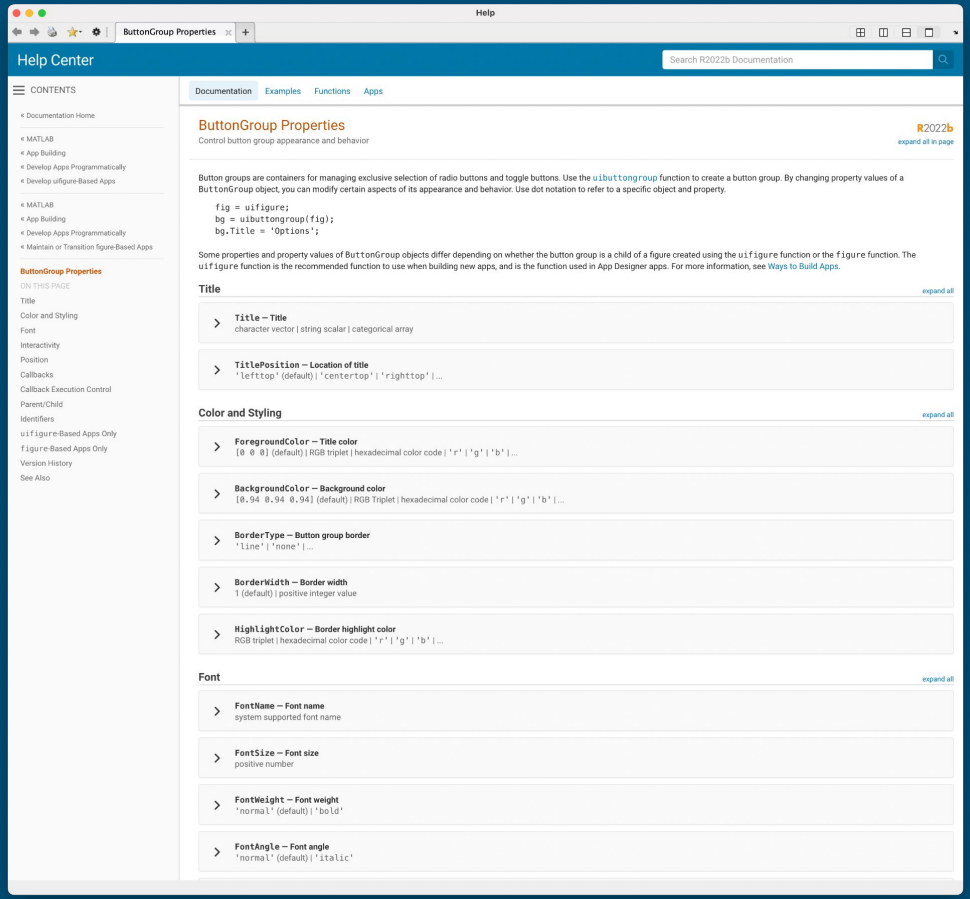
Some assignments say

- Only accept digits
- Make a field uneditable
- Start at x
- Provide a default value on startup
- etc



USE THE HELP DOC





Have Fun

- Be creative
- Adjust the design to your liking
- Follow the requirements
- Keep it intuitive
- Throw an easter egg in there if you want

Key Takeaways

- GUIs are implemented using the APPDESIGNER tool
- The appdesigner command starts the APPDESIGNER tool
- Launch the GUI by pressing “Run” just like your scripts
- Component Browser allows you to manually change properties
- The app is like a structure object, it has properties