GUI Toolkit

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GUI

What

- GUI
  - Graphical User Interface
  - Interactive with graphical components
    - Windows, scrollbars, buttons, textboxes,
  - Sexy (?)
- CLI
  - Command Line Interface
  - Writing commands in terminal
  - Wait for response from system
  - Old school, boring (?)

CLI vs GUI

Feature	CLI	GUI
Learning curve	Steep	Easy
Flexibility	Very high	Limited
Memory	Low	Higher
Speed	Fast	Slower
Interact	Keyboard	Keyboard, Mouse
Theming	Limited	Easy

Why

- User friendly, intuitive for new comers
- Easy to learn, no need to remember comments
- Better multitasking

Python GUI Toolkit

Toolkits

Feature	Tkinter	PyQt	Kivy	wxPython
Included?	Yes	No	No	No
Cross platform	Yes	Yes	Yes	Yes
Backend	Tcl/Tk	Qt	OpenGL	wxWidgets

Tkinter

- Simplicity
- Flexibility
- Focusing on new comers

- TODO: image of student management system here

Tkinter

- Window
- Widgets
- Layout
- Window event loop

Tkinter: Window

- Types: Main window and sub window
- Important attributes: title, size
- Main window

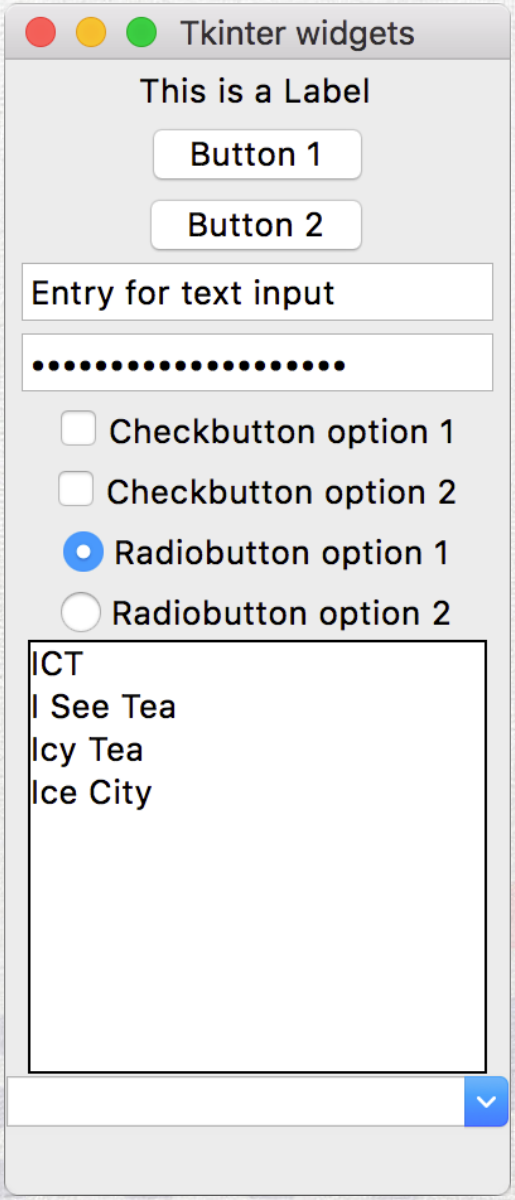
```
import tkinter as tk
window = tk.Tk()
window.title("Student Information System")
window.geometry("800x600")
```

- Sub window

```
sub = tk.Toplevel(window)
sub.title("Students")
sub.geometry("600x400")
```

Tkinter: Widgets

- Everything is widget
  - Frame
  - Label
  - Buttons
  - Entry
  - Check Button
  - Radio Button
  - List Box
  - ComboBox
  - Menu
  - ...
- Important attributes
  - Dimension: `width = 400, height = 300`
  - Background color: `bg = "green"`



Tkinter: Widgets

- Frame
  - A container for other widgets
  - `tk.Frame(window, width = 100, height = 100)`
- Label
  - Show texts
  - `tk.Label(window, text = "This is a Label")`

Tkinter: Widgets

1. Window
2. Widgets
3. Layout
4. Window event loop
5. Message box

- Button
  - Clickable
  - Handle click: `command = onClickFunc`

```
from tkinter import messagebox

def onClick():
    messagebox.showinfo(message="Button 1 clicked")

tk.Button(window, text = "Button 1", command = onClick)
```

Tkinter: Widgets

1. Window
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- Entry
  - Input texts
  - Can be used for password field (with `show = "*"`)

```
entry = tk.Entry(window)
entry.insert(-1, "Entry for text input")
```

- Checkbutton
  - Checkboxes
  - 2 states: check and uncheck
  - `tk.Checkbutton(window, text = "Checkbutton option 1")`

Tkinter: Widgets

1. Window
2. Widgets
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- Radiobutton
  - Single choice among options
  - Text != Value

```
radioValue = tk.StringVar(value = "op1")
tk.Radiobutton(window, variable = radioValue,
    text = "Radiobutton option 1", value = "op1")
tk.Radiobutton(window, variable = radioValue,
    text = "Radiobutton option 2", value = "op2")
```

Tkinter: Widgets

1. Window
2. Widgets
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- Listbox
  - A list of items
  - Selectable item
  - Get selected item: `listbox.get(tk.ACTIVE)`

```
icts = ["ICT", "I See Tea", "Icy Tea", "Ice City"]
listbox = tk.Listbox(window)
for i in icts:
    listbox.insert(icts.index(i), i)
```

Tkinter: Widgets

1. Window
2. Widgets
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- Combobox
  - A list of selectable items
  - Initially collapsed, can be expanded
  - Get selected item: `combobox.get()`

```
from tkinter import ttk
icts = ["ICT", "I See Tea", "Icy Tea", "Ice City"]
ttk.Combobox(window, values = icts)
```

Tkinter: Layout

1. Window
2. Widgets
3. Layout
4. Window event loop
5. Message box

- Geometry manager
  - Handle placements (positions) of widgets on windows
  - Main container: `tk.Frame`
  - Widget methods for geometry management
    - `.pack()`
    - `.place()`
    - `.grid()`

Tkinter: Layout

- `.pack()`
  - Packing algorithm
  - Similar to HTML `div`
  - Default
    - Vertically align
    - Horizontally centered
  - Alignment direction: `side = tk.LEFT`
  - Automatic expand: `fill = tk.X`, `fill = tk.Y`

Tkinter: Layout

1. Window
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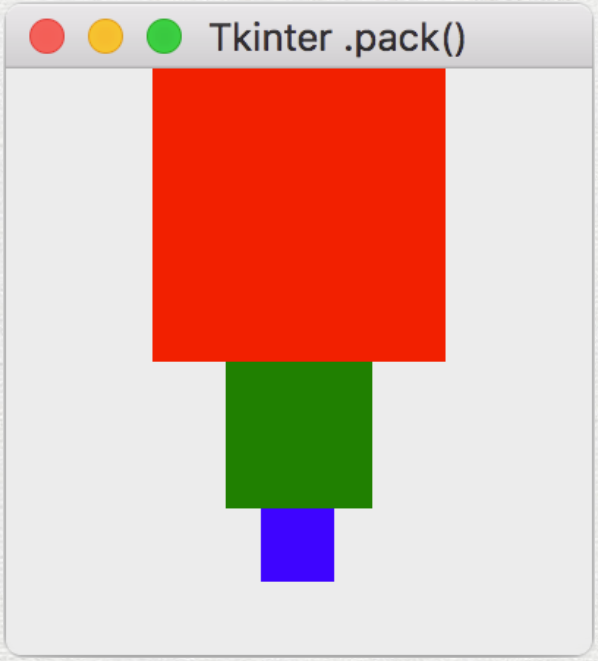
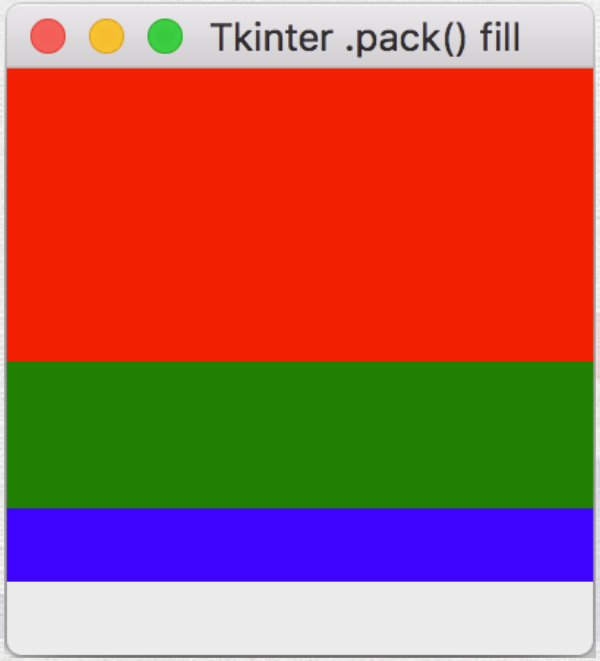
```
# default window
tk.Frame(window, width = 100, ..., bg="red").pack()
tk.Frame(window, width = 50, ..., bg="green").pack()
tk.Frame(window, width = 25, ..., bg="blue").pack()

# secondary window with fill
tk.Frame(sub, width = 100, ..., bg="red").pack(fill = tk.X)
tk.Frame(sub, width = 50, ..., bg="green").pack(fill = tk.X)
tk.Frame(sub, width = 25, ..., bg="blue").pack(fill = tk.X)
```





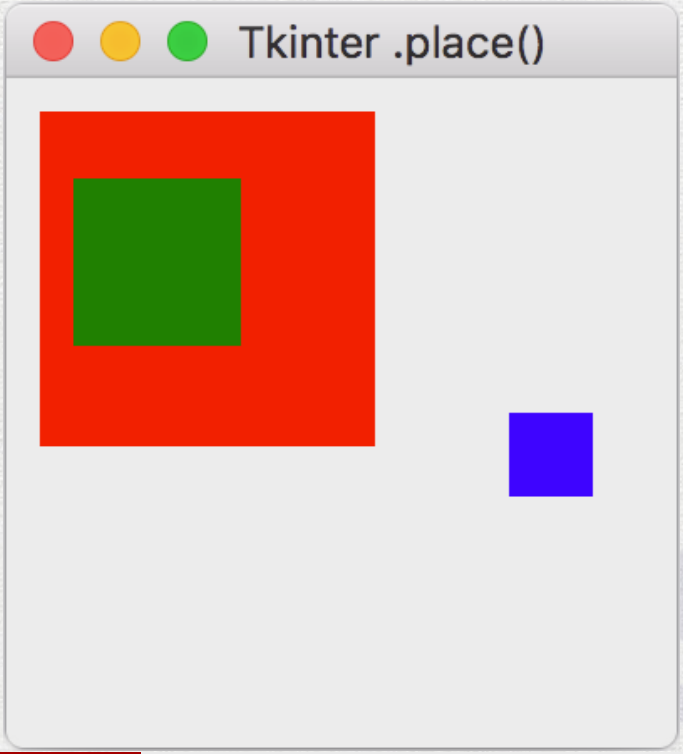
Tkinter: Layout

- `.place()`
  - Similar to HTML `position: absolute`
  - Unit: pixels
  - Absolute values
    - Position: `x = 10`, `y = 10`
    - Dimension: `width = 400`, `height = 300`
  - Relative values [0...1]
    - Position: `relx = 0.1`, `rely = 0.1`
    - Dimension: `relwidth = 0.5`, `relheight = 0.7`

Tkinter: Layout

```
tk.Frame(window, bg="red").place(
    x = 10, y = 10, width = 100, height = 100)
tk.Frame(window, bg="green").place(
    x = 20, y = 30, width = 50, height = 50)
tk.Frame(window, bg="blue").place(
    x = 150, y = 100, width = 25, height = 25)
```

Output:



1. Window
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Tkinter: Layout

- `.grid()`
  - Similar to HTML `table`
  - Position: `column = 0`, `row = 2`
  - Stretching: `sticky = tk.EW`
  - Padding: `padx = 3`, `pady = 3`
  - Spanning
    - `columnspan = 3`
    - `rowspan = 2`

Tkinter: Layout

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```
tk.Label(window, text = "Username").grid(
    column = 0, row = 0, sticky = tk.EW, padx = 3, pady = 3)
tk.Label(window, text = "Password").grid(
    column = 0, row = 1, sticky = tk.EW, padx = 3, pady = 3)

tk.Entry(window).grid(
    column = 1, row = 0, sticky = tk.EW, padx = 3, pady = 3, columnspan = 4)
tk.Entry(window).grid(
    column = 1, row = 1, sticky = tk.EW, padx = 3, pady = 3, columnspan = 4)

tk.Button(window, text = "Login").grid(
    column = 0, row = 2, columnspan = 2)
tk.Button(window, text = "Exit").grid(
    column = 2, row = 2, columnspan = 2)
```

Tkinter: Layout

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Tkinter: Window loop

- A **blocking** method
- Handles input, output events
- `window.mainloop()`

Practice!

Practical work 9: GUI'ed management system

- Copy your `pw8` directory to `pw9` directory
- Upgrade your user interface to GUI using Tkinter
- Push your work to corresponding forked Github repository