

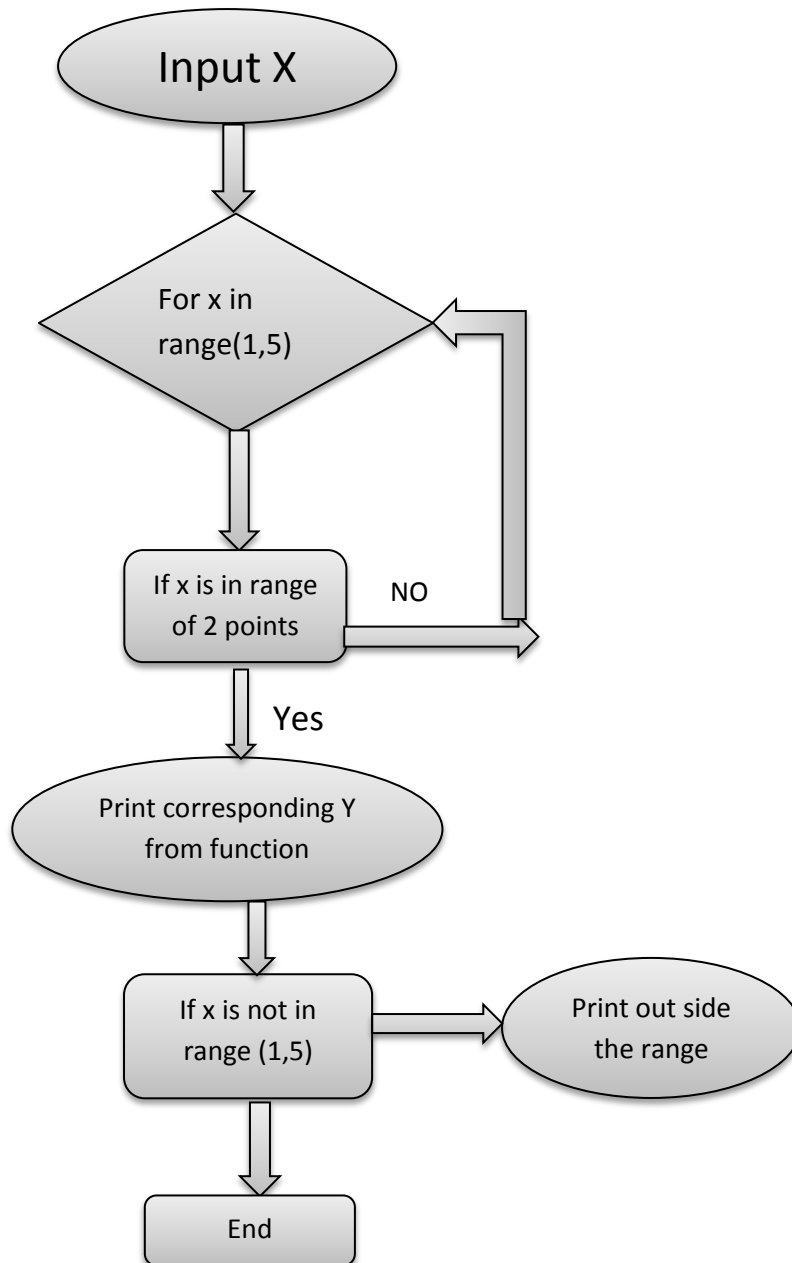
Assignment – 3 Interpolation

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Problem – 1

Method :



Results :

We run the program, it asks for the value of x and reply corresponding answer

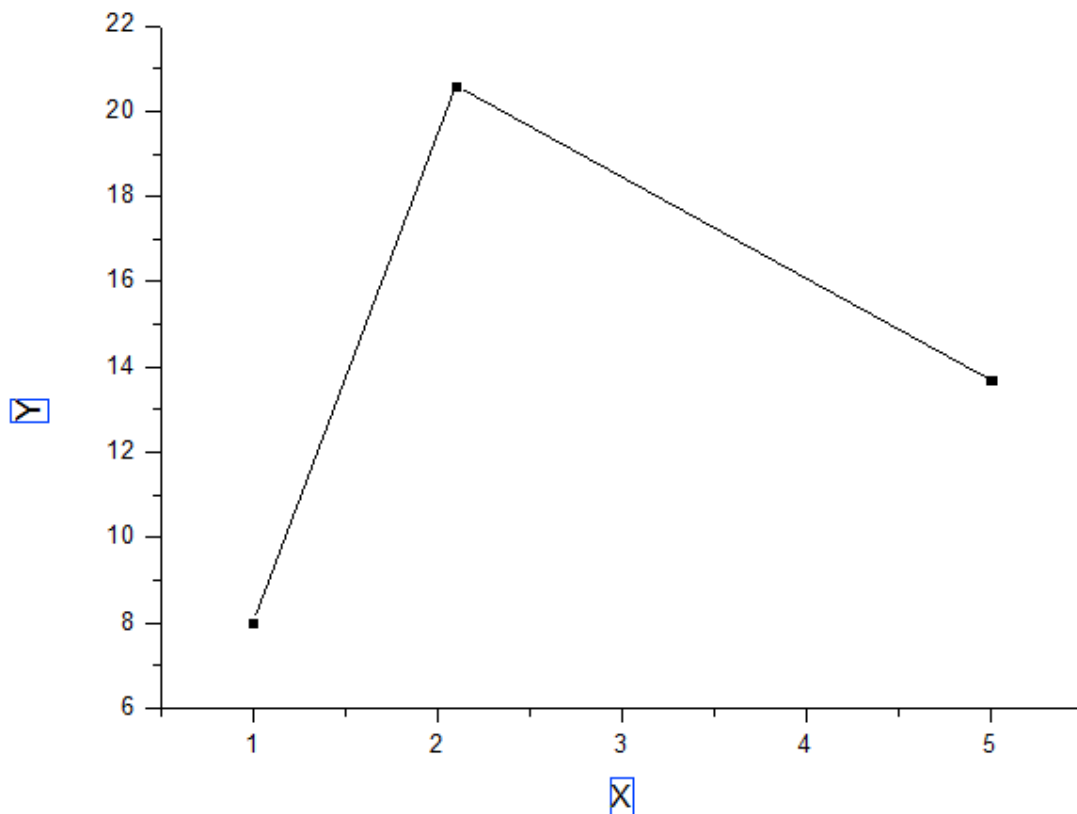
Enter the value of x : 4.2

15.603448275862068

Enter the value of x : 0.8

Out of range

Graph :



Discussion and Conclusion :

Instead of taking 3 points individually we defined an array, so that we can also use loop and it became clearer and easier.

Appendix :

`X = [1.0,2.1,5.0]`

`Y = [8.0,20.6,13.7]` *#x and y values of 3 data points are stored in two arrays*

`x = float(input("Enter the value of x : "))` *#Getting the x value from user*

`for i in range(2) :` *#to run the loop two times*

`if (X[i] <= x <= X[i+1]) :` *#checking whether the entered x is in given range or not*

`y = ((x - X[i])/(X[i+1] - X[i]))*(Y[i+1]-Y[i]) + Y[i]` *#assign the value to y by formula*

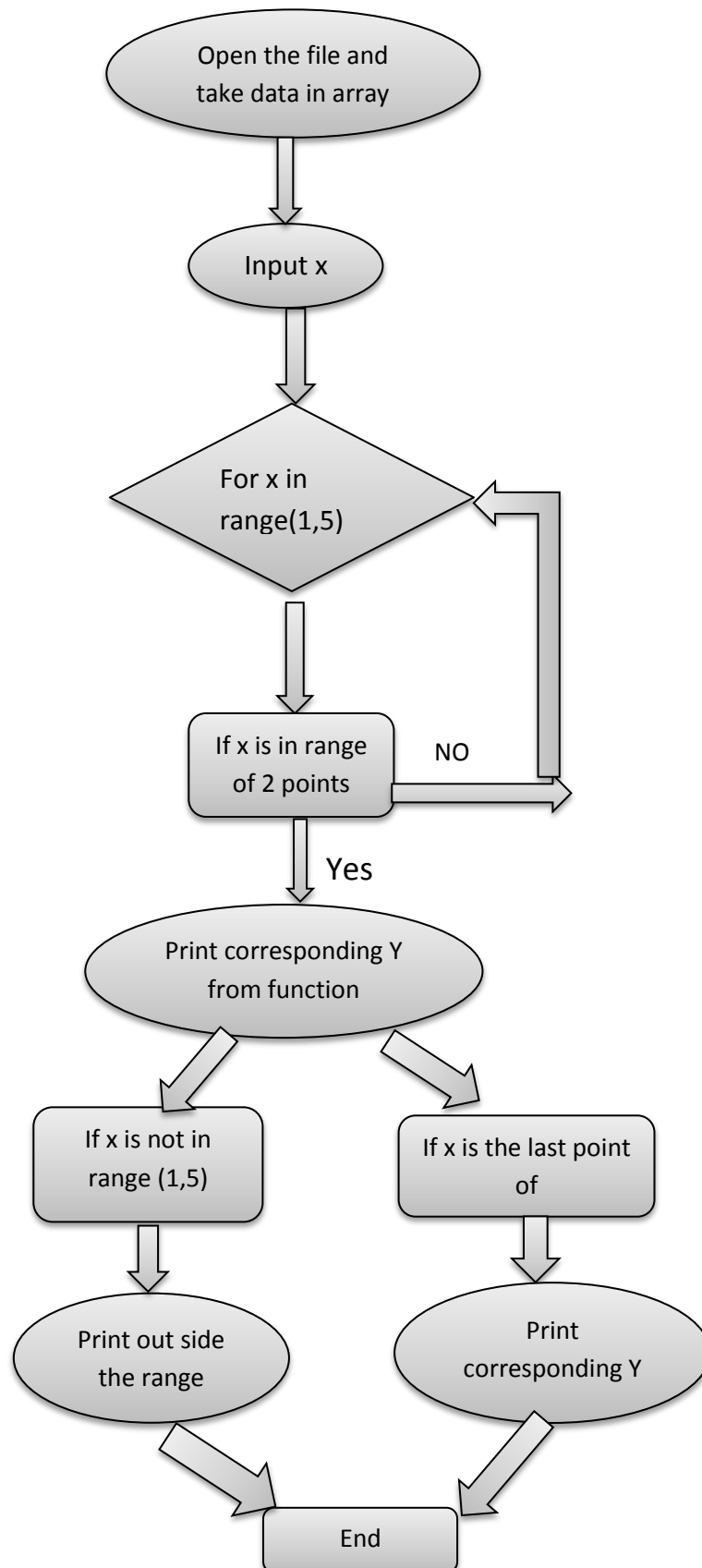
`print(y)` *#to print y*

`if(x < X[0] or x > X[2]) :` *#to check the x is not in the range*

`print("Out of range")`

Problem – 2 :

Method :



Result :

We run the program, it asks for the value of x and reply corresponding answer

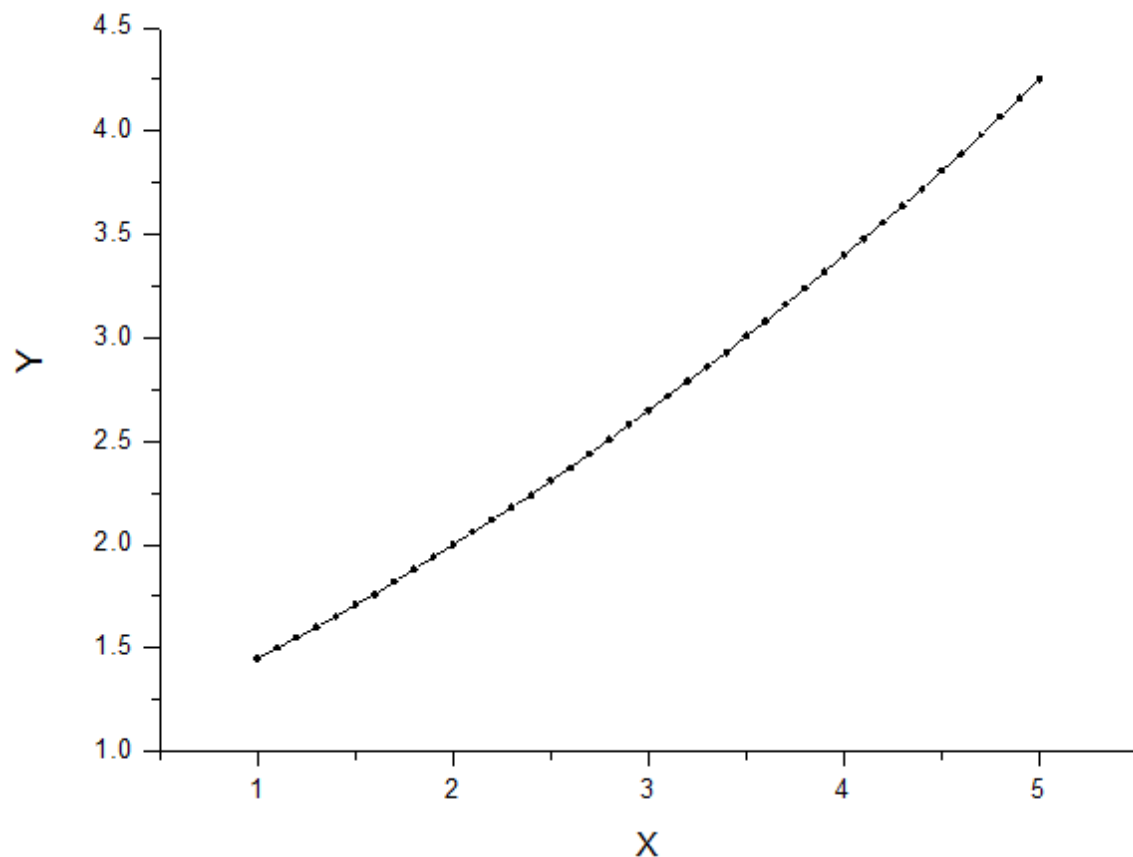
Enter the value of x : 1.6

1.76

Enter the value of x : 5.9

Out of range

Graph :



Discussion and Conclusion :

In this program we input a file to read data and store it in corresponding arrays. To run the loop we used **len()** function because we didn't given total number of data. All other things are same as problem 1.

Appendix :

```
X = []
```

```
Y = [] #Define arrays
```

```
f = open('points.dat','r') #To open the file in reading mode
```

```
for line in f: #run a loop to read line to line
```

```

t = line.split() #to split a line so that x and y data separated.
X.append(float(t[0]))
Y.append(float(t[1])) #taking data into corresponding arrays
f.close() #close the file
l = len(X) #to determine the length of array.
x = float(input("Enter the value of x : ")) #get value from user

for i in range(l-1): #to run the loop l-1 times
    if (X[i] <= x < X[i+1]) : #checking whether the entered x is in given range or not
        y = ((x - X[i])/(X[i+1] - X[i]))*(Y[i+1]-Y[i]) + Y[i] #assign the value to y by formula
        print(y) #print the value of y

if (x == X[l-1]): #check if the x is the last data point
    print(Y[l-1]) #print corresponding y

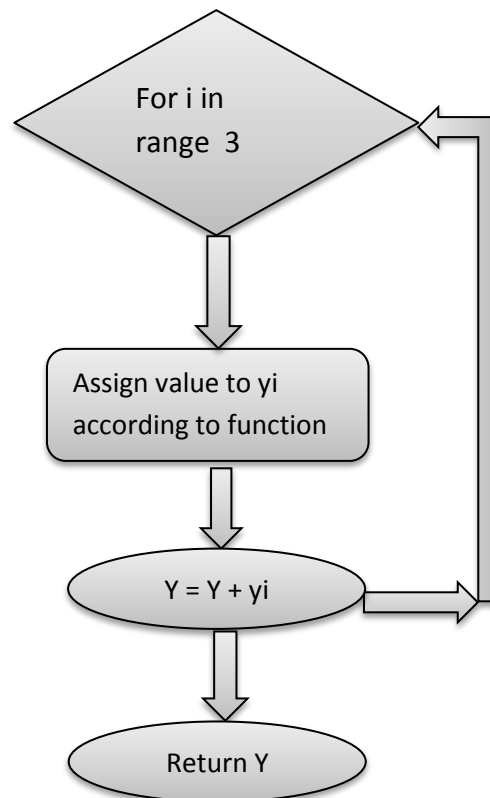
if (x < X[0] or x > X[l-1]) : #check if x is not in range
    print("Out of range")

```

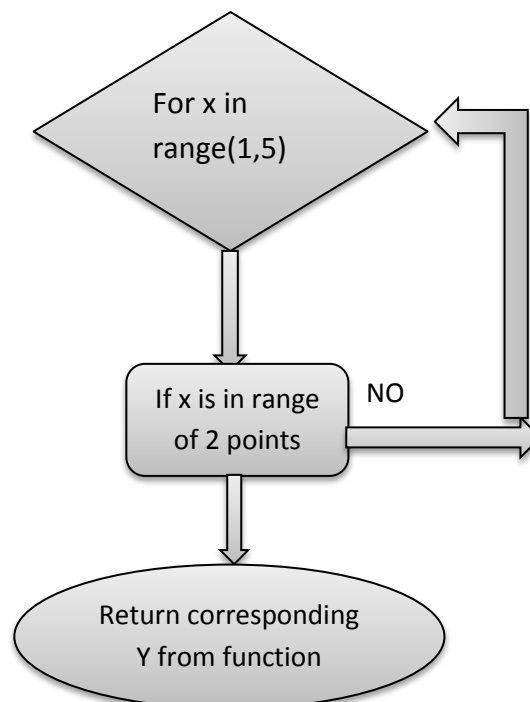
Problem : 3

Method :

Define
function for
Polynomial
fit



Define
function for
Linear fit

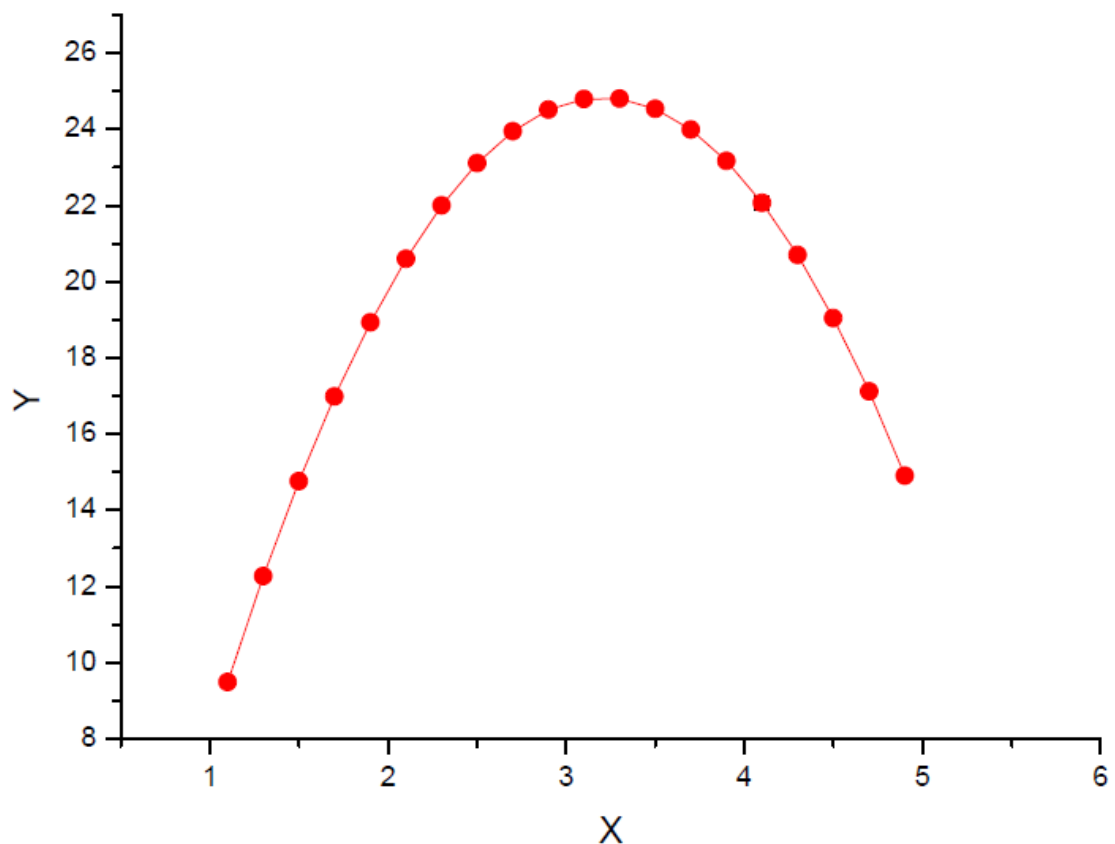


Print 'x and two functions and difference' for given range.

Result :

for data between 1.0 to 5.0 in step 0.2 we got following result.

x	Polynomial fit	Linear fit	Difference
1.1	9.491300940438872	9.145454545454546	0.345846394984326
1.3	12.266394984326022	11.436363636363637	0.8300313479623842
1.5	14.764811912225706	13.727272727272727	1.0375391849529798
1.7	16.986551724137932	16.018181818181816	0.9683699059561164
1.9	18.931614420062694	18.30909090909091	0.622523510971785
2.1	20.6 20.6 0.0		
2.3	21.991708463949845	20.124137931034486	1.8675705329153587
2.5	23.106739811912227	19.648275862068967	3.45846394984326
2.7	23.945094043887153	19.17241379310345	4.772680250783704
2.9	24.50677115987461	18.696551724137933	5.810219435736677
3.1	24.79177115987461	18.220689655172414	6.571081504702196
3.3	24.800094043887153	17.7448275862069	7.055266457680254
3.5	24.531739811912225	17.26896551724138	7.2627742946708445
3.7	23.986708463949842	16.79310344827586	7.193605015673981
3.9	23.165 16.317241379310346	6.847758620689653	
4.1	22.0666144200627	15.841379310344829	6.22523510971787
4.3	20.69155172413793	15.365517241379312	5.326034482758619
4.5	19.03981191222571	14.889655172413793	4.150156739811916
4.7	17.11139498432602	14.413793103448274	2.6976018808777447
4.9	14.906300940438868	13.937931034482757	0.968369905956111



Discussion and conclusion :

We doubled the length of array and appended same data points to avoid further calculation in finding out y in function P(x).

Appendix :

```
X = [1.0,2.1,5.0]
```

```
Y = [8.0,20.6,13.7] #define array
```

```
for i in range(3,5): #loop defined to append the data as mentioned in Discussion
```

```
    X.append(X[i-3])
```

```
    Y.append(Y[i-3])
```

```
def P(x): #Define function for polynomial fit
```

```
    y = 0
```

```
    for i in range(3): #to run the loop 3 times
```

```
        yi = Y[i]*((x-X[i+1])*(x-X[i+2]))/((X[i]-X[i+1])*(X[i]-X[i+2])) #calculate ith term as from formula
```

```
        y = y + yi #to sum all the terms
```

```
    return y
```

```
def L(x): #Define function for Linear fit
```

```
    for i in range(2): #to run the loop 2 times
```

```
        if (X[i] <= x <= X[i+1]): #Checking the x in given range
```

```
            y = ((x - X[i])/(X[i+1] - X[i]))*(Y[i+1]-Y[i]) + Y[i] #assigning value to y
```

```
            return(y)
```

```
print("x | Polynomial fit | Linear fit | Difference ")
```

```
for i in range(11,50,2): #To go from 1.1 to 5.0 in step size of 0.2
```

```
    j=i/10
```

```
    print(j," | ",P(j)," | ",L(j)," | ",P(j)-L(j))
```