Python provides various options for developing graphical user interfaces (GUIs). The most important features are listed below.

- **Tkinter** − Tkinter is the Python interface to the Tk GUI toolkit shipped with Python. We would look at this option in this chapter.
- **wxPython** − This is an open-source Python interface for wxWidgets GUI toolkit. You can find a complete tutorial on WxPython here.
- **PyQt** − This is also a Python interface for a popular cross-platform Qt GUI library. TutorialsPoint has a very good tutorial on PyQt5 here.
- **PyGTK** − PyGTK is a set of wrappers written in Python and C for GTK + GUI library. The complete PyGTK tutorial is available here.
- **PySimpleGUI** − PySimpleGui is an open source, cross-platform GUI library for Python. It aims to provide a uniform API for creating desktop GUIs based on Python's Tkinter, PySide and WxPython toolkits. For a detaile PySimpleGUI tutorial, click here.
- **Pygame** − Pygame is a popular Python library used for developing video games. It is free, open source and cross-platform wrapper around Simple DirectMedia Library (SDL). For a comprehensive tutorial on Pygame, visit this link.
- **Jython** − Jython is a Python port for Java, which gives Python scripts seamless access to the Java class libraries on the local machinehttp: //www.jython.org.

There are many other interfaces available, which you can find them on the net.

Tkinter Programming

Tkinter is the standard GUI library for Python. Python when combined with Tkinter provides a fast and easy way to create GUI applications. Tkinter provides a powerful object-oriented interface to the Tk GUI toolkit.

The tkinter package includes following modules −

- **Tkinter** − Main Tkinter module.
- **tkinter.colorchooser** − Dialog to let the user choose a color.
- **tkinter.commondialog** − Base class for the dialogs defined in the other modules listed here.

tkinter.filedialog − Common dialogs to allow the user to specify a file to open or save.

tkinter.font − Utilities to help work with fonts.

tkinter.messagebox − Access to standard Tk dialog boxes.

tkinter.scrolledtext − Text widget with a vertical scroll bar built in.

tkinter.simpledialog − Basic dialogs and convenience functions.

tkinter.ttk − Themed widget set introduced in Tk 8.5, providing modern alternatives for many of the classic widgets in the main tkinter module.

Creating a GUI application using Tkinter is an easy task. All you need to do is perform the following steps.

Import the Tkinter module.

Create the GUI application main window.

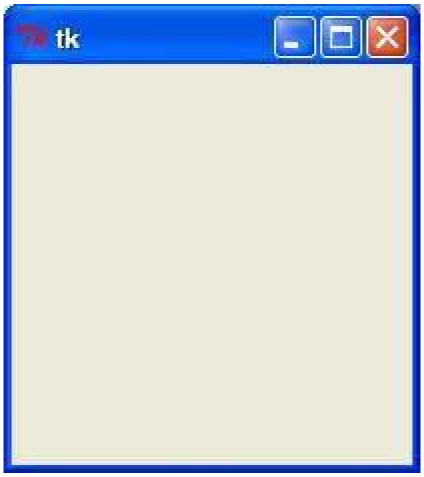
Add one or more of the above-mentioned widgets to the GUI application.

Enter the main event loop to take action against each event triggered by the user.

Example

```
# note that module name has changed from Tkinter in Python 2
# to tkinter in Python 3

import tkinter
top = tkinter.Tk()

# Code to add widgets will go here...
top.mainloop()
```

This would create a following window −



When the program becomes more complex, using an object-oriented programming approach makes the code more organized.

```
import tkinter as tk
class App(tk.Tk):
   def __init__(self):
      super().__init__()

app = App()
app.mainloop()
```

Tkinter Widgets

Tkinter provides various controls, such as buttons, labels and text boxes used in a GUI application. These controls are commonly called widgets.

There are currently 15 types of widgets in Tkinter. We present these widgets as well as a brief description in the following table −

Sr.No.	Operator & Description
1	**Button** The Button widget is used to display the buttons in your application.
2	**Canvas** The Canvas widget is used to draw shapes, such as lines, ovals, polygons and rectangles, in your application.
3	**Checkbutton** The Checkbutton widget is used to display a number of options as checkboxes. The user can select multiple options at a time.
4	**Entry**

The Entry widget is used to display a single-line text field for accepting values from a user.

Frame

5 The Frame widget is used as a container widget to organize other widgets.

Label

6 The Label widget is used to provide a single-line caption for other widgets. It can also contain images.

7 **Listbox**

The Listbox widget is used to provide a list of options to a user.

8 **Menubutton**

The Menubutton widget is used to display menus in your application.

Menu

9 The Menu widget is used to provide various commands to a user. These commands are contained inside Menubutton.

Message

10 The Message widget is used to display multiline text fields for accepting values from a user.

Radiobutton

11 The Radiobutton widget is used to display a number of options as radio buttons. The user can select only one option at a time.

12 **Scale**

The Scale widget is used to provide a slider widget.

Scrollbar

13 The Scrollbar widget is used to add scrolling capability to various widgets, such as list boxes.

14 **Text**

The Text widget is used to display text in multiple lines.

15 **Toplevel**

The Toplevel widget is used to provide a separate window container.

Spinbox

16 The Spinbox widget is a variant of the standard Tkinter Entry widget, which can be used to select from a fixed number of values.

PanedWindow

17 A PanedWindow is a container widget that may contain any number of panes, arranged horizontally or vertically.

LabelFrame

18 A labelframe is a simple container widget. Its primary purpose is to act as a spacer or container for complex window layouts.

19	**tkMessageBox** This module is used to display message boxes in your applications.

Let us study these widgets in detail.

Standard Attributes

Let us look at how some of the common attributes, such as sizes, colors and fonts are specified.

Dimensions

Colors

Fonts

Anchors

Relief styles

Bitmaps

Cursors

Let us study them briefly −

Geometry Management

All Tkinter widgets have access to the specific geometry management methods, which have the purpose of organizing widgets throughout the parent widget area. Tkinter exposes the following geometry manager classes: pack, grid, and place.

The pack() Method − This geometry manager organizes widgets in blocks before placing them in the parent widget.

The grid() Method − This geometry manager organizes widgets in a table-like structure in the parent widget.

The place() Method − This geometry manager organizes widgets by placing them in a specific position in the parent widget.

Let us study the geometry management methods briefly −

SimpleDialog

The simpledialog module in tkinter package includes a dialog class and convenience functions for accepting user input through a modal dialog. It consists of a label, an entry widget and two buttons Ok and Cancel. These functions are −

askfloat(title, prompt, **kw) – Accepts a floating point number.

askinteger(title, prompt, **kw) – Accepts an integer input.

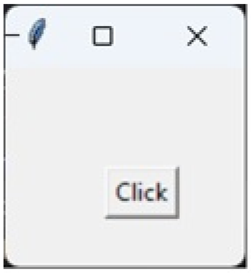
askstring(title, prompt, **kw) – Accepts a text input from the user.

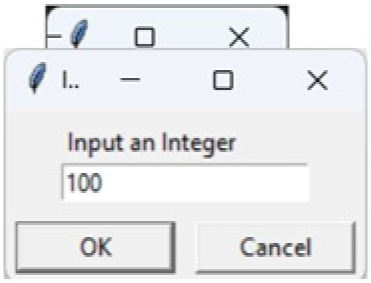
The above three functions provide dialogs that prompt the user to enter a value of the desired type. If Ok is pressed, the input is returned, if Cancel is pressed, None is returned.

askinteger

```
from tkinter.simpledialog import askinteger
from tkinter import *
from tkinter import messagebox
top = Tk()

top.geometry("100x100")
def show():
   num = askinteger("Input", "Input an Integer")
   print(num)

B = Button(top, text ="Click", command = show)
B.place(x=50,y=50)

top.mainloop()
```

It will produce the following **output** –





Input an Integer

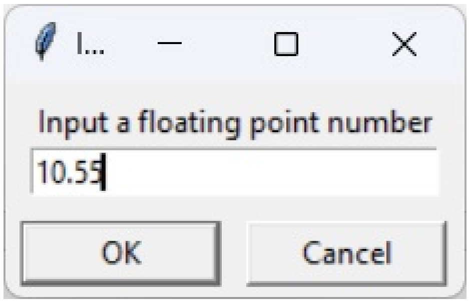
100

askfloat

```
from tkinter.simpledialog import askfloat
from tkinter import *
top = Tk()
```

```
top.geometry("100x100")
def show():
   num = askfloat("Input", "Input a floating point number")
   print(num)

B = Button(top, text ="Click", command = show)
B.place(x=50,y=50)

top.mainloop()
```

It will produce the following **output** −



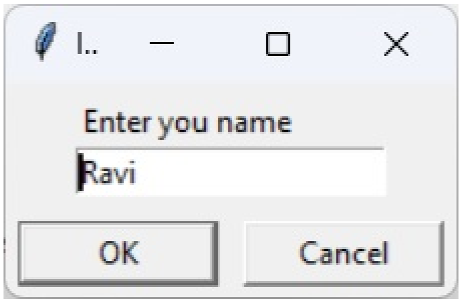
Input a floating point number

10.55

askstring

```
from tkinter.simpledialog import askstring
from tkinter import *

top = Tk()

top.geometry("100x100")
def show():
   name = askstring("Input", "Enter you name")
   print(name)

B = Button(top, text ="Click", command = show)
B.place(x=50,y=50)

top.mainloop()
```

It will produce the following **output** −



Enter you name

Ravi

The FileDialog Module

The filedialog module in Tkinter package includes a FileDialog class. It also defines convenience functions that enable the user to perform open file, save file, and open directory activities.

filedialog.asksaveasfilename()

filedialog.asksaveasfile()

filedialog.askopenfilename()

filedialog.askopenfile()

filedialog.askdirectory()

filedialog.askopenfilenames()

filedialog.askopenfiles()

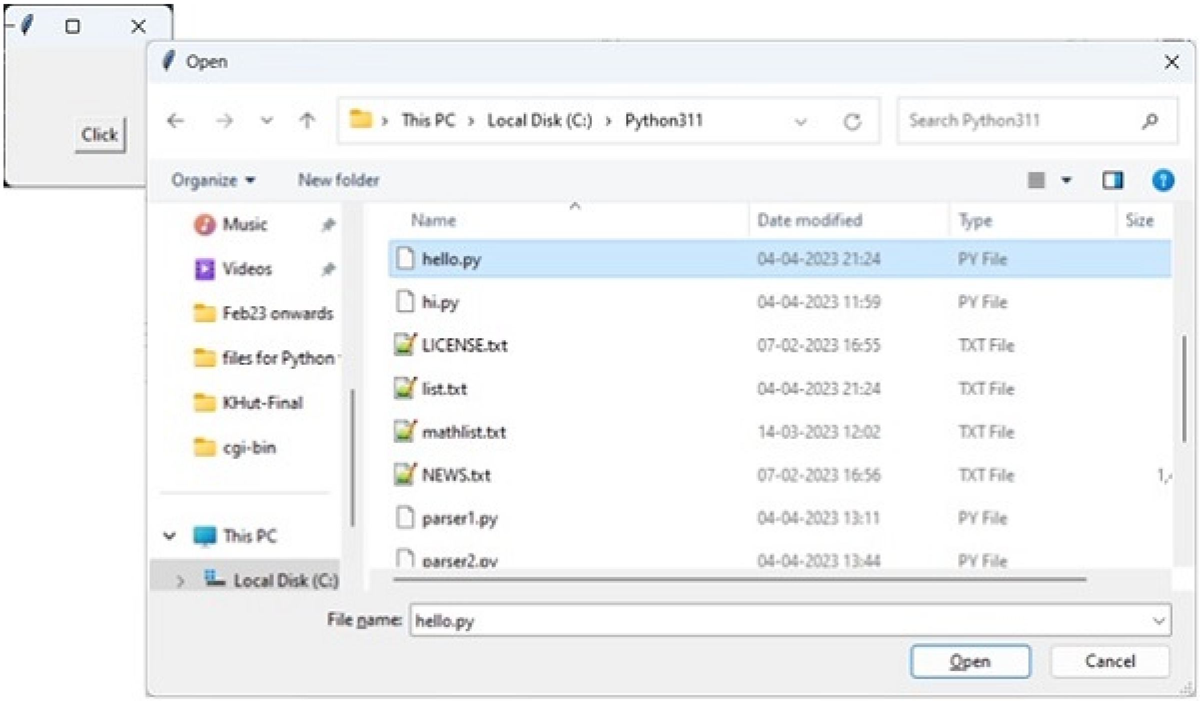
askopenfile

This function lets the user choose a desired file from the filesystem. The file dialog window has Open and Cancel buttons. The file name along with its path is returned when Ok is pressed, None if Cancel is pressed.

```
from tkinter.filedialog import askopenfile
from tkinter import *

top = Tk()

top.geometry("100x100")
def show():
   filename = askopenfile()
   print(filename)

B = Button(top, text ="Click", command = show)
B.place(x=50,y=50)
```

```
top.mainloop()
```

It will produce the following **output** –



Name	Date modified	Type	Size
hello.py	04-04-2023 21:24	PY File	
hi.py	04-04-2023 11:59	PY File	
LICENSE.txt	07-02-2023 16:55	TXT File	
list.txt	04-04-2023 21:24	TXT File	
mathlist.txt	14-03-2023 12:02	TXT File	
NEWS.txt	07-02-2023 16:56	TXT File	1,
parser1.py	04-04-2023 13:11	PY File	
parser2.py	04-04-2023 13:44	PY File	

File name: hello.py

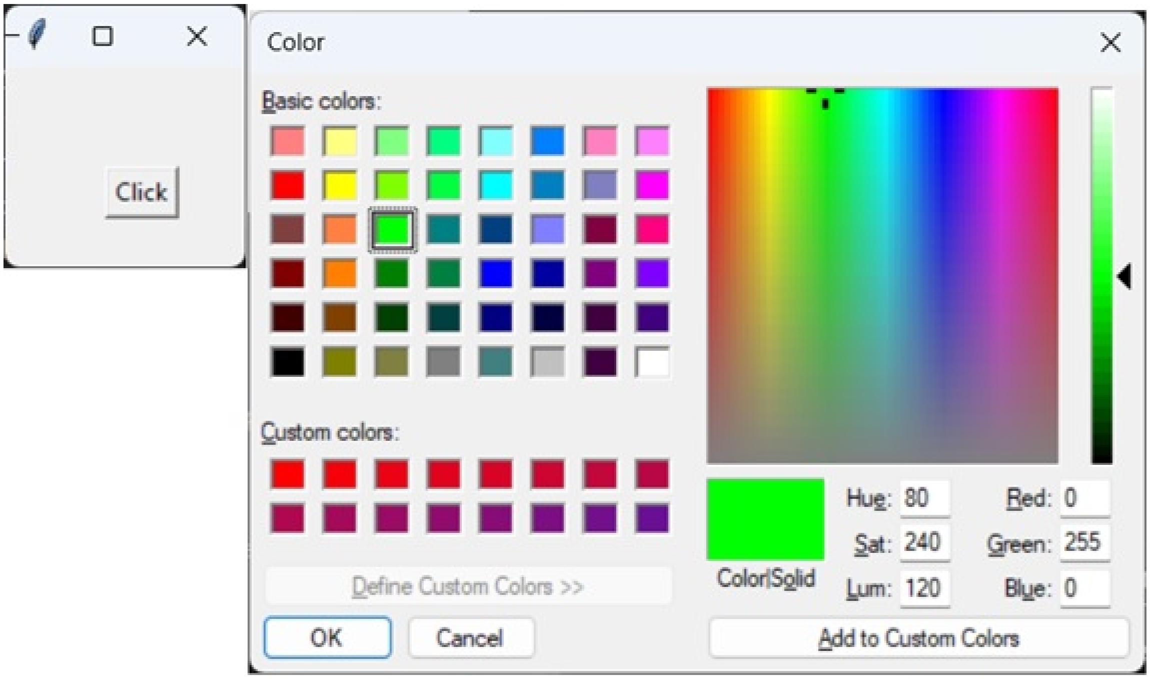
ColorChooser

The colorchooser module included in tkinter package has the feature of letting the user choose a desired color object through the color dialog. The askcolor() function presents with the color dialog with predefined color swatches and facility to choose custome color by setting RGB values. The dialog returns a tuple of RGB values of chosen color as well as its hex value.

```
from tkinter.colorchooser import askcolor
from tkinter import *

top = Tk()

top.geometry("100x100")
def show():
   color = askcolor()
   print(color)

B = Button(top, text ="Click", command = show)
B.place(x=50,y=50)
```

```
top.mainloop()
```

It will produce the following **output** −



Hue: 80
Sat: 240
Lum: 120
Red: 0
Green: 255
Blue: 0

```
((0, 255, 0), '#00ff00')
```

ttk module

The term ttk stands from Tk Themed widgets. The ttk module was introduced with Tk 8.5 onwards. It provides additional benefits including anti-aliased font rendering under X11 and window transparency. It provides theming and styling support for Tkinter.

The ttk module comes bundled with 18 widgets, out of which 12 are already present in Tkinter. Importing ttk over-writes these widgets with new ones which are designed to have a better and more modern look across all platforms.

The 6 new widgets in ttk are, the Combobox, Separator, Sizegrip, Treeview, Notebook and ProgressBar.

To override the basic Tk widgets, the import should follow the Tk import −

```
from tkinter import *
from tkinter.ttk import *
```

The original Tk widgets are automatically replaced by tkinter.ttk widgets. They are Button, Checkbutton, Entry, Frame, Label, LabelFrame, Menubutton, PanedWindow, Radiobutton, Scale and Scrollbar.

New widgets which gives a better look and feel across platforms; however, the replacement widgets are not completely compatible. The main difference is that widget options such as "fg", "bg" and others related to widget styling are no longer present in Ttk widgets. Instead, use the ttk.Style class for improved styling effects.

The new widgets in ttk module are −

- **Notebook** − This widget manages a collection of "tabs" between which you can swap, changing the currently displayed window.
- **ProgressBar** − This widget is used to show progress or the loading process through the use of animations.
- **Separator** − Used to separate different widgets using a separator line.
- **Treeview** − This widget is used to group together items in a tree-like hierarchy. Each item has a textual label, an optional image, and an optional list of data values.
- **ComboBox** − Used to create a dropdown list of options from which the user can select one.
- **Sizegrip** − Creates a little handle near the bottom-right of the screen, which can be used to resize the window.

Combobox Widget

The Python ttk Combobox presents a drop down list of options and displays them one at a time. It is a sub class of the widget Entry. Hence it inherits many options and methods from the Entry class.

Syntax

```
from tkinter import ttk

Combo = ttk.Combobox(master, values.......)
```

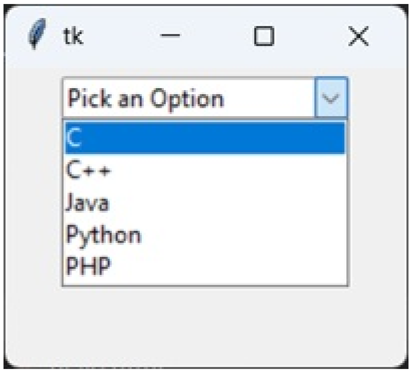
The get() function to retrieve the current value of the Combobox.

Example

```
from tkinter import *
from tkinter import ttk
```

```
top = Tk()
top.geometry("200x150")

frame = Frame(top)
frame.pack()

langs = ["C", "C++", "Java",
   "Python", "PHP"]

Combo = ttk.Combobox(frame, values = langs)
Combo.set("Pick an Option")
Combo.pack(padx = 5, pady = 5)
top.mainloop()
```

It will produce the following **output** −



Progressbar

The ttk ProgressBar widget, and how it can be used to create loading screens or show the progress of a current task.

Syntax

```
ttk.Progressbar(parent, orient, length, mode)
```

Parameters

Parent − The container in which the ProgressBar is to be placed, such as root or a Tkinter frame.

Orient – Defines the orientation of the ProgressBar, which can be either vertical of horizontal.

Length – Defines the width of the ProgressBar by taking in an integer value.

Mode – There are two options for this parameter, determinate and indeterminate.

Example

The code given below creates a progressbar with three buttons which are linked to three different functions.

The first function increments the "value" or "progress" in the progressbar by 20. This is done with the step() function which takes an integer value to change progress amount. (Default is 1.0)

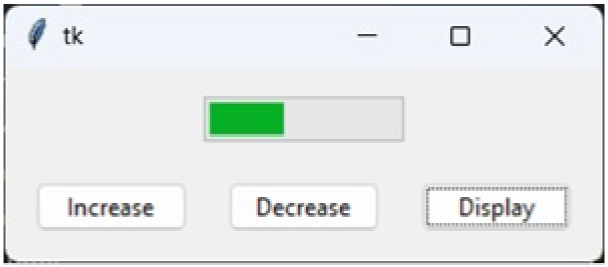
The second function decrements the "value" or "progress" in the progressbar by 20.

The third function prints out the current progress level in the progressbar.

```
import tkinter as tk
from tkinter import ttk

root = tk.Tk()
frame= ttk.Frame(root)
def increment():
   progressBar.step(20)

def decrement():
   progressBar.step(-20)

def display():
   print(progressBar["value"])

progressBar= ttk.Progressbar(frame, mode='determinate')
progressBar.pack(padx = 10, pady = 10)

button= ttk.Button(frame, text= "Increase", command= increment)
button.pack(padx = 10, pady = 10, side = tk.LEFT)

button= ttk.Button(frame, text= "Decrease", command= decrement)
button.pack(padx = 10, pady = 10, side = tk.LEFT)
button= ttk.Button(frame, text= "Display", command= display)
button.pack(padx = 10, pady = 10, side = tk.LEFT)
```

```
frame.pack(padx = 5, pady = 5)
```

It will produce the following **output** −



Notebook

Tkinter ttk module has a new useful widget called Notebook. It is a of collection of of containers (e.g frames) which have many widgets as children inside.

Each "tab" or "window" has a tab ID associated with it, which is used to determine which tab to swap to.

You can swap between these containers like you would on a regular text editor.

Syntax

```
notebook = ttk.Notebook(master, *options)
```

Example

In this example, add 3 windows to our Notebook widget in two different ways. The first method involves the add() function, which simply appends a new tab to the end. The other method is the insert() function which can be used to add a tab to a specific position.

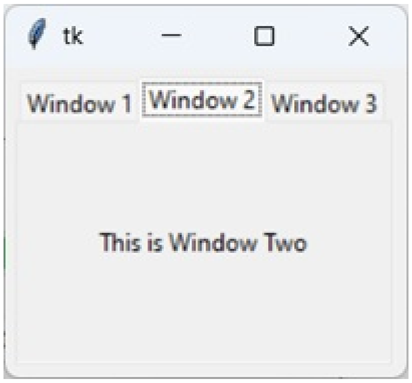
The add() function takes one mandatory parameter which is the container widget to be added, and the rest are optional parameters such as text (text to be displayed as tab title), image and compound.

The insert() function requires a tab_id, which defines the location where it should be inserted. The tab_id can be either an index value or it can be string literal like "end", which will append it to the end.

```
import tkinter as tk
from tkinter import ttk
```

```
root = tk.Tk()
nb = ttk.Notebook(root)

# Frame 1 and 2
frame1 = ttk.Frame(nb)
frame2 = ttk.Frame(nb)

label1 = ttk.Label(frame1, text = "This is Window One")
label1.pack(pady = 50, padx = 20)
label2 = ttk.Label(frame2, text = "This is Window Two")
label2.pack(pady = 50, padx = 20)

frame1.pack(fill= tk.BOTH, expand=True)
frame2.pack(fill= tk.BOTH, expand=True)
nb.add(frame1, text = "Window 1")
nb.add(frame2, text = "Window 2")

frame3 = ttk.Frame(nb)
label3 = ttk.Label(frame3, text = "This is Window Three")
label3.pack(pady = 50, padx = 20)
frame3.pack(fill= tk.BOTH, expand=True)
nb.insert("end", frame3, text = "Window 3")
nb.pack(padx = 5, pady = 5, expand = True)
```

It will produce the following **output** −



This is Window Two

Treeview

The Treeview widget is used to display items in a tabular or hierarchical manner. It has support for features like creating rows and columns for items, as well as allowing items to have children as well, leading to a hierarchical format.

Syntax

```
tree = ttk.Treeview(container, **options)
```

Options

Sr.No.	Option & Description
1	**columns** A list of column names
2	**displaycolumns** A list of column identifiers (either symbolic or integer indices) specifying which data columns are displayed and the order in which they appear, or the string "#all".
3	**height** The number of rows visible.
4	**padding** Specifies the internal padding for the widget. Can be either an integer or a list of 4 values.
5	**selectmode** One of "extended", "browse" or "none". If set to "extended" (default), multiple items can be selected. If "browse", only a single item can be selected at a time. If "none", the selection cannot be changed by the user.
6	**show** A list containing zero or more of the following values, specifying which elements of the tree to display. The default is "tree headings", i.e., show all elements.

Example

In this example we will create a simple Treeview ttk Widget and fill in some data into it. We have some data already stored in a list which will be reading and adding to the Treeview widget in our read_data() function.

We first need to define a list/tuple of column names. We have left out the column "Name" because there already exists a (default) column with a blank name.

We then assign that list/tuple to the columns option in Treeview, followed by defining the "headings", where the column is the actual column, whereas the heading is just the title of the column that appears when the widget is displayed. We give each a column a name. "#0" is the name of the default column.

The tree.insert() function has the following parameters −

Parent – which is left as an empty string if there is none.

Position – where we want to add the new item. To append, use tk.END

Iid – which is the item ID used to later track the item in question.

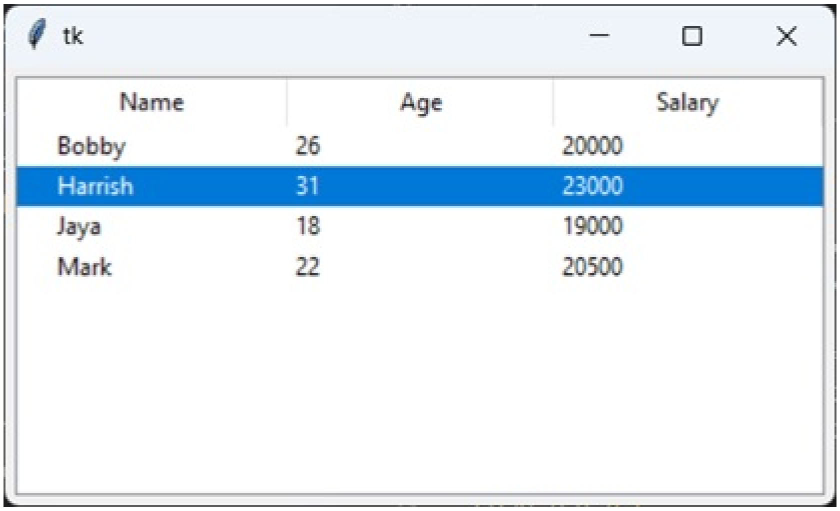
Text – to which we will assign the first value in the list (the name).

Value we will pass the the other 2 values we obtained from the list.

The Complete Code

```
import tkinter as tk
import tkinter.ttk as ttk
from tkinter import simpledialog

root = tk.Tk()
data = [
   ["Bobby",26,20000],
   ["Harrish",31,23000],
   ["Jaya",18,19000],
   ["Mark",22, 20500],
]
index=0
def read_data():
   for index, line in enumerate(data):
      tree.insert('', tk.END, iid = index,
         text = line[0], values = line[1:])
columns = ("age", "salary")

tree= ttk.Treeview(root, columns=columns ,height = 20)
tree.pack(padx = 5, pady = 5)

tree.heading('#0', text='Name')
tree.heading('age', text='Age')
tree.heading('salary', text='Salary')

read_data()
root.mainloop()
```

It will produce the following **output** –



Name	Age	Salary
Bobby	26	20000
Harrish	31	23000
Jaya	18	19000
Mark	22	20500

Sizegrip

The Sizegrip widget is basically a small arrow-like grip that is typically placed at the bottom-right corner of the screen. Dragging the Sizegrip across the screen also resizes the container to which it is attached to.

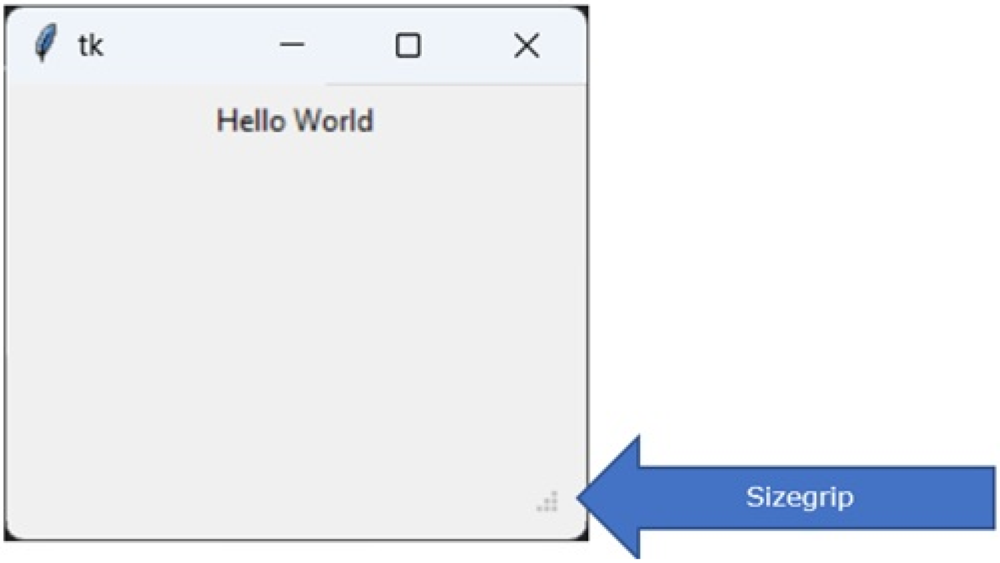
Syntax

```
sizegrip = ttk.Sizegrip(parent, **options)
```

Example

```
import tkinter as tk
import tkinter.ttk as ttk

root = tk.Tk()
root.geometry("100x100")

frame = ttk.Frame(root)
label = ttk.Label(root, text = "Hello World")
label.pack(padx = 5, pady = 5)
sizegrip = ttk.Sizegrip(frame)
sizegrip.pack(expand = True, fill = tk.BOTH, anchor = tk.SE)
frame.pack(padx = 10, pady = 10, expand = True, fill = tk.BOTH)

root.mainloop()
```

It will produce the following **output** −



Separator

The ttk Separator widget is a very simple widget, that has just one purpose and that is to help "separate" widgets into groups/partitions by drawing a line between them. We can change the orientation of this line (separator) to either horizontal or vertical, and change its length/height.

Syntax

```
separator = ttk.Separator(parent, **options)
```

The "orient", which can either be tk.VERTICAL or tk.HORIZTONAL, for a vertical and horizontal separator respectively.

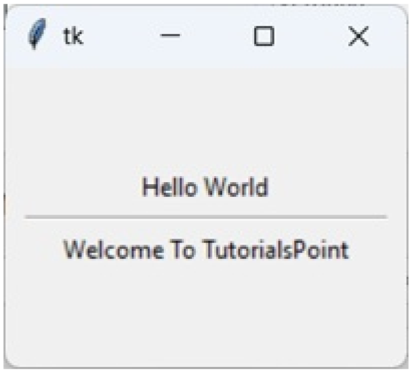
Example

Here we have created two Label widgets, and then created a Horizontal Separator between them.

```
import tkinter as tk
import tkinter.ttk as ttk

root = tk.Tk()
root.geometry("200x150")

frame = ttk.Frame(root)
```

```
label = ttk.Label(frame, text = "Hello World")
label.pack(padx = 5)

separator = ttk.Separator(frame,orient= tk.HORIZONTAL)
separator.pack(expand = True, fill = tk.X)

label = ttk.Label(frame, text = "Welcome To TutorialsPoint")
label.pack(padx = 5)

frame.pack(padx = 10, pady = 50, expand = True, fill = tk.BOTH)

root.mainloop()
```

It will produce the following **output** –



Hello World

Welcome To TutorialsPoint