1) **Syntax of while loop**

Syntax:

```
While (Expression):
    CODE BLOCK
```

Example:

Let's write a program to display 1 to 10 using the while loop.

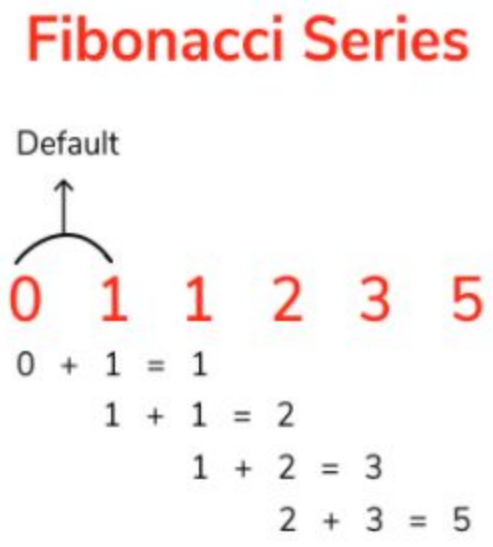
```
i = 1
while i <= 10 :
    print( i )
    i = i + 1
```

Output:

```
In [65]: runfile('C:/Users/SAURABH/Desktop/Python/whileloop.py',
wdir='C:/Users/SAURABH/Desktop/Python')
1
2
3
4
5
6
7
8
9
10
```

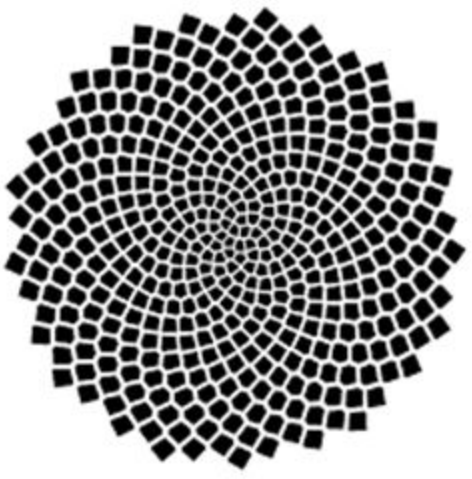
2) Fibonacci Series

0+1 =1, 1+1=2, 1+2=3, 2+3= 5, 3+5 = 8, 8+5 = 13, 5+13 = 21 ..and so on

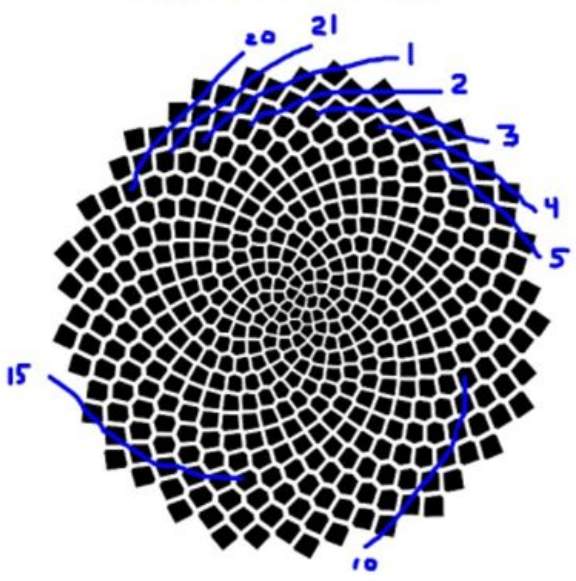


3) Fibonacci Series in Sunflower head

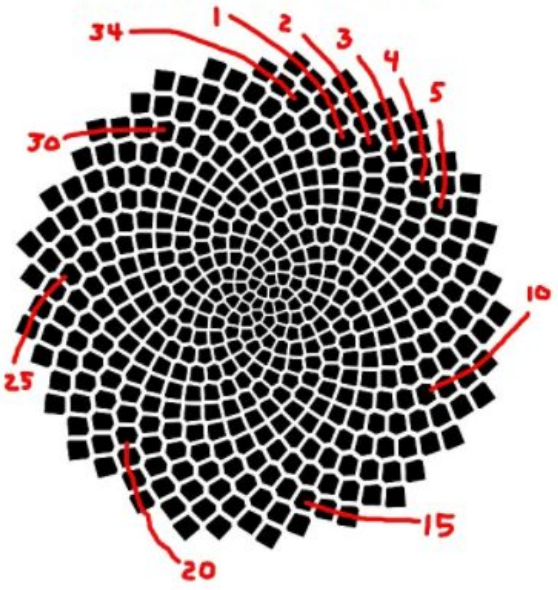
Sunflower seed spiral



Number of spirals to the right = 21

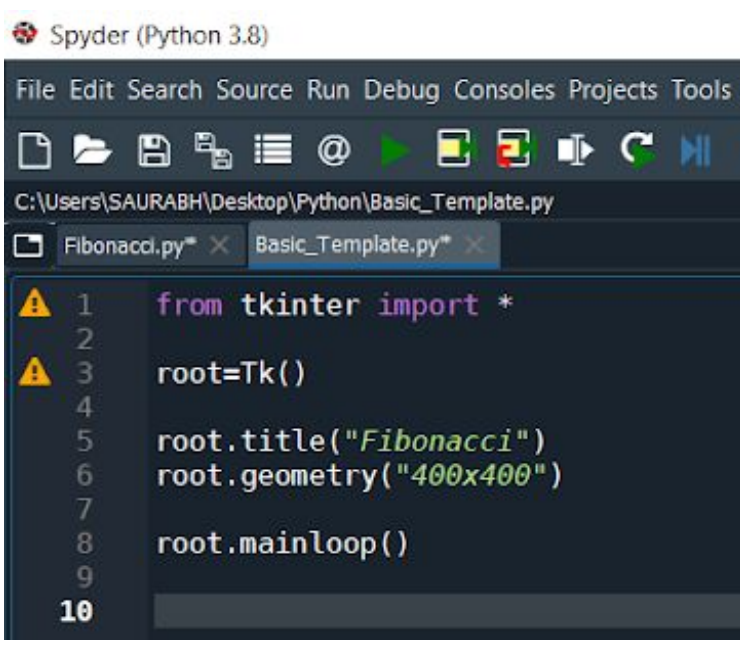


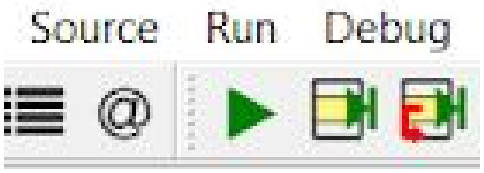
Number of spirals to the left = 34



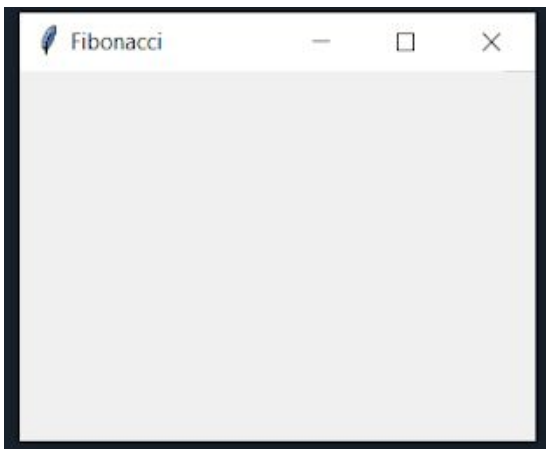
Number of spirals that are going to the right (21) + Number of spirals that are going to the left (34) = Total number of sprails (55)

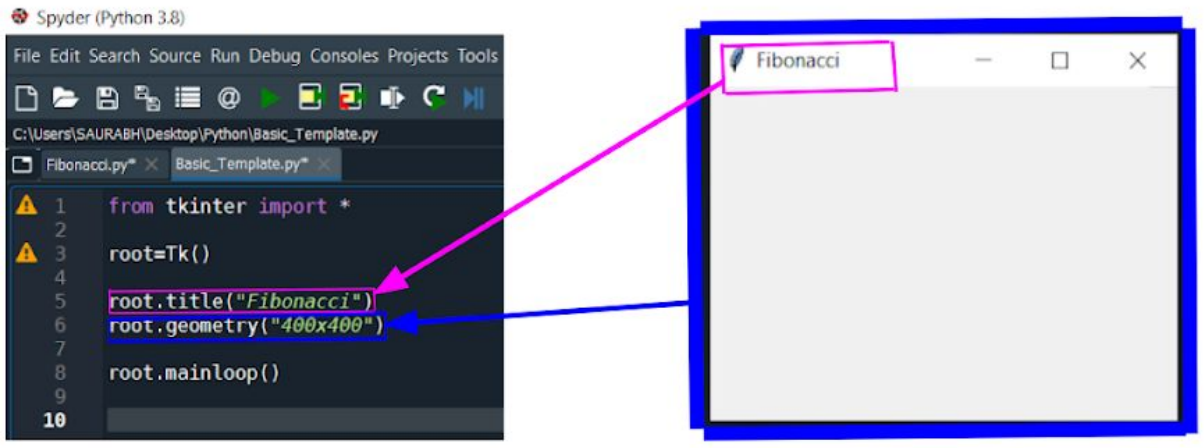
3) Basic template of Tkinter



To run press run - 

We get the following output, which is the root window named as Fibonacci.





1) Complete Code

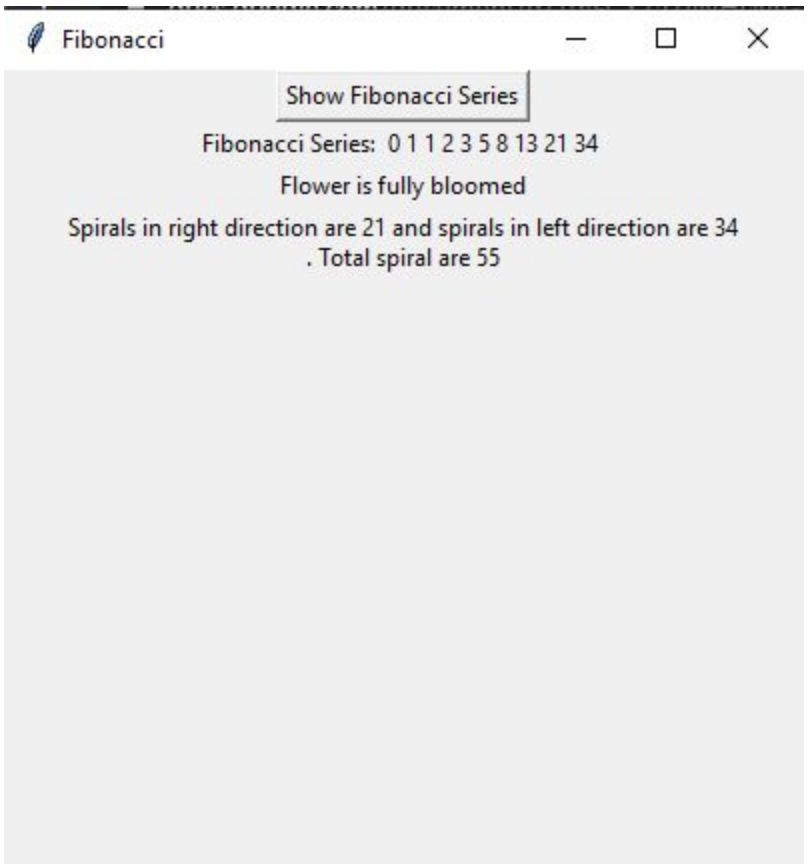
```
label_series = Label(root, text="Fibonacci Series:  ")
label_flower = Label(root)
label_spiral = Label(root)

def Fibonacci():
    num = 10

    first_no = 0
    second_no = 1
    sum = 0
    counter = 1
    while (counter <= num):
        label_series["text"] += str(sum) + " "
        counter = counter + 1
        first_no = second_no
        second_no = sum
        sum = first_no + second_no
    label_flower['text'] = "Flower is fully bloomed"
    label_spiral["text"] = "Spirals in right direction are " + str(first_no) + " and spirals in left
    direction are " + str(second_no) + "\n. Total spiral are " + str(sum)

btn = Button(root, text="Show Fibonacci Series", command=Fibonacci)

btn.pack()
label_series.pack()
label_flower.pack()
label_spiral.pack()
```

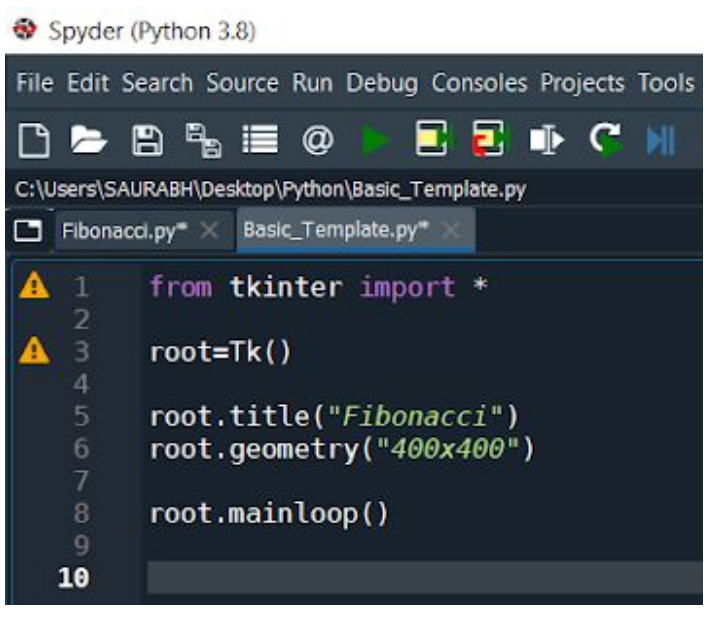


For better understanding lets take an example suppose that the num variable has value 5. Our First_no and second_no are fixed i.e 0 and 1 respectively.

sum variable will hold the fibonacci number generated

counter	first_no	second_no	sum
1	0	1	1
2	1	1	2
3	1	2	3
4	2	3	5
5	3	5	8

- **Code to create a basic template for tkinter**



- **Code to create labels**

```
label_series = Label(root, text="Fibonacci Series:  ")
label_flower = Label(root)
label_spiral = Label(root)
```

- **Code for Fibonacci function**

```
def Fibonacci():
    num = 10
    first_no = 0
    second_no = 1
    sum = 0
    counter = 1
    while (counter <= num):
        label_series["text"] += str(sum) + " "
        counter = counter + 1
        first_no = second_no
        second_no = sum
        sum = first_no + second_no
```

- **Code to update the label**

```
    label_flower['text'] = "Flower is fully bloomed"
    label_spiral["text"] = "Spirals in right direction are " + str(first_no) + " and spirals in left
    direction are " + str(second_no) + "\n. Total spiral are " + str(sum)
```

- **Code to create a button**

```
btn=Button(root,text="Show Fibonacci Series",command=Fibonacci)
btn.pack()
```

- **Mapping of GUI elements on the root window**

```
label_series = Label(root, text="Fibonacci Series:  ")
label_flower = Label(root)
label_spiral = Label(root)

def Fibonacci():
    num = 14
    first_no = 0
    second_no = 1
    sum = 0
    counter = 1

    while (counter <= num):
        label_series["text"] += str(sum) + " "
        counter = counter + 1
        first_no = second_no
        second_no = sum
        sum = first_no + second_no

    label_flower['text'] = "Flower is still blooming"
    label_spiral["text"] = "Spirals in right direction are " + " and spirals in left  direction are " +
    str(second_no) + ".\n Total spirals are " + str(sum)

btn = Button(root, text="Show Fibonacci Series", command=Fibonacci)
btn.pack()
label_series.pack()
label_flower.pack()
label_spiral.pack()
```