Graphical user interfaces (GUI)

- Tkinter

primitive_calculator.py

```python
accumulator = 0

while True:
    print("Accumulator:", accumulator)
    print("Select:")
    print("  1: clear")
    print("  2: add")
    print("  3: subtract")
    print("  4: multiply")
    print("  5: quit")

    choice = int(input("Choice: "))

    if choice == 1: accumulator = 0
    if choice == 2: accumulator += int(input("add: "))
    if choice == 3: accumulator -= int(input("subtract: "))
    if choice == 4: accumulator *= int(input("multiply by: "))
    if choice == 5: break
```

Python shell

```
Accumulator: 0
Select:
  1: clear
  2: add
  3: subtract
  4: multiply
  5: quit
Choice: 2
add: 10
Accumulator: 10
Select:
  1: clear
  2: add
  3: subtract
  4: multiply
  5: quit
Choice: 2
add: 15
Accumulator: 25
Select:
...
```

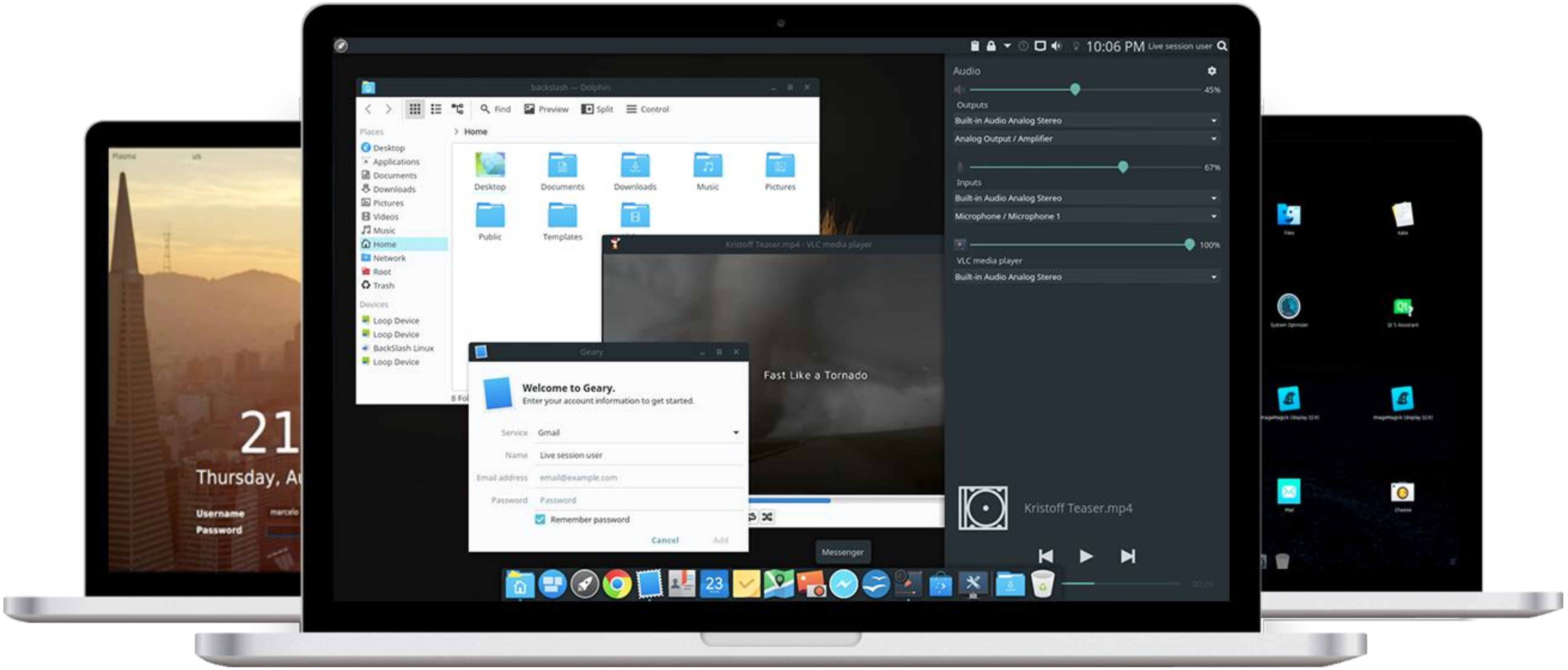
Python GUI’s (Graphical Users Interfaces)

- There is a long list of GUI frameworks and toolkits, designer tools
  - we will only briefly look at Tkinter
- GUI are, opposed to a text terminal, easier to use, more intuitive and flexible
- Windows, icons, menus, buttons, scrollbards mouse / touch / keyboard interaction etc.
- Operating system (e.g. Windows, maxOS, iOS, Linux, Android) can provides basic functionality in particular a windows manager
- Writing GUI applications from scratch can be painful – frameworks try to provide all standard functionality

```
YOU ARE STANDING AT THE END OF A ROAD BEFORE A SMALL BRICK BUILDING.
AROUND YOU IS A FOREST.  A SMALL STREAM FLOWS OUT OF THE BUILDING AND
DOWN A GULLY.
>ENTER BUILDING
YOU ARE INSIDE A BUILDING, A WELL HOUSE FOR A LARGE SPRING.
THERE ARE SOME KEYS ON THE GROUND HERE.
THERE IS A SHINY BRASS LAMP NEARBY.
THERE IS FOOD HERE.
THERE IS A BOTTLE OF WATER HERE.
>GET LAMP
OK
>INVENTORY
YOU ARE CURRENTLY HOLDING THE FOLLOWING:
BRASS LANTERN
>QUIT
DO YOU REALLY WANT TO QUIT NOW?
>Y
OK

YOU SCORED  27 OUT OF A POSSIBLE 350, USING   4 TURNS.
YOU ARE OBVIOUSLY A RANK AMATEUR.  BETTER LUCK NEXT TIME.
TO ACHIEVE THE NEXT HIGHER RATING, YOU NEED  9 MORE POINTS.

.
```

en.wikipedia.org/wiki/Colossal_Cave_Adventure

wiki.python.org/moin/GuiProgramming



BackSlash Linux GUI
www.backslashlinux.com

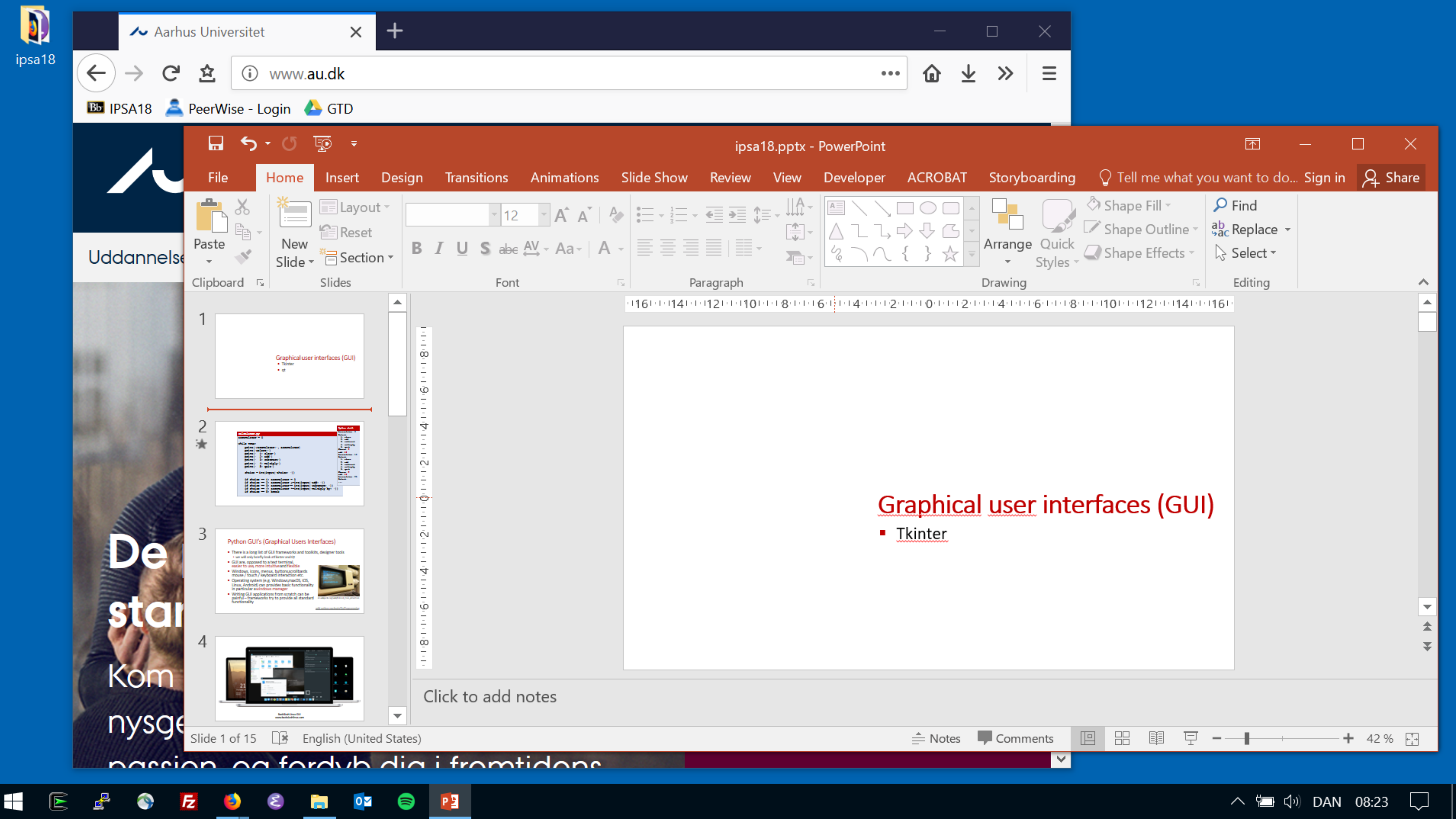
Tkinter

- “Tkinter is Python's de-facto standard GUI (Graphical User Interface) package. It is a thin object-oriented layer on top of Tcl/Tk.”
- “Tcl is a high-level, general-purpose, interpreted, dynamic programming language.”
- “Tk is a free and open-source, cross-platform widget toolkit that provides a library of basic elements of GUI widgets for building a graphical user interface (GUI) in many programming languages.”
- “The popular combination of Tcl with the Tk extension is referred to as Tcl/Tk, and enables building a graphical user interface (GUI) natively in Tcl. Tcl/Tk is included in the standard Python installation in the form of Tkinter.”

en.wikipedia.org

Terminology

- widgets (e.g. buttons, editable text fields, labels, scrollbars, menus, radio buttons, check buttons, canvas for drawing, frames...)
- events (e.g. mouse click, mouse entering/leaving, resizing windows, redraw requests, ...)
- listening (application waits for events to fired)
- event handler (a function whose purpose is to handle an event, many triggered by OS/Window manager)
- geometry managers (how to organize widgets in a window: Tkinter *pack*, *grid*, *place*)



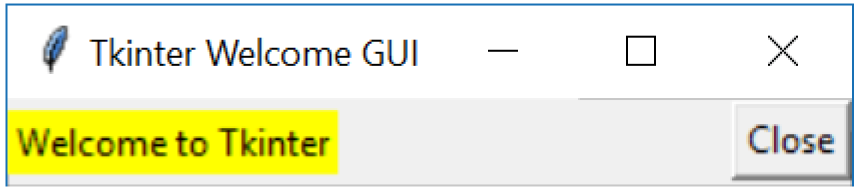
Graphical user interfaces (GUI)

- Tkinter

docs.python.org/3/library/tk.html

⚠ *“tkinter is also famous for having an outdated look and feel”*

Welcome example



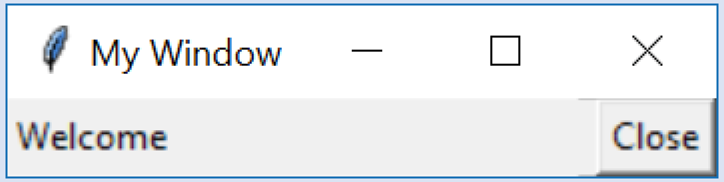
welcome.py

```
import tkinter

root = tkinter.Tk()  # root window

def do_quit():  # event handler for "Close" button
    root.destroy()

root.title("Tkinter Welcome GUI")

label = tkinter.Label(root, text="Welcome to Tkinter", background="yellow")
label.pack(side=tkinter.LEFT)
                                       # parent window
close_button = tkinter.Button(root, text="Close", command=do_quit)
close_button.pack(side=tkinter.RIGHT)

tkinter.mainloop()  # loop until all windows are closed/destroyed
```

Welcome example (class)

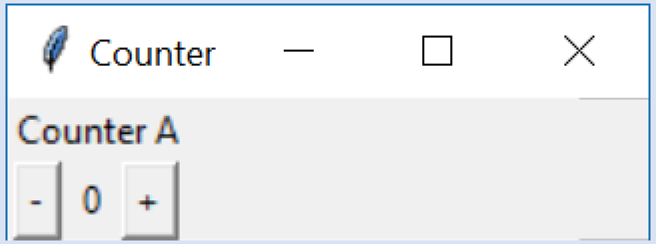
welcome_class.py

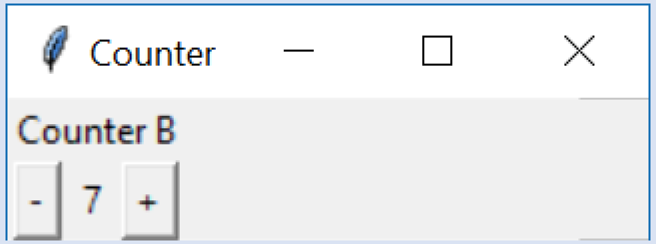
```
import tkinter

class Welcome:
    def do_quit(self):  # event handler for "Close"
        self.root.destroy()

    def __init__(self, window_title):
        self.root = tkinter.Tk()
        self.root.title(window_title)

        self.label = tkinter.Label(self.root, text="Welcome")
        self.label.pack(side=tkinter.LEFT)

        self.close_button = tkinter.Button(self.root, text="Close", command=self.do_quit)
        self.close_button.pack(side=tkinter.RIGHT)

Welcome("My Window")

tkinter.mainloop()
```



increment.py (part I)

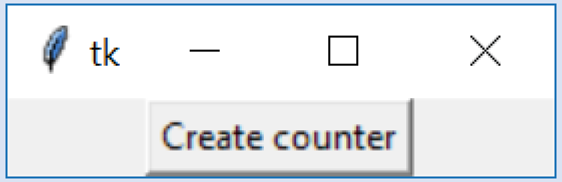
```
import tkinter

class Counter:
    def do_quit(self):
        self.root.destroy()
    def add(self, x):
        self.counter += x
        self.count.set(self.counter)
    def __init__(self, message):
        self.counter = 0
        self.root = tkinter.Toplevel()
        self.root.title("Counter")
        self.label = tkinter.Label(self.root, text=message)
        self.label.grid(row=0, columnspan=3)
        self.minus_button = tkinter.Button(self.root, text="-", command=lambda: self.add(-1))
        self.minus_button.grid(row=1, column=0)
        self.count = tkinter.IntVar()
        self.count_label = tkinter.Label(self.root, textvariable=self.count)
        self.count_label.grid(row=1, column=1)
        self.plus_button = tkinter.Button(self.root, text="+", command=lambda: self.add(+1))
        self.plus_button.grid(row=1, column=2)
```





increment.py (part II)

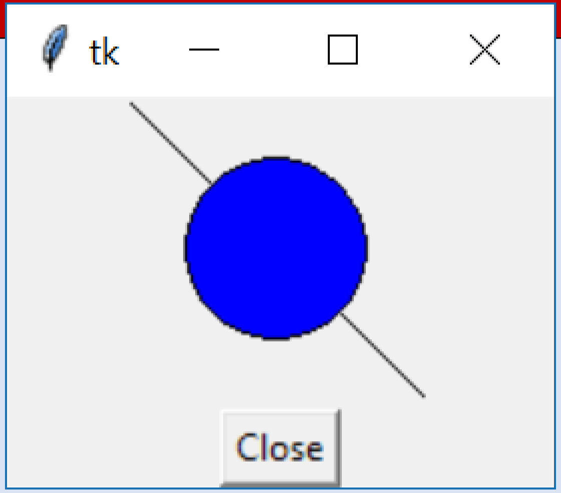
```
class Counter_app:
    def new_counter(self):
        Counter("Counter " + chr(ord('A') + self.counters))
        self.counters += 1

    def __init__(self):
        self.counters = 0

        self.root = tkinter.Tk()

        self.create = tkinter.Button(self.root, text="Create counter", command=self.new_counter)
        self.create.pack()

Counter_app()

tkinter.mainloop()
```

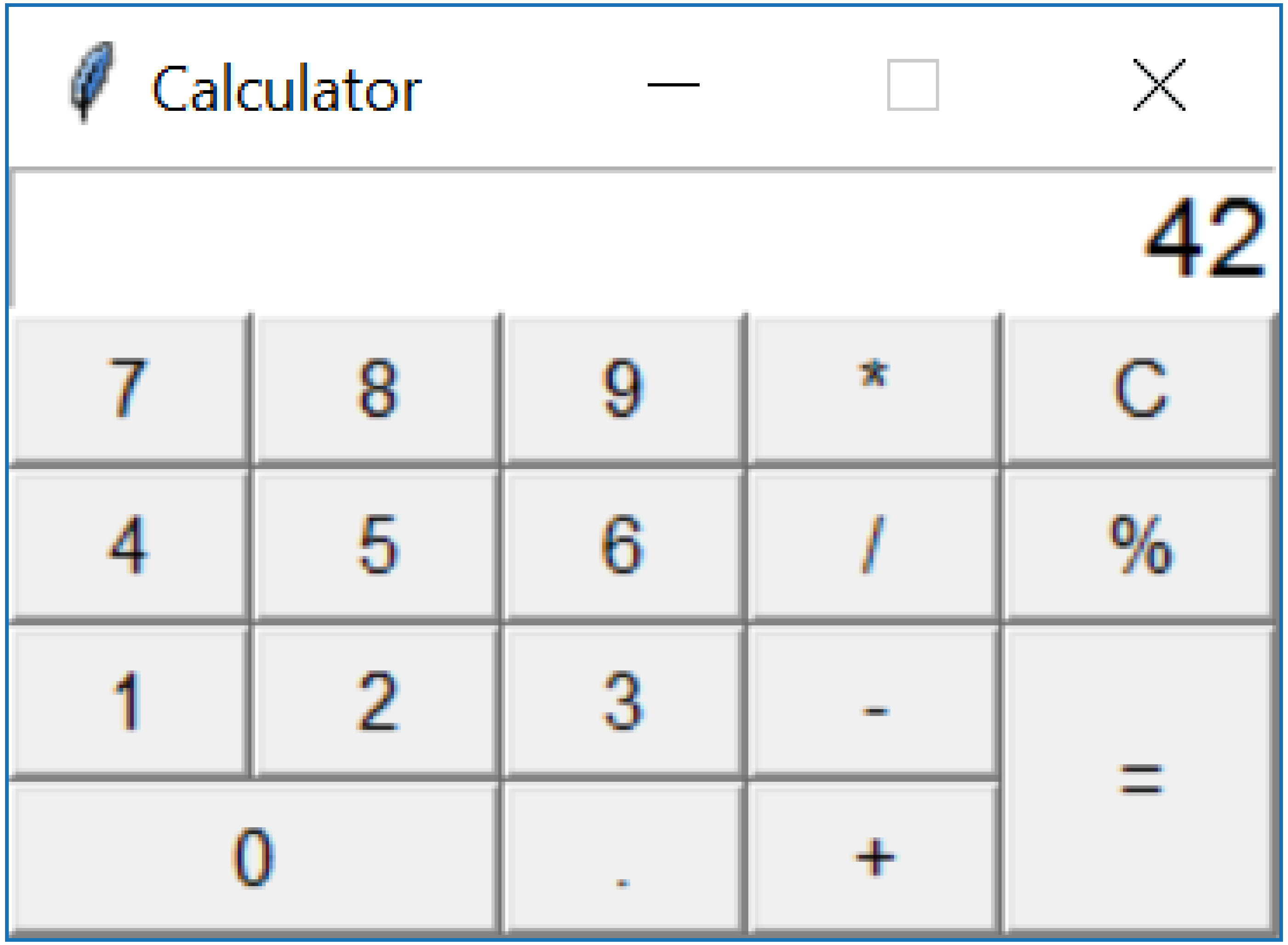


Canvas

canvas.py

```
import tkinter

root = tkinter.Tk()

canvas = tkinter.Canvas(root, width=100, height=100)
canvas.pack()
canvas.create_line(0, 0, 100, 100)
canvas.create_oval(20, 20, 80, 80, fill="blue")

close = tkinter.Button(root, text="Close", command=root.destroy)
close.pack()

tkinter.mainloop()
```




Calculator
42
7
8
9
*
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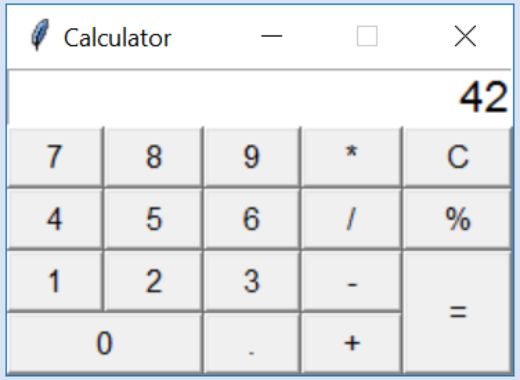
4
5
6
/
%
1
2
3
-
=
0
.
+

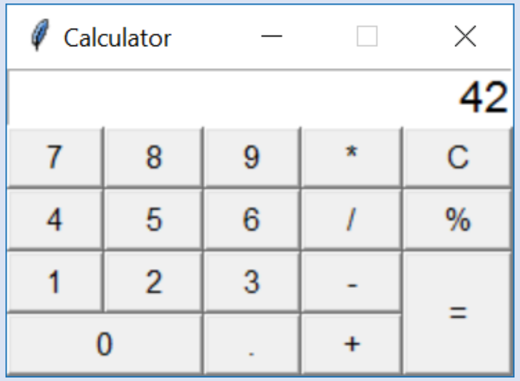
calculator.py (Part I)

```
import tkinter
from tkinter import messagebox

class Calculator:
    def __init__(self, root):
        self.root = root

        self.display = tkinter.Entry(self.root, font=("Helvetica", 16), justify=tkinter.RIGHT)
        self.display.insert(0, "0")
        self.display.grid(row=0, column=0, columnspan=5)

        self.button(1, 0, '7')
        self.button(1, 1, '8')
        self.button(1, 2, '9')
        self.button(1, 3, '*')
        self.button(1, 4, 'C', command=self.clearText)   # 'C' button
        self.button(2, 0, '4')
        self.button(2, 1, '5')
        self.button(2, 2, '6')
        self.button(2, 3, '/')
        self.button(2, 4, '%')
        self.button(3, 0, '1')
        self.button(3, 1, '2')
        self.button(3, 2, '3')
        self.button(3, 3, '-')
        self.button(3, 4, '=', rowspan=2, command=calculateExpression)   # '=' button
        self.button(4, 0, '0', columnspan=2)
        self.button(4, 2, '.')
        self.button(4, 3, '+')
```



calculator.py (Part II)

```
    def button(self, row, column, text, command=None, columnspan=1, rowspan=1):
        if command == None:
            command = lambda: self.appendToDisplay(text)
        B = tkinter.Button(self.root, font=("Helvetica", 11), text=text,command=command)
        B.grid(row=row, column=column, rowspan=rowspan, columnspan=columnspan, sticky="NWNESWSE")

    def clearText(self):
        self.replaceText("0")

    def replaceText(self, text):
        self.display.delete(0, tkinter.END)
        self.display.insert(0, text)

    def appendToDisplay(self, text):
        if self.display.get() == "0":
            self.replaceText(text)
        else:
            self.display.insert(tkinter.END, text)

    def calculateExpression(self):
        expression = self.display.get().replace("%", "/ 100")
        try:
            result = eval(expression)  # DON'T DO THIS !!!
            self.replaceText(result)
        except:
            messagebox.showinfo("Message", "Invalid expression", icon="warning")

root = tkinter.Tk()
root.title("Calculator")
root.resizable(0, 0)

Calculator(root)

tkinter.mainloop()
```


Calculator
42
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9
*
C
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6
/
%
1
2
3
-
=
0
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+