PYTHON FOR COMPUTATIONAL PROBLEM SOLVING

GUI With Tkinter

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Why GUI?

- A user with zero technical knowledge can still use a computer thanks to GUIs.
- GUIs provide an intuitive and visual method of interacting with software applications. They simplify workflows and reduce the learning curve for new users.
- They don’t require the user to know any programming or memorize commands to interact with the machine.

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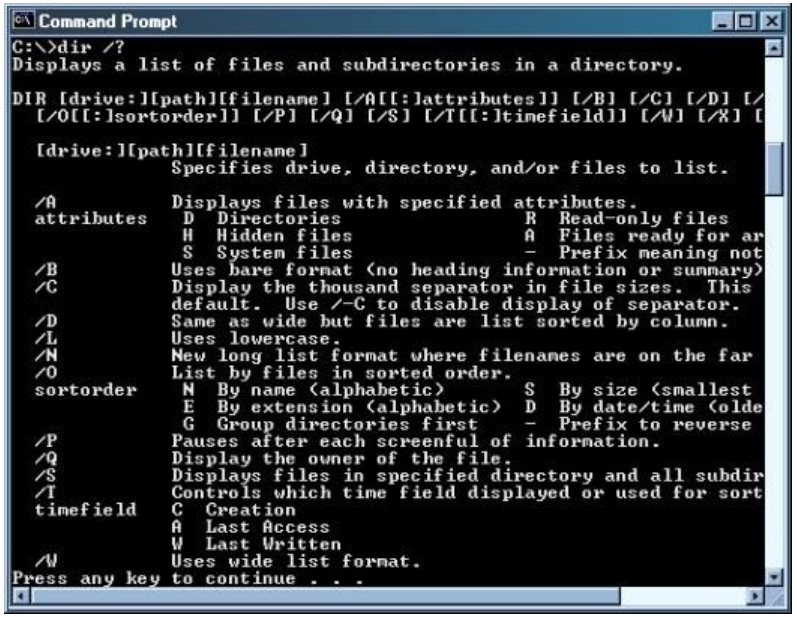
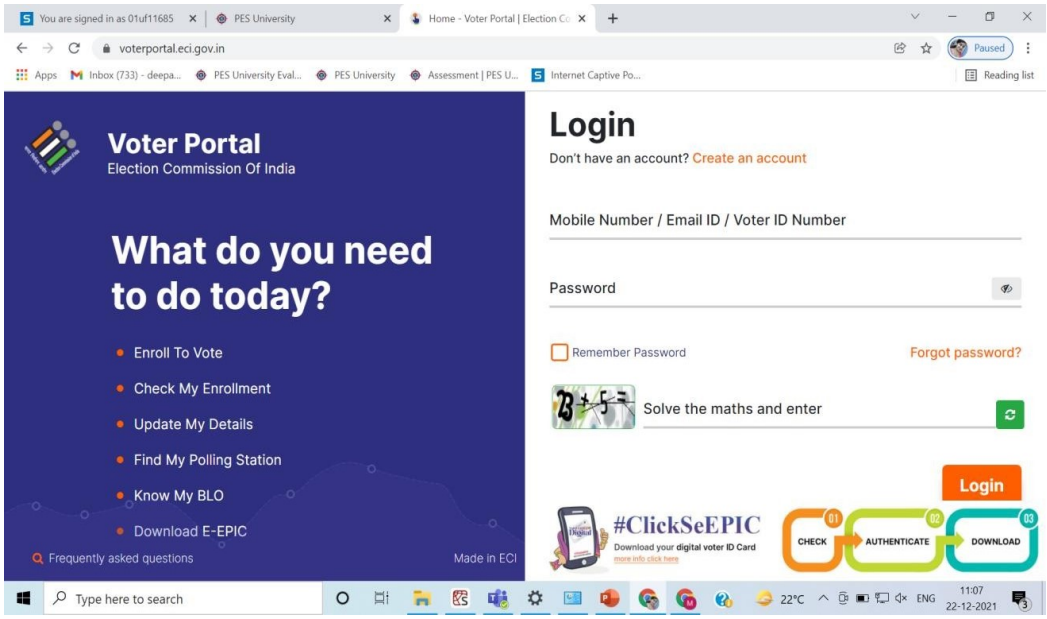
GUI - Tkinter





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Popular Python GUI frameworks

1. Tkinter/ttkbootstrap
2. Qt for Python: PySide2 / Qt5
3. PySimpleGUI
4. PyGUI
5. Kivy
6. wxPython
7. Libavg
8. PyForms
9. Wax
10. PyGTK

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Tkinter

- Built into the Python standard library
- It’s cross-platform, so the same code works on Windows, macOS, and Linux
- Lightweight and relatively easy to use compared to other frameworks

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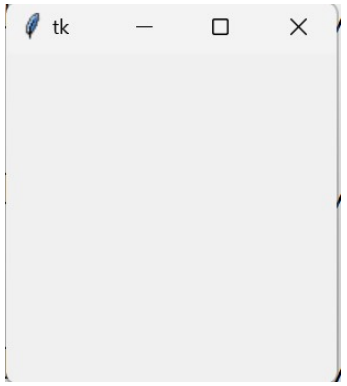
Basic Window

Step 1: Import tkinter package

Step 2: root=tkinter.Tk()

Step 3: root.mainloop()

Output




```
import tkinter
root = tkinter.Tk()          #creates window
root.mainloop()     #loops continuously until we close the  window
```

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mainloop()

- A function that **continuously loops and displays the window** till we close it or an action closes the window.
- It will loop forever waiting for events from the user, until the user exits the program (either by closing the window, or by terminating the program with a keyboard interrupt in the console).
- All windows that are created work on this concept of constant looping to keep track of the interactions of the user with the interface.
- It **can track the movements of the mouse** on the window because it constantly loops and has knowledge of where the mouse pointer is on the window at every frame.

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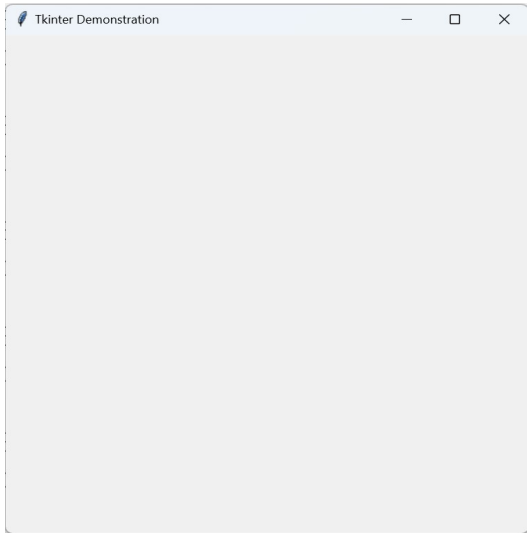
Adding title and geometry to the Window

root.title(Title Name)
root.geometry(Dimension in widthxheight)

Example:

```
import tkinter
root = tkinter.Tk()   #creates window
root.title("Tkinter Demonstration")   #Title
root.geometry('500x500’)  #Dimension
root.mainloop()
```

Output:



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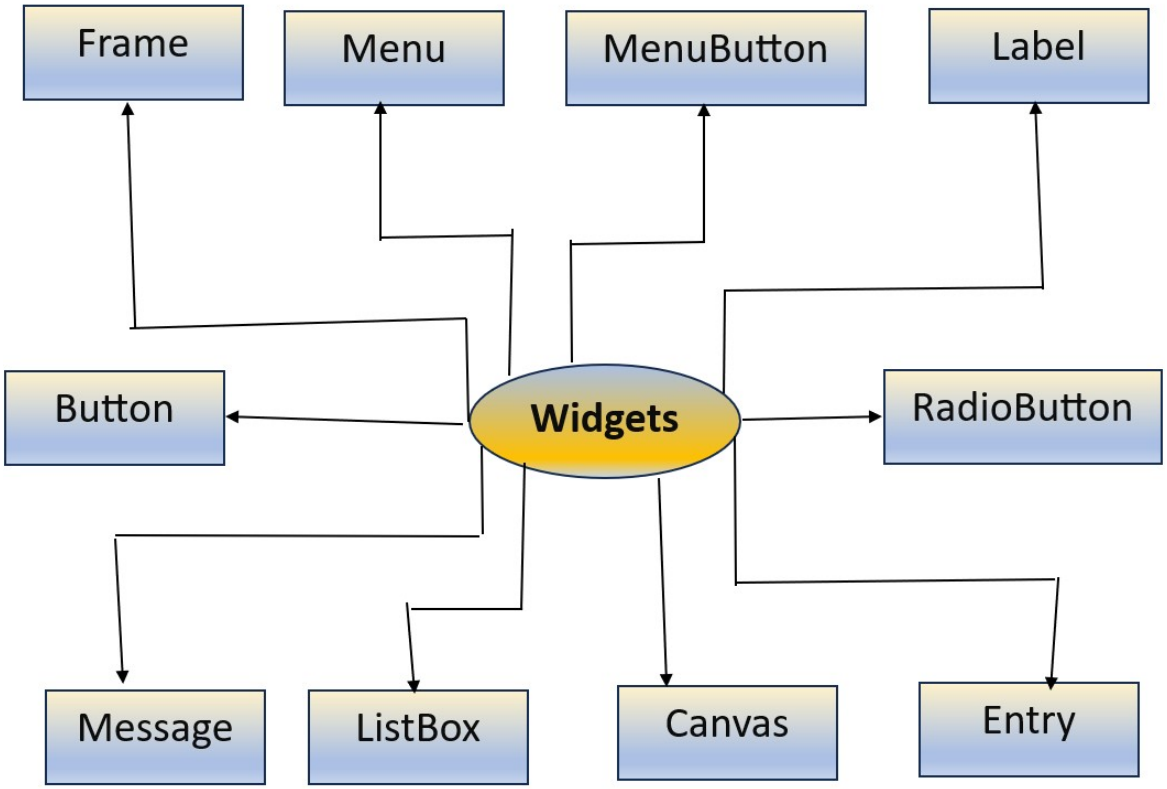
Widgets

- After creating window, we need to add elements to make it more interactive.
- **Each element in Tkinter is a widget**.
- **Each separate widget is a Python object**.
- When creating a widget, we must **pass its parent as a parameter** to the widget creation function.
- **The 'root' window is an exception** as it is the top-level window that will contain everything else and does not have a parent.

GUI - Tkinter


Frame
Menu
MenuButton
Label
Button
Widgets
RadioButton
Message
ListBox
Canvas
Entry

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GUI - Tkinter

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Widget Name	Description
Button	To add a button to the application
Canvas	To draw a complex layout and pictures (like graphics, text etc.)
CheckButton	To display a number of options as checkboxes
Entry	To display a single-line text field that accepts values from the user
Frame	To group and organize other widgets
Label	To provide a single-line caption, can contain images also.
Listbox	To provide a user with a list of options
Menu	Creates all kinds of menus required in the application
Menubutton	To display the menu items to the user

GUI - Tkinter

Widget Name	Description
Message	Displays a message box to the user
Radiobutton	Number of options to be displayed as radio buttons
Scale	A graphical slider that allows to select values from the scale
Scrollbar	To scroll the window up and down
Text	A multi-line text field to the user where users enter or edit the text and it is different from entry
Toplevel	Used to provide a separate window container
Spinbox	An entry to the “entry” widget in which value can be input just by selecting a fixed value of numbers
PanedWindow	A container widget that is mainly used to handle different panes
MessageBox	Used to display messages in desktop applications

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Widgets

- Steps to add widget to the Window
  1. Create widget
  2. Add it to the Window

- Creating a new widget doesn't mean that it will appear on the screen. To display it, we need to call a special method: either **grid, pack**, or **place**.

1. **pack()** - packs widgets in rows or columns
2. **grid()** - puts the widgets in a 2-dimensional table.
   The master widget is split into a number of rows and columns, and each "cell" in the resulting table can hold a widget.
3. **place()** - explicitly set the position and size of a window, either in absolute terms, or relative to another window.

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Button Widget - To add a button to the application

- **Syntax**

```
W = Button(parent,options)
```

- parent – parent window
- options – to change look of the buttons, written as comma-separated

Button widget options

activebackground – background of button when the mouse hovers the button
activeforeground – represents the font color when the mouse hovers the button
bd – width of the border
bg – background color of button
fg – foreground colot of button
height – height of button
justify – with 3 values, LEFT, RIGHT, CENTER
underline – underline the text of button
width – width of the button

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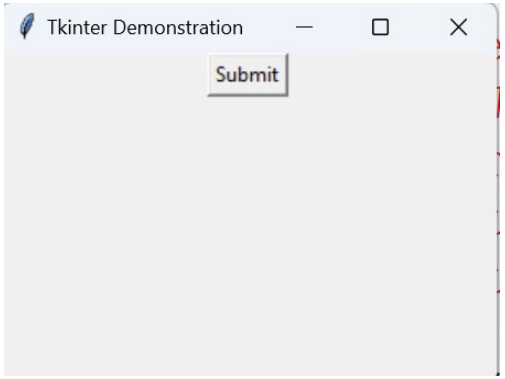
Button Widget: Example 1

```
from tkinter import *
win =Tk()
win.title("Tkinter Demonstration")
win.geometry('300x200')
b=Button(win, text='Submit')
b.pack()
win.mainloop()
```

Output



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Button Widget: Example 2

```
import tkinter
from tkinter import *
from tkinter import messagebox

win = Tk()
win.title("Tkinter Button Widget Demonstration")
win.geometry('300x200')

def click():
    messagebox.showinfo("Message", "Green Button clicked")

a=Button(win, text="yellow", activeforeground="yellow",
activebackground="orange", pady=10)
```

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Button Widget: Example 2 (continued)

```
b=Button(win, text="Blue", activeforeground="blue",
activebackground="orange", pady=10)
# adding click function to the below button
c=Button(win, text="Green", command=click, activeforeground =
"green", activebackground="orange", pady=10)
d=Button(win, text="red", activeforeground="red",
activebackground="orange", pady=10)
a.pack(side=LEFT)
b.pack(side=RIGHT)
c.pack(side=TOP)
d.pack(side=BOTTOM)
win.mainloop()
```

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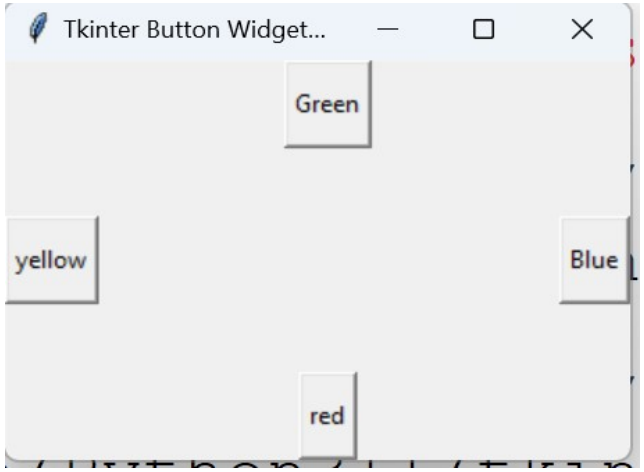
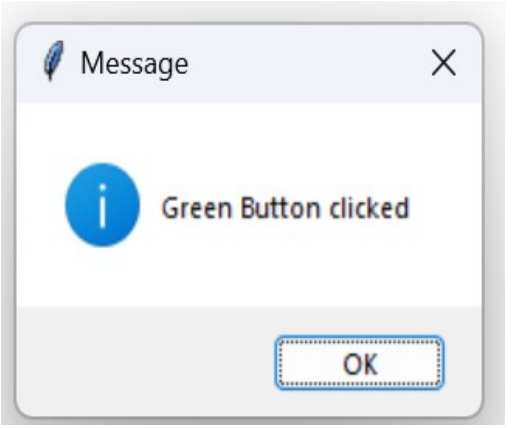
Button Widget
Example2 (Contd…)

Output



After clicking Green button, Messagebox appears.



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Canvas Widget - used to draw anything on the application window

- **Syntax**

```
W = Canvas(parent,option=value)
```

- parent – parent window
- option – to change layout of the canvas, written as comma-separated-Key-values.

Canvas widget options

bd – width of the border
bg – background color
cursor – to use arrow, dot, or circle
height – height of canvas
xscrollcommand – horizontal scrollbar
yscrollcommand – vertical scrollbar
confine – non-scrollable outside the scroll region

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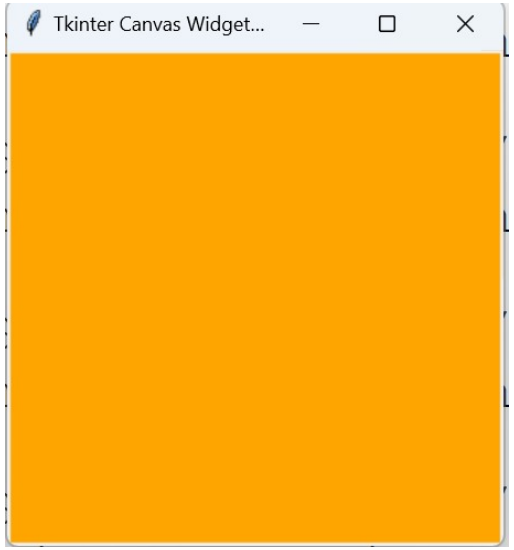
Canvas Widget: Example 1

```
from tkinter import *

win=Tk()
win.title("Tkinter Canvas Widget Demonstration")
win.geometry("300x300")

#creating canvas
cv=Canvas(win, bg = "orange", height = "300")

cv.pack()

win.mainloop()
```

Output



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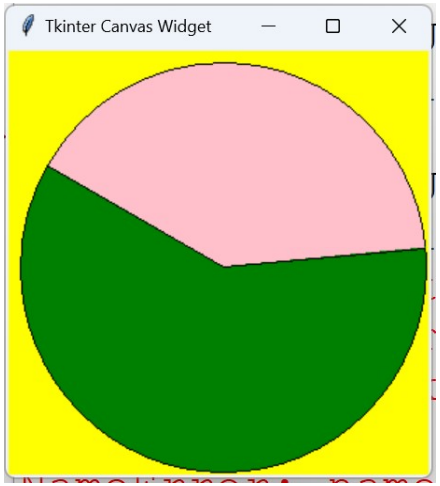
Canvas Widget: Example 2

```
import tkinter
win=tkinter.Tk()
win.title("Tkinter Canvas Widget")

# creating canvas
cv=tkinter.Canvas(win, bg="yellow", height=300, width=300)
# drawing two arcs
coord = 10, 10, 300, 300
arc1=cv.create_arc(coord, start=0, extent=150, fill="pink")
arc2=cv.create_arc(coord, start=150, extent=215, fill="green")
# adding canvas to window and display it
cv.pack()
win.mainloop()
```



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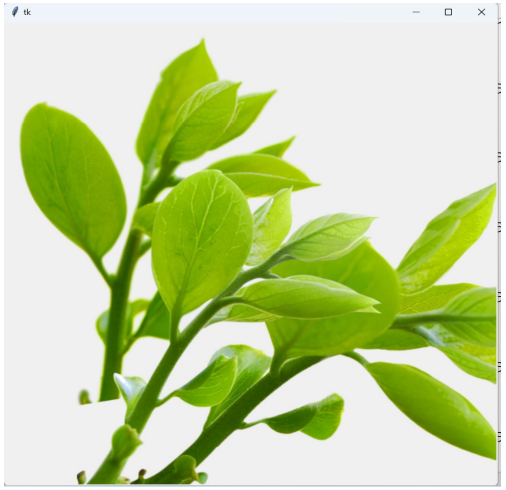
Canvas Widget: Example 3

```
from tkinter import *
win=Tk()

cv=Canvas(win, height=700, width=700)
filename=PhotoImage(file="nature.png")

image=cv.create_image(20, 20, anchor=NW, image=filename)

cv.pack()
win.mainloop()
```



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Checkbutton Widget - button to select from multiple options

- **Syntax**

```
W = Checkbutton(parent,option=value)
```

- parent – parent window
- option – to configure checkbutton, written as comma-separated key-value pair.

Checkbutton widget options

bd – width of the border
bg – background color of button
bitmap – to display image in the button
command – function to be called on checking the button
height – height of widget
image – display generic image on the button
justify – with 3 values, LEFT, RIGHT, CENTER
padx – space to leave to the left and right of the checkbutton and text. Default value is 1 pixel
pady – space to leave to the above and below the checkbutton and text. Default value is 1 pixel

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Checkbutton Widget

- **Functions**

1. deselect() – to turn off the checkbutton
2. flash(): The checkbutton is flashed between the active and normal colors.
3. invoke(): invoke the method associated with the checkbutton.
4. select(): to turn on the checkbutton.
5. toggle(): to toggle between the different Checkbuttons.

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Checkbutton Widget

Example

```
from tkinter import *

win=Tk()
win.geometry("300x300")

w=Label(win, text ='Select Your Hobbies:', fg="Blue",font = "100")
w.pack()

Checkbutton1 = IntVar() # holds integer data passed to the checkbutton
widget
Checkbutton2 = IntVar()
Checkbutton3 = IntVar()
```

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Checkbutton Widget

Example (Contd…)

```
cb1=Checkbutton(win, text="Painting",variable = Checkbutton1,
                                    onvalue = 1,
                                offvalue = 0,
                                height = 2,
                                width = 10)

cb2=Checkbutton(win, text = "Dancing", variable = Checkbutton2,
                                    onvalue = 1,
                                    offvalue = 0,
                                    height = 2,
                                    width = 10)
```

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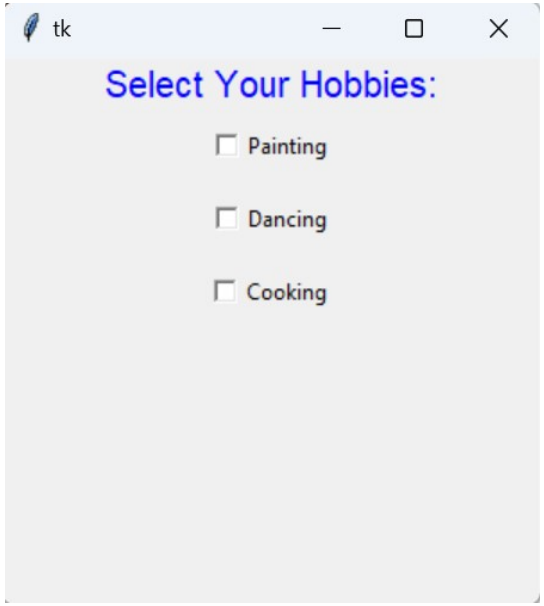
Checkbutton Widget

Example (Contd…)

```
cb3=Checkbutton(win, text = "Cooking", variable = Checkbutton3,
                                onvalue = 1,
                                offvalue = 0,
                                height = 2,
                                width = 10)
```

```
cb1.pack()
cb2.pack()
cb3.pack()

mainloop()
```



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Label Widget - to provide a message about the other widgets

- **Syntax**

```
W = Label(parent,options)
```

- parent – parent window
- option – to configure the text, written as comma-separated-Key-value pair.

Label widget options

anchor – to control the position of widget
bg – background color of widget
bitmap – to set the bitmap equals to the graphical object
cursor – type of cursor to show when the mouse is moved over the label
height – height of widget
image – indicates the image that is shown as label
justify – with 3 values, LEFT, RIGHT, CENTER
padx – Horizontal padding of text. Default value is 1.
pady – Vertical padding of text. Default value is 1.

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Label Widget

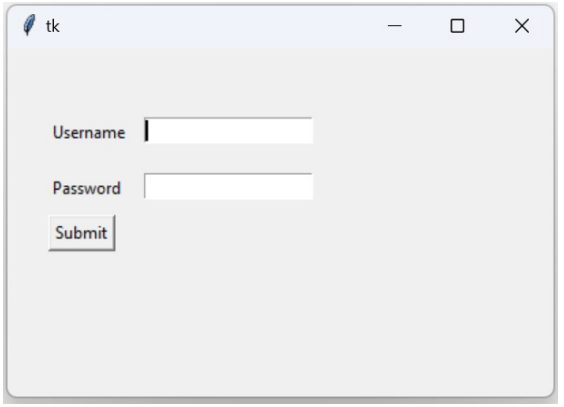
Example

```
from tkinter import *
win=Tk()
win.geometry("400x250")

username=Label(win, text = "Username").place(x = 30,y = 50)
password=Label(win, text = "Password").place(x = 30, y = 90)
submitbutton=Button(win, text = "Submit",activebackground = "red",
activeforeground = "blue").place(x = 30, y = 120)

e1=Entry(win,width = 20).place(x = 100, y = 50)
e2=Entry(win, width = 20).place(x = 100, y = 90)

win.mainloop()
```



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Entry Widget - to enter or display single line of text

- **Syntax**

```
W = Entry(parent,options)
```

- parent – parent window
- option – to configure the entry, written as comma-separated values.

Entry widget options

bg – background color of widget

font – font used for the text

fg – color to render the text

relief – default value, relief=FLAT. Other styles are : SUNKEN, RIGID, RAISED, GROOVE

show –to show the text while making an entry, Eg: for Password set Show="*"

textvariable – to retrieve the current text from your entry widget

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Entry Widget

- **Functions**

1. get() – Returns the entry's current text as a string
2. delete(): Deletes characters from the widget
3. insert(index,name): Inserts string 'name' before the character at the given index

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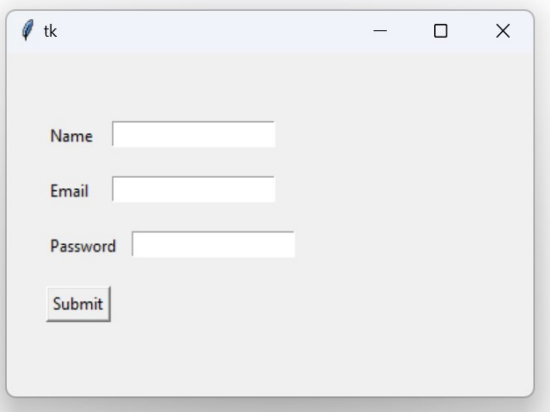
Entry Widget - Example

```
from tkinter import *
win=Tk()
win.geometry("400x250")

name=Label(win, text = "Name").place(x = 30,y = 50)
email=Label(win, text = "Email").place(x = 30, y = 90)
password=Label(win, text = "Password").place(x = 30, y = 130)
submitbtn=Button(win, text = "Submit",activebackground = "red",
activeforeground = "blue").place(x = 30, y = 170)

entry1=Entry(win).place(x = 80, y = 50)
entry2=Entry(win).place(x = 80, y = 90)
entry3=Entry(win).place(x = 95, y = 130)

win.mainloop()
```



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Dialogs in Tkinter

- A window which is used to "talk" to the application
- Used to input data, modify data, change the application settings etc.
- Communication between a user and a computer program

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Tkinter Message Box Dialog

- Provide messages to the user of the application
- Message consists of text and image data
- Located in tkMessagebox module
- By using the message box library, information from the application is displayed to the user; this information can be classified into various types such as Error, Warning, Cancellation etc.

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Message Box

- **Syntax**

```
messagebox.function_name(Title,  Message, [,options] )
```

- function_name – Name of the function we want to use
- Title – Message box's title
- Message – Message to be shown on the dialog
- options – to configure the options

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function_name

Name of the function	Significance
showinfo()	To display some important information
showwarning()	To display some type of warning
showerror()	To display some error message
askquestion()	To display a dialog box that asks a question with two options: YES or NO
askokcancel()	To display a dialog box that asks a question with two options: OK or CANCEL
askretrycancel()	To display a dialog box that asks a question with two options: RETRY or CANCEL
askyesnocancel()	To display a dialog box that asks a question with three options: YES or NO or CANCEL

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Messagebox – askquestion()

Example 1

```
from tkinter import *
from tkinter import messagebox
win=Tk()

# function to use the askquestion() function
def Submit():
    messagebox.askquestion("Form", "Do you want to Submit")

win.geometry("300x300")
# creating Submit Button
b=Button(win, text = "Submit", command = Submit)
b.pack()
win.mainloop()
```

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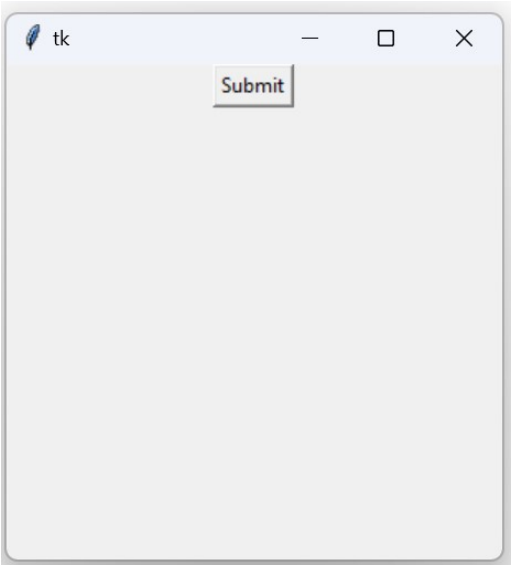
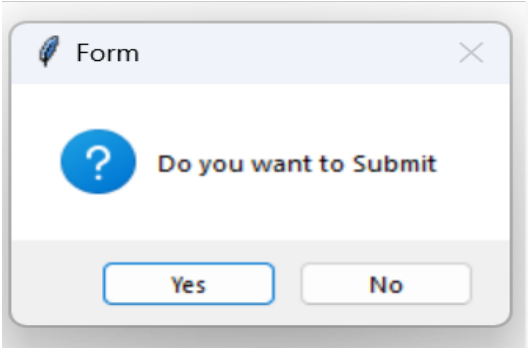
Example 1 Output





After clicking Submit button in the 1st window, 2nd window is displayed.

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Frame widget in Tkinter

- A frame - rectangular region on the screen.
- Used to implement complex widgets.
- Organize a group of widgets.
- **Syntax**

```
W = frame(parent,options)
```

- parent – parent window
- options – to configure frames, written as comma-separated key-value pair.

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Frame widget options

bg – background color displayed behind the label and indicator
bd – border size, default is 2 pixels
cursor – to change the mouse cursor pattern
height – vertical dimension of new frame
highlightcolor – color of focus highlight when the frame has focus
highlightthickness – color the focus when the frame does not have the focus
highlightbackground – thickness of focus highlight
relief – type of the border of the frame. default = FLAT
width – width of the frame

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Frame Widget – Example 1

```
from tkinter import *
win = Tk()
win.geometry("300x150")
w=Label(win, text ='Frame Demonstration', font = "50")
w.pack()

frame=Frame(win)
frame.pack()

b1= Button(frame, text ="Python", fg ="red")
b1.pack( side = LEFT)
b2 = Button(frame, text ="Java", fg ="brown")
b2.pack( side = LEFT )
b3 = Button(frame, text =".Net", fg ="blue")
b3.pack( side = LEFT )
```

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Example 1 (Continued)

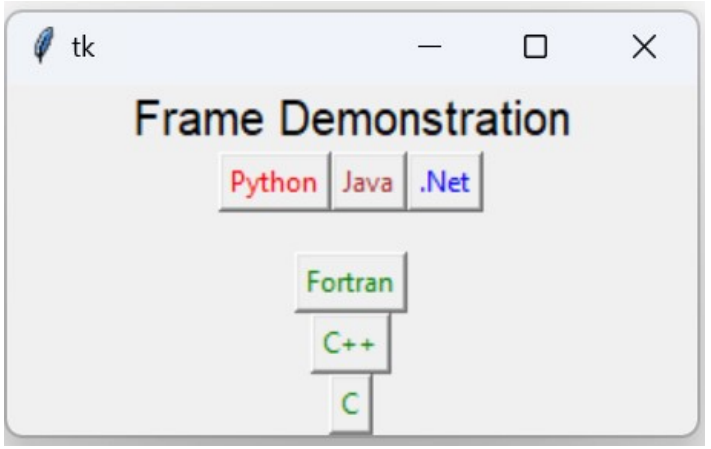
```
bottomframe=Frame(win)
bottomframe.pack(side = BOTTOM )

b4 = Button(bottomframe, text ="C", fg ="green")
b4.pack( side = BOTTOM)

b5 = Button(bottomframe, text ="C++", fg ="green")
b5.pack( side = BOTTOM)

b6 = Button(bottomframe, text ="Fortran", fg ="green")
b6.pack( side = BOTTOM)

win.mainloop()
```



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Frame widget –Nested Frames

- A frame within another frame

- Steps to create Nested Frames
  1. Create normal Tkinter window
  2. Create 1st Frame
  3. Create 2nd Frame
  4. Take the 1st window as its parent window
  5. Execute code

- Syntax

```
frame(parent)
```

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Frame widget – Nested Frames

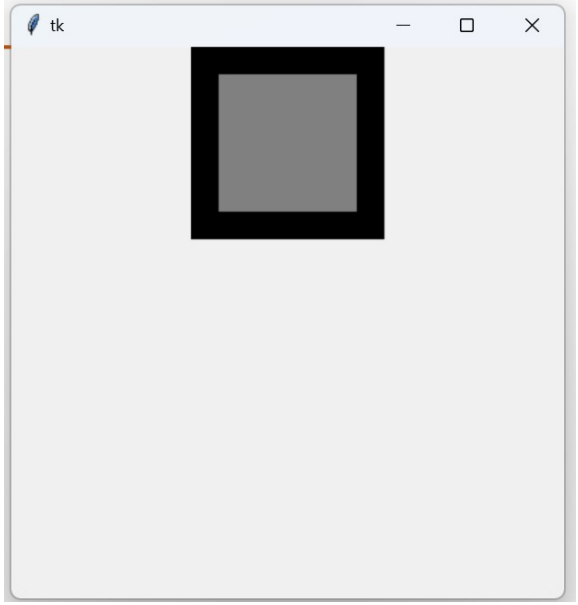
Example 2

```
from tkinter import *
win=Tk()
win.geometry("400x400")

# Frame 1
frame1=Frame(win,bg="black",width=500,height=300)
frame1.pack()

# Frame 2 is created within Frame 1
frame2=Frame(frame1,bg="Grey",width=100,height=100)
frame2.pack(pady=20,padx=20)

win.mainloop()
```



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Explore further:

- Tkinter Color Chooser Dialog - colorchooser – askcolor()
- Tkinter file dialog - filedialog – askopenfile()
- Frame widget – Change width
- Frame widget – Change Color

THANK YOU

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