#   --Temprature-Rainfall 1901-2016--

#   19F-0113 (CS),   19F-0171 (CS),   19F-0254 (CS),   19F-0931 (SE)

#   Talha Ahmad,   M. Talha Shehroze,   Muhammad Farhan,   Daniyal Ahmed

- ➔ **frontend.py**

```
from tkinter import *

from backend import *

from PIL import ImageTk,Image

import tkinter.font as font


root = Tk()

root.title("Pakistan's Rain-Temp Data")


myFont = font.Font(family='Montserrat', size=10)


def tempBarButtonClick():

   avgTMBarG()


def rainBarButtonClick():

   avgRMBarG()


def multiBarButtonClick():

   tempRainMultiBarChart()


def scatterTempButtonClick():

   scatterTempGraphFunc()


def scatterTempDecadeButtonClick():

   scatterTempGraphFuncDecade()


def scatterRainButtonClick():

   scatterRainGraphFunc()


def scatterRainDecadeButtonClick():

   scatterRainGraphFuncDecade()


def scatterMultiButtonClick():
    scatterMultiGraphFunc()

def scatterMultiDecadeButtonClick():
    scatterMultiGraphFuncDecade()

def boxPlotButtonClick():
    boxPlotTempRain()

def boxPlotDecadeButtonClick():
    boxPlotTempRainDecade()

def LRButtonClick():
    linearReg()

def LRButton2Click():
    linearReg2()

def textbuttonClick():

    def openFile():
        tf = open("dataset/statstext.txt", 'r')
        data = tf.read()
        txtarea.insert(END, data)
        tf.close()

    ws = Tk()
    ws.title("Statistics")
    ws.geometry("600x450")
    ws['bg']='#fb0'

    txtarea = Text(ws, width=70, height=22)
    txtarea.pack(pady=20)

    Button(ws,text="Calculate & Show Stats",command=openFile).pack(side=RIGHT, expand=True, fill=X, padx=20)
    ws.mainloop()

def OnHoverScatter(event):
    scatterButton.config(bg='black', fg='white')

def OnLeaveScatter(event):
    scatterButton.config(bg='green', fg='black')

def OnHoverTempScatter(event):
    scatterTempButton.config(bg='black', fg='white')

def OnLeaveTempScatter(event):
    scatterTempButton.config(bg='green', fg='black')

def OnHoverRainScatter(event):
    scatterRainButton.config(bg='black', fg='white')

def OnLeaveRainScatter(event):
   scatterRainButton.config(bg='green', fg='black')

def OnHoverScatterDecade(event):
    scatterButtonDecade.config(bg='black', fg='white')

def OnLeaveScatterDecade(event):
    scatterButtonDecade.config(bg='green', fg='black')

def OnHoverTempScatterDecade(event):
    scatterTempButtonDecade.config(bg='black', fg='white')

def OnLeaveTempScatterDecade(event):
    scatterTempButtonDecade.config(bg='green', fg='black')

def OnHoverRainScatterDecade(event):
    scatterRainButtonDecade.config(bg='black', fg='white')

def OnLeaveRainScatterDecade(event):
   scatterRainButtonDecade.config(bg='green', fg='black')

def OnHoverBarTemp(event):
    rainBarButton.config(bg='black', fg='white')
```

```
def OnLeaveBarTemp(event):

    rainBarButton.config(bg='green', fg='black')


def OnHoverBarRain(event):

    tempBarButton.config(bg='black', fg='white')


def OnLeaveBarRain(event):

    tempBarButton.config(bg='green', fg='black')


def OnHoverMultiBar(event):

    multiBarButton.config(bg='black', fg='white')


def OnLeaveMultiBar(event):

    multiBarButton.config(bg='green', fg='black')


def OnHoverBoxPlot(event):

    boxPlotButton.config(bg='black', fg='white')


def OnLeaveBoxPlot(event):

    boxPlotButton.config(bg='green', fg='black')


def OnLeaveBoxPlotDecade(event):

    boxPlotDecadeButton.config(bg='green', fg='black')


def OnHoverBoxPlotDecade(event):

    boxPlotDecadeButton.config(bg='black', fg='white')


def OnHoverText(event):

    TextButton.config(bg='black', fg='white')


def OnLeaveText(event):

    TextButton.config(bg='green', fg='black')


def OnHoverLR(event):

    LRButton.config(bg='black', fg='white')
```

```
def OnLeaveLR(event):

    LRButton.config(bg='green', fg='black')


def OnHoverLR2(event):

    LRButton2.config(bg='black', fg='white')


def OnLeaveLR2(event):

    LRButton2.config(bg='green', fg='black')


backgroundImage = Image.open("images/Background.jpg")

resizedBackground = backgroundImage.resize((1920,1080),Image.ANTIALIAS)

newBackground = ImageTk.PhotoImage(resizedBackground)

backgroundLabel = Label( root, image =newBackground)

backgroundLabel.place(x = 0, y = 0)


multiBarButton = Button(root,text="Multi Bar Graph",width=42,height=2,command=multiBarButtonClick, bg='green',
relief='groove')

multiBarButton.bind('<Enter>', OnHoverMultiBar)

multiBarButton.bind('<Leave>', OnLeaveMultiBar)

multiBarButton['font'] = myFont

multiBarButton.place(x=620, y= 260)


tempBarButton = Button(root,text="Temp Bar Graph",width=42,height=2,command=tempBarButtonClick, bg='green',
relief='groove')

tempBarButton.bind('<Enter>', OnHoverBarRain)

tempBarButton.bind('<Leave>', OnLeaveBarRain)

tempBarButton['font'] = myFont

tempBarButton.place(x=420, y= 320)


rainBarButton = Button(root,text="Rain Bar Graph",width=42,height=2,command=rainBarButtonClick, bg='green',
relief='groove')

rainBarButton.bind('<Leave>', OnLeaveBarTemp)

rainBarButton.bind('<Enter>', OnHoverBarTemp)

rainBarButton['font'] = myFont

rainBarButton.place(x=820, y= 320)


scatterTempButton = Button(root,text="Temp Line Plot by Month",width=42,height=2,command=scatterTempButtonClick,
bg='green', relief='groove')
```

```
scatterTempButton.bind('<Enter>', OnHoverTempScatter)

scatterTempButton.bind('<Leave>', OnLeaveTempScatter)

scatterTempButton['font'] = myFont

scatterTempButton.place(x=420, y= 380)


scatterRainButton = Button(root,text="Rain Line Plot by Month",width=42,height=2,command=scatterRainButtonClick, bg='green', relief='groove')

scatterRainButton.bind('<Enter>', OnHoverRainScatter)

scatterRainButton.bind('<Leave>', OnLeaveRainScatter)

scatterRainButton['font'] = myFont

scatterRainButton.place(x=420, y= 440)


scatterButton = Button(root,text="Scatter Plot by Month",width=42,height=2,command=scatterMultiButtonClick, bg='green', relief='groove')

scatterButton.bind('<Enter>', OnHoverScatter)

scatterButton.bind('<Leave>', OnLeaveScatter)

scatterButton['font'] = myFont

scatterButton.place(x=420, y= 500)


scatterTempButtonDecade = Button(root,text="Temp Line Plot by Decade",width=42,height=2,command=scatterTempDecadeButtonClick, bg='green', relief='groove')

scatterTempButtonDecade.bind('<Enter>', OnHoverTempScatterDecade)

scatterTempButtonDecade.bind('<Leave>', OnLeaveTempScatterDecade)

scatterTempButtonDecade['font'] = myFont

scatterTempButtonDecade.place(x=820, y= 380)


scatterRainButtonDecade = Button(root,text="Rain Line Plot by Decade",width=42,height=2,command=scatterRainDecadeButtonClick, bg='green', relief='groove')

scatterRainButtonDecade.bind('<Enter>', OnHoverRainScatterDecade)

scatterRainButtonDecade.bind('<Leave>', OnLeaveRainScatterDecade)

scatterRainButtonDecade['font'] = myFont

scatterRainButtonDecade.place(x=820, y= 440)


scatterButtonDecade = Button(root,text="Scatter Plot by Decade",width=42,height=2,command=scatterMultiDecadeButtonClick, bg='green', relief='groove')

scatterButtonDecade.bind('<Enter>', OnHoverScatterDecade)

scatterButtonDecade.bind('<Leave>', OnLeaveScatterDecade)

scatterButtonDecade['font'] = myFont

scatterButtonDecade.place(x=820, y= 500)
```

```
boxPlotButton = Button(root,text="Box Plot by Month",width=42,height=2,command=boxPlotButtonClick, bg='green', relief='groove')
boxPlotButton.bind('<Enter>', OnHoverBoxPlot)
boxPlotButton.bind('<Leave>', OnLeaveBoxPlot)
boxPlotButton['font'] = myFont
boxPlotButton.place(x=420, y= 560)

boxPlotDecadeButton = Button(root,text="Box Plot by Decade",width=42,height=2,command=boxPlotDecadeButtonClick, bg='green', relief='groove')
boxPlotDecadeButton.bind('<Enter>', OnHoverBoxPlotDecade)
boxPlotDecadeButton.bind('<Leave>', OnLeaveBoxPlotDecade)
boxPlotDecadeButton['font'] = myFont
boxPlotDecadeButton.place(x=820, y= 560)

LRButton = Button(root,text="Linear Regression",width=42,height=2,command=LRButtonClick, bg='green', relief='groove')
LRButton.bind('<Enter>', OnHoverLR)
LRButton.bind('<Leave>', OnLeaveLR)
LRButton['font'] = myFont
LRButton.place(x=420, y= 620)

LRButton = Button(root,text="Linear Regression T o R",width=42,height=2,command=LRButtonClick, bg='green', relief='groove')
LRButton.bind('<Enter>', OnHoverLR)
LRButton.bind('<Leave>', OnLeaveLR)
LRButton['font'] = myFont
LRButton.place(x=420, y= 620)

LRButton2 = Button(root,text="Linear Regression R o T",width=42,height=2,command=LRButton2Click, bg='green', relief='groove')
LRButton2.bind('<Enter>', OnHoverLR2)
LRButton2.bind('<Leave>', OnLeaveLR2)
LRButton2['font'] = myFont
LRButton2.place(x=820, y= 620)

TextButton = Button(root,text="Quantitative Stats",width=42,height=2,command=textbuttonClick, bg='green', relief='groove')
TextButton.bind('<Enter>', OnHoverText)
TextButton.bind('<Leave>', OnLeaveText)
```

```
TextButton['font'] = myFont
TextButton.place(x=620, y= 680)

root.state('zoomed')
root.mainloop()
```

➔ **backend.py**

```
import csv
import math
from os import sep
import statistics
from scipy import stats
import numpy as np
import pandas as pd
from matplotlib import colors
from collections import Counter
import matplotlib.pyplot as plt
from matplotlib.ticker import PercentFormatter

#                    --Temprature-Rainfall 1901-2016--
#    19F-0113 (CS),    19F-0171 (CS),        19F-0254 (CS),       19F-0931 (SE)
#    Talha Ahmad,      M. Talha Shehroze,     Muhammad Farhan,     Daniyal Ahmed

# Reading Data from CSV.
dataset1 = pd.read_csv(r'dataset\19012016.csv')

# Taking Mean of Monthly Temprature and Rainfall from 1901-2016
def meanTempRainFunc():
    tempMean=dataset1['Temperature (Celsius)'].mean().round(3)
    strTempMean=str(tempMean)
    temp="->Average Monthly Temprature (Celsius) from 1901-2016 was: "
    file.write(temp)
    file.write(strTempMean)
    file.write(" °C\n")

    rainMean=dataset1['Rainfall (MM)'].mean().round(3)
    strrainMean=str(rainMean)
    temp0="->Average Monthly Rainfall (MM) from 1901-2016 was: "
    file.write(temp0)
    file.write(strrainMean)
    file.write(" mm\n\n")

# Taking Median of Monthly Temprature and Rainfall from 1901-2016
def medianTempRainFunc():
    tempMedian=dataset1['Temperature (Celsius)'].median()
    strTempMedian=str(tempMedian)
    temp="->Median Monthly Temprature (Celsius) from 1901-2016 was: "
    file.write(temp)
    file.write(strTempMedian)
    file.write(" °C\n")

    rainMedian=dataset1['Rainfall (MM)'].median()
    strRainMedian=str(rainMedian)
    temp0="->Median Monthly Rainfall (MM) from 1901-2016 was: "
    file.write(temp0)
    file.write(strRainMedian)
    file.write(" mm\n\n")

# Descriptive Statistics of Dataset of Temprature and Rainfall from 1901-2016
def dataDescript():
    describeData1=dataset1[['Temperature (Celsius)']].describe().round()
    print(describeData1)
    describeData2=dataset1[['Rainfall (MM)']].describe().round()
    print(describeData2)

# Taking Minimum and Maximum of Monthly Temprature from 1901-2016
tempMin=dataset1['Temperature (Celsius)'].min()
tempMax=dataset1['Temperature (Celsius)'].max()

# Taking Minimum and Maximum Value of Monthly Rainfall from 1901-2016
rainMin=dataset1['Rainfall (MM)'].min()
rainMax=dataset1['Rainfall (MM)'].max()

# Taking Minimum and Maximum Row of Monthly Temprature from 1901-2016
```

```
def minMaxTempratureRow():
    tempMinRow = dataset1.loc[dataset1['Temperature (Celsius)'] == tempMin]
    temp="->Minimum Monthly Temprature (Celsius) from 1901-2016 was in:"
    file.write(temp+'\n')
    temp1=tempMinRow.to_string(index=False)
    file.write(temp1+'\n\n')
    tempMaxRow = dataset1.loc[dataset1['Temperature (Celsius)'] == tempMax]
    temp0="->Maximum Monthly Temprature (Celsius) from 1901-2016 was in:"
    file.write(temp0+'\n')
    temp2=tempMaxRow.to_string(index=False)
    file.write(temp2+'\n\n')

# Taking Minimum and Maximum Row of Monthly Rainfall from 1901-2016
def minMaxRainfallRow():
    rainMinRow = dataset1.loc[dataset1['Rainfall (MM)'] == rainMin]
    temp="->Minimum Monthly Rainfall (MM) from 1901-2016 was in:"
    file.write(temp+'\n')
    temp1=rainMinRow.to_string(index=False)
    file.write(temp1+'\n\n')
    rainMaxRow = dataset1.loc[dataset1['Rainfall (MM)'] == rainMax]
    temp0 ="->Maximum Monthly Rainfall (MM) from 1901-2016 was in:"
    file.write(temp0+'\n')
    temp2=rainMaxRow.to_string(index=False)
    file.write(temp2+'\n\n')

# Reading Data from CSV by Month.
janDataset = dataset1.loc[dataset1['Month'] == 'January']
febDataset = dataset1.loc[dataset1['Month'] == 'February']
marDataset = dataset1.loc[dataset1['Month'] == 'March']
aprDataset = dataset1.loc[dataset1['Month'] == 'April']
mayDataset = dataset1.loc[dataset1['Month'] == 'May']
junDataset = dataset1.loc[dataset1['Month'] == 'June']
julDataset = dataset1.loc[dataset1['Month'] == 'July']
augDataset = dataset1.loc[dataset1['Month'] == 'August']
sepDataset = dataset1.loc[dataset1['Month'] == 'September']
octDataset = dataset1.loc[dataset1['Month'] == 'October']
novDataset = dataset1.loc[dataset1['Month'] == 'November']
```

```
decDataset = dataset1.loc[dataset1['Month'] == 'December']

# Calculating Mean Temprature and Rain by Month.
janTempMean=janDataset['Temperature (Celsius)'].mean();    janRainMean=janDataset['Rainfall (MM)'].mean()
febTempMean=febDataset['Temperature (Celsius)'].mean();    febRainMean=febDataset['Rainfall (MM)'].mean()
marTempMean=marDataset['Temperature (Celsius)'].mean();    marRainMean=marDataset['Rainfall (MM)'].mean()
aprTempMean=aprDataset['Temperature (Celsius)'].mean();    aprRainMean=aprDataset['Rainfall (MM)'].mean()
mayTempMean=mayDataset['Temperature (Celsius)'].mean();    mayRainMean=mayDataset['Rainfall (MM)'].mean()
junTempMean=junDataset['Temperature (Celsius)'].mean();    junRainMean=junDataset['Rainfall (MM)'].mean()
julTempMean=julDataset['Temperature (Celsius)'].mean();    julRainMean=julDataset['Rainfall (MM)'].mean()
augTempMean=augDataset['Temperature (Celsius)'].mean();    augRainMean=augDataset['Rainfall (MM)'].mean()
sepTempMean=sepDataset['Temperature (Celsius)'].mean();    sepRainMean=sepDataset['Rainfall (MM)'].mean()
octTempMean=octDataset['Temperature (Celsius)'].mean();    octRainMean=octDataset['Rainfall (MM)'].mean()
novTempMean=novDataset['Temperature (Celsius)'].mean();    novRainMean=novDataset['Rainfall (MM)'].mean()
decTempMean=decDataset['Temperature (Celsius)'].mean();    decRainMean=decDataset['Rainfall (MM)'].mean()


# Reading Data from CSV by Decades.
dataset1903 = dataset1.loc[dataset1['Year'] == 1903]
dataset1913 = dataset1.loc[dataset1['Year'] == 1913]
dataset1923 = dataset1.loc[dataset1['Year'] == 1923]
dataset1933 = dataset1.loc[dataset1['Year'] == 1933]
dataset1943 = dataset1.loc[dataset1['Year'] == 1943]
dataset1953 = dataset1.loc[dataset1['Year'] == 1953]
dataset1963 = dataset1.loc[dataset1['Year'] == 1963]
dataset1973 = dataset1.loc[dataset1['Year'] == 1973]
dataset1983 = dataset1.loc[dataset1['Year'] == 1983]
dataset1993 = dataset1.loc[dataset1['Year'] == 1993]
dataset2003 = dataset1.loc[dataset1['Year'] == 2003]
dataset2013 = dataset1.loc[dataset1['Year'] == 2013]

# Calculating Mean Temprature and Rain by Decades.
TempMean1903=dataset1903['Temperature (Celsius)'].mean();    RainMean1903=dataset1903['Rainfall (MM)'].mean()
TempMean1913=dataset1913['Temperature (Celsius)'].mean();    RainMean1913=dataset1913['Rainfall (MM)'].mean()
TempMean1923=dataset1923['Temperature (Celsius)'].mean();    RainMean1923=dataset1923['Rainfall (MM)'].mean()
TempMean1933=dataset1933['Temperature (Celsius)'].mean();    RainMean1933=dataset1933['Rainfall (MM)'].mean()
TempMean1943=dataset1943['Temperature (Celsius)'].mean();    RainMean1943=dataset1943['Rainfall (MM)'].mean()
```

```
TempMean1953=dataset1953['Temperature (Celsius)'].mean();    RainMean1953=dataset1953['Rainfall (MM)'].mean()
TempMean1963=dataset1963['Temperature (Celsius)'].mean();    RainMean1963=dataset1963['Rainfall (MM)'].mean()
TempMean1973=dataset1973['Temperature (Celsius)'].mean();    RainMean1973=dataset1973['Rainfall (MM)'].mean()
TempMean1983=dataset1983['Temperature (Celsius)'].mean();    RainMean1983=dataset1983['Rainfall (MM)'].mean()
TempMean1993=dataset1993['Temperature (Celsius)'].mean();    RainMean1993=dataset1993['Rainfall (MM)'].mean()
TempMean2003=dataset2003['Temperature (Celsius)'].mean();    RainMean2003=dataset2003['Rainfall (MM)'].mean()
TempMean2013=dataset2013['Temperature (Celsius)'].mean();    RainMean2013=dataset2013['Rainfall (MM)'].mean()


months = ['January', 'February', 'March', 'April', 'May', 'June', 'July', 'August', 'September', 'October', 'November', 'December']
monthsN = [1,2,3,4,5,6,7,8,9,10,11,12]
avgTemp = [janTempMean,febTempMean,marTempMean,aprTempMean,mayTempMean,junTempMean,julTempMean,augTempMean,sepTempMean,octTempMean,novTempMean,decTempMean]
avgRain = [janRainMean,febRainMean,marRainMean,aprRainMean,mayRainMean,junRainMean,julRainMean,augRainMean,sepRainMean,octRainMean,novRainMean,decRainMean]


yearsN = [1903,1913,1923,1933,1943,1953,1963,1973,1983,1993,2003,2013]
avgTempDecade = [TempMean1903,TempMean1913,TempMean1923,TempMean1933,TempMean1943,TempMean1953,TempMean1963,TempMean1973,TempMean1983,TempMean1993,TempMean2003,TempMean2013]
avgRainDecade = [RainMean1903,RainMean1913,RainMean1923,RainMean1933,RainMean1943,RainMean1953,RainMean1963,RainMean1973,RainMean1983,RainMean1993,RainMean2003,RainMean2013]


avgTRdata = [avgTemp,avgRain]
avgTRdataDecade = [avgTempDecade,avgRainDecade]


months2 = [ 'November','December', 'January', 'February', 'March', 'April', 'May', 'June', 'July', 'August', 'September', 'October']
avgRain2 = [novRainMean,decRainMean,janRainMean,febRainMean,marRainMean,aprRainMean,mayRainMean,junRainMean,julRainMean,augRainMean,sepRainMean,octRainMean]


# Bar Graph of Pakistan's Average Temprature/Month from 1901-2016
def avgTMBarG():
    fig = plt.figure()
    ax = fig.add_axes([0.1,0.1,0.8,0.8])
    ax.bar(months,avgTemp,color='red')
    plt.xlabel("x - Month")
    plt.ylabel("y - Temprature (°C)")
    plt.title("Pakistan's Average Temprature/Month from 1901-2016")
    wm = plt.get_current_fig_manager()
    wm.window.state('zoomed')
    plt.show()

# Bar Graph of Pakistan's Average Rainfall/Month from 1901-2016
def avgRMBarG():
    fig1 = plt.figure()
    ax = fig1.add_axes([0.1,0.1,0.8,0.8])
    ax.bar(months2,avgRain2,color='green')
    plt.xlabel("x - Month")
    plt.ylabel("y - Rainfall (mm)")
    plt.title("Pakistan's Average Rainfall/Month from 1901-2016")
    wm = plt.get_current_fig_manager()
    wm.window.state('zoomed')
    plt.show()

def tempRainMultiBarChart():
    fig2 = plt.figure()
    ax = fig2.add_axes([0.1,0.1,0.8,0.8])
    X_axis = np.arange(len(months))
    plt.bar(X_axis - 0.2, avgTemp, 0.4, label = 'Temp (°C)', color='red')
    plt.bar(X_axis + 0.2, avgRain, 0.4, label = 'Rain (mm)', color='green')
    plt.xticks(X_axis, months)
    plt.xlabel("Months")
    plt.ylabel("Temp (°C), Rain (mm)")
    plt.title("Pakistan's Temprature/Month in each Month")
    plt.legend()
    wm = plt.get_current_fig_manager()
    wm.window.state('zoomed')
    plt.show()

# Scatter Plot of Pakistan's Average Temprature/Month from 1901-2016 (Showing Relation)
def scatterTempGraphFunc():
    fig3 = plt.figure()
    a1 = fig3.add_axes([0.1,0.1,0.8,0.8])
    a1.plot(monthsN, avgTemp, 'r-')
    a1.set_xlabel('Months')
    a1.set_ylabel('Temp (°C)')

    #fig3.legend(labels = ('Temp (°C)'),loc='upper center')
    plt.title("Pakistan's Temprature in each Month")
    wm = plt.get_current_fig_manager()
    wm.window.state('zoomed')
    plt.show()

def scatterTempGraphFuncDecade():
    fig10 = plt.figure()
    a1 = fig10.add_axes([0.1,0.1,0.8,0.8])
    a1.plot(yearsN, avgTempDecade, 'r-')
    a1.set_xlabel('Years')
    a1.set_ylabel('Temp (°C)')

    #fig3.legend(labels = ('Temp (°C)'),loc='upper center')
    plt.title("Pakistan's Temprature in each Decade from 1900-2010")
    wm = plt.get_current_fig_manager()
    wm.window.state('zoomed')
    plt.show()

# Scatter Plot of Pakistan's Average Temprature/Month from 1901-2016 (Showing Relation)
def scatterRainGraphFunc():
    fig5 = plt.figure()
    a1 = fig5.add_axes([0.1,0.1,0.8,0.8])

    a1.plot(monthsN, avgRain, 'g-')
    a1.set_xlabel('Months')
    a1.set_ylabel('Rain (mm)')

    #fig5.legend(labels = ('Rain (mm)'),loc='upper center')
    plt.title("Pakistan's Rainfall in each Month")
    wm = plt.get_current_fig_manager()
    wm.window.state('zoomed')
    plt.show()
```

```
def scatterRainGraphFuncDecade():
    fig15 = plt.figure()
    a1 = fig15.add_axes([0.1,0.1,0.8,0.8])

    a1.plot(yearsN, avgRainDecade, 'g-')
    a1.set_xlabel('Years')
    a1.set_ylabel('Rain (mm)')

    #fig5.legend(labels = ('Rain (mm)'),loc='upper center')
    plt.title("Pakistan's Rainfall in each Decade from 1900-2010")
    wm = plt.get_current_fig_manager()
    wm.window.state('zoomed')
    plt.show()

# Scatter Plot of Pakistan's Average Rainfall-Temprature/Month from 1901-2016 (Showing Relation)
def scatterMultiGraphFunc():
    fig6 = plt.figure()
    a1 = fig6.add_axes([0.1,0.1,0.8,0.8])
    a1.plot(monthsN, avgTemp, 'ro-')
    a1.set_xlabel('Months')
    a1.set_ylabel('Temp (°C)')

    a2 = a1.twinx()
    a2.plot(monthsN, avgRain, 'go-')
    a2.set_ylabel('Rain (mm)')

    fig6.legend(labels = ('Temp (°C)','Rain (mm)'),loc='upper center')
    plt.title("Relationship b/w Pakistan's Rainfall/Temprature in each Month")
    wm = plt.get_current_fig_manager()
    wm.window.state('zoomed')
    plt.show()

# Scatter Plot of Pakistan's Average Rainfall-Temprature/Month from 1901-2016 (Showing Relation)
def scatterMultiGraphFuncDecade():
    fig16 = plt.figure()
    a1 = fig16.add_axes([0.1,0.1,0.8,0.8])
    a1.plot(yearsN, avgTempDecade, 'ro-')
    a1.set_xlabel('Years')
    a1.set_ylabel('Temp (°C)')

    a2 = a1.twinx()
    a2.plot(yearsN, avgRainDecade, 'go-')
    a2.set_ylabel('Rain (mm)')

    fig16.legend(labels = ('Temp (°C)','Rain (mm)'),loc='upper center')
    plt.title("Relationship b/w Pakistan's Rainfall/Temprature in each Decade from 1900-2010")
    wm = plt.get_current_fig_manager()
    wm.window.state('zoomed')
    plt.show()

def boxPlotTempRain():
    fig4 = plt.figure()
    ax = fig4.add_axes([0.1,0.1,0.8,0.8])
    ax.set_xticklabels(['Temprature', 'Rain']) # warning for fixed labels.
    bp = ax.boxplot(avgTRdata)
    wm = plt.get_current_fig_manager()
    wm.window.state('zoomed')
    plt.show()

def boxPlotTempRainDecade():
    fig14 = plt.figure()
    ax = fig14.add_axes([0.1,0.1,0.8,0.8])
    ax.set_xticklabels(['Temprature', 'Rain']) # warning for fixed labels.
    bp = ax.boxplot(avgTRdataDecade)
    wm = plt.get_current_fig_manager()
    wm.window.state('zoomed')
    plt.show()

def linearReg():

    slope, intercept, r, p, std_err = stats.linregress(avgTempDecade, avgRainDecade)

    def myfunc(avgTempDecade):
      return slope * avgTempDecade + intercept
    mymodel = list(map(myfunc, avgTempDecade))

    fig24 = plt.figure()
    ax = fig24.add_axes([0.1,0.1,0.8,0.8])
    ax.set_xlabel('Temp (°C)')
    ax.set_ylabel('Rain (mm)')

    plt.scatter(avgTempDecade, avgRainDecade)
    plt.plot(avgTempDecade, mymodel)
    plt.title("Regression Model b/w Pakistan's Temprature on Rainfall by each Month")
    wm = plt.get_current_fig_manager()
    wm.window.state('zoomed')
    plt.show()

def linearReg2():

    slope, intercept, r, p, std_err = stats.linregress(avgRainDecade, avgTempDecade)

    def myfunc(avgRainDecade):
      return slope * avgRainDecade + intercept

    mymodel = list(map(myfunc, avgRainDecade))

    fig34 = plt.figure()
    ax = fig34.add_axes([0.1,0.1,0.8,0.8])
    ax.set_xlabel('Rain (mm)')
    ax.set_ylabel('Temp (°C)')

    plt.scatter(avgRainDecade, avgTempDecade)
    plt.plot(avgRainDecade, mymodel)
    plt.title("Regression Model b/w Pakistan's Rainfall on Temprature by each Month")
    wm = plt.get_current_fig_manager()
    wm.window.state('zoomed')
    plt.show()

#####     FunctionCalls()
```

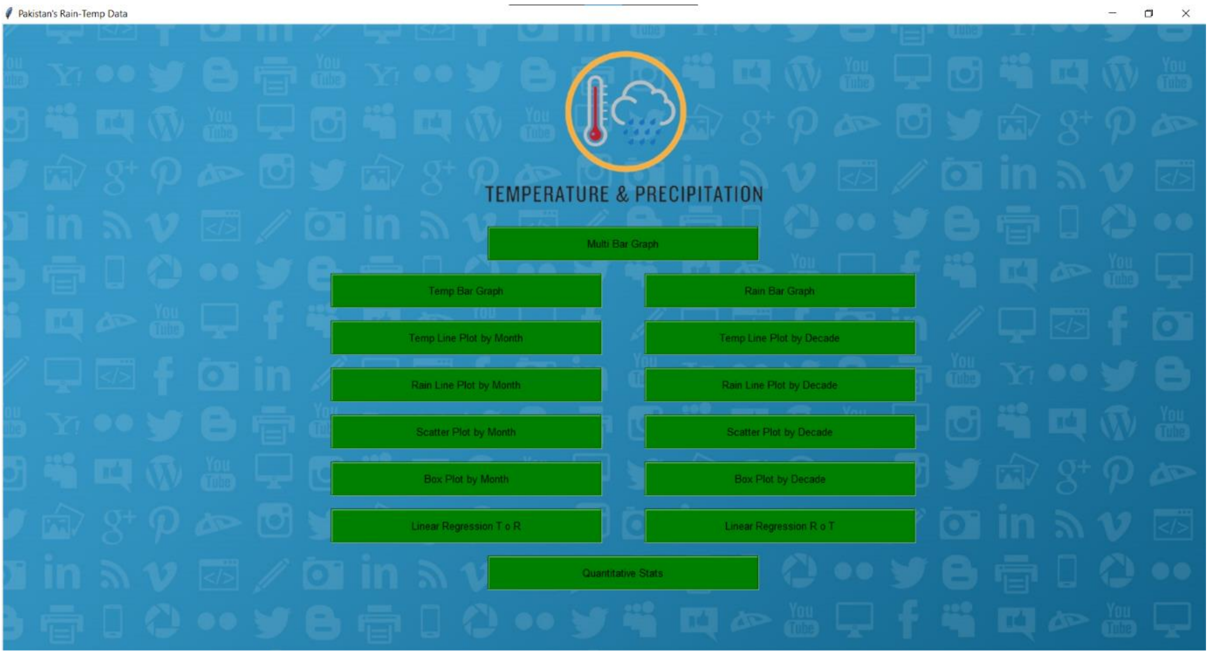
```
file = open("dataset/statstext.txt","w")

meanTempRainFunc()
medianTempRainFunc()
#    dataDescript()
minMaxTempratureRow()
minMaxRainfallRow()

file.close()

#    avgTMBarG()
#    avgTMBarGDecade()
#    scatterTempGraphFuncDecade()
#    scatterRainGraphFuncDecade()
#    scatterMultiGraphFuncDecade()
#    avgRMBarG()
#    tempRainMultiBarChart()
#    boxPlotTempRain()
#    scatterTempGraphFunc()
#    scatterRainGraphFunc()
#    scatterMultiGraphFunc()
#    boxPlotTempRain()
#    boxPlotTempRainDecade()
#    linearReg()
#    linearReg2()

#___________________E____N____D________O__F________P___R___O___G___R___A___M_______________________________________
```


Pakistan's Rain-Temp Data
TEMPERATURE & PRECIPITATION
Multi Bar Graph
Temp Bar Graph
Rain Bar Graph
Temp Line Plot by Month
Temp Line Plot by Decade
Rain Line Plot by Month
Rain Line Plot by Decade
Scatter Plot by Month
Scatter Plot by Decade
Box Plot by Month
Box Plot by Decade
Linear Regression T o R
Linear Regression R o T
Quantitative Stats

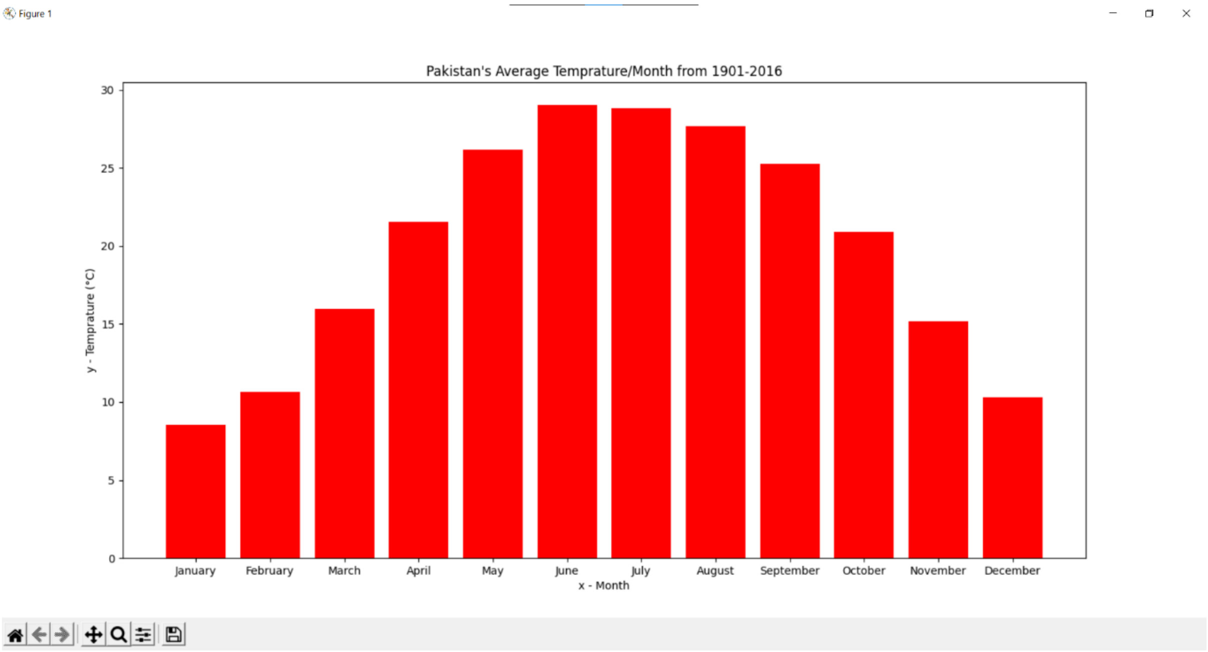


Figure 1
Pakistan's Average Temprature/Month from 1901-2016
y - Temprature (°C)
30
25
20
15
10
5
0
January
February
March
April
May
June
July
August
September
October
November
December
x - Month

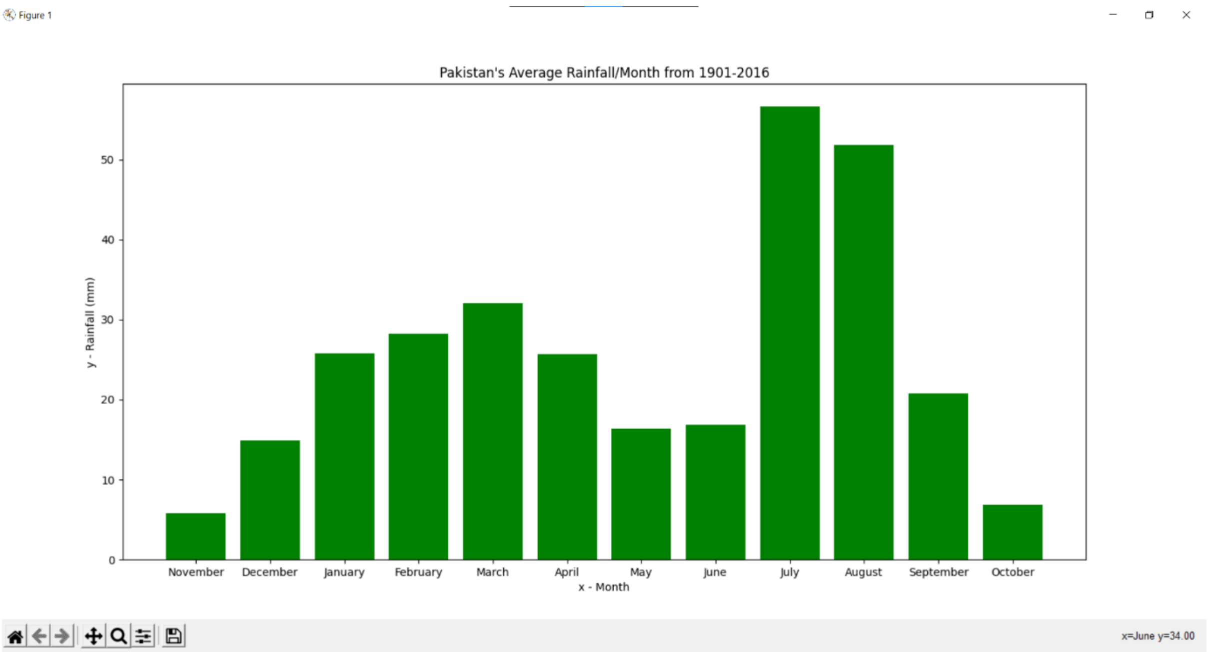


Figure 1
Pakistan's Average Rainfall/Month from 1901-2016
y - Rainfall (mm)
0
10
20
30
40
50
November
December
January
February
March
April
May
June
July
August
September
October
x - Month
x=June y=34.00

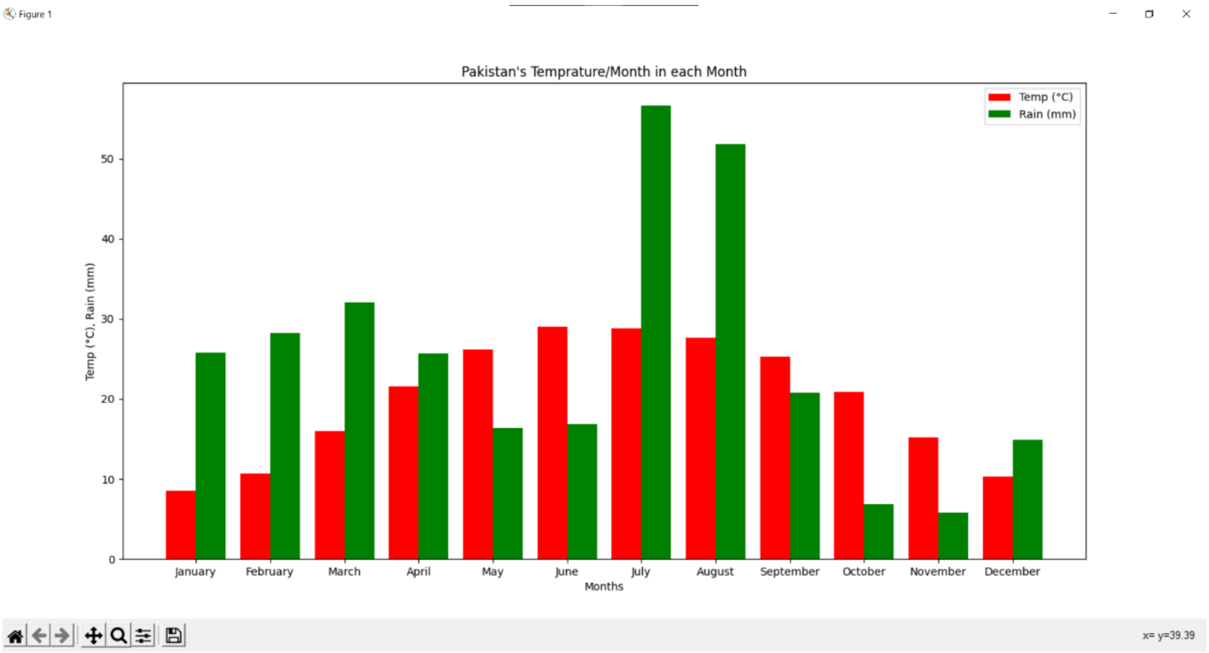


Figure 1
Pakistan's Temprature/Month in each Month
🟥 Temp (°C)
🟩 Rain (mm)
Temp (°C), Rain (mm)
0
10
20
30
40
50
January
February
March
April
May
June
July
August
September
October
November
December
Months
x= y=39.39

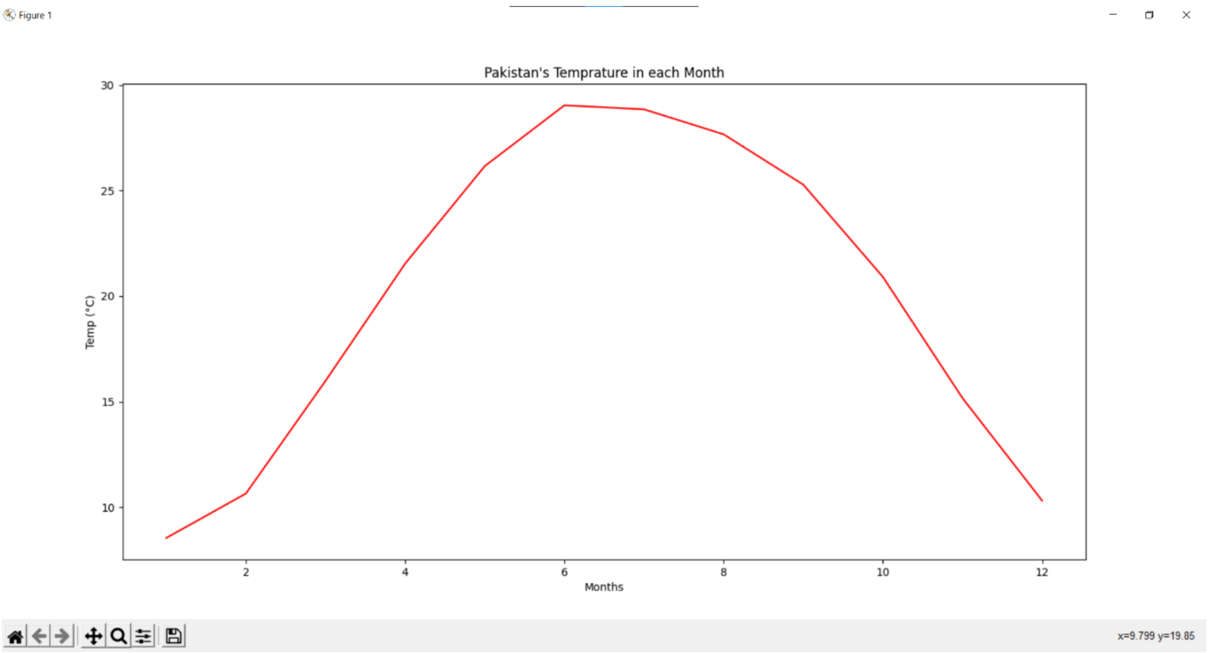


Figure 1
Pakistan's Temprature in each Month
Temp (°C)
30
25
20
15
10
2
4
6
8
10
12
Months
x=9.799 y=19.85

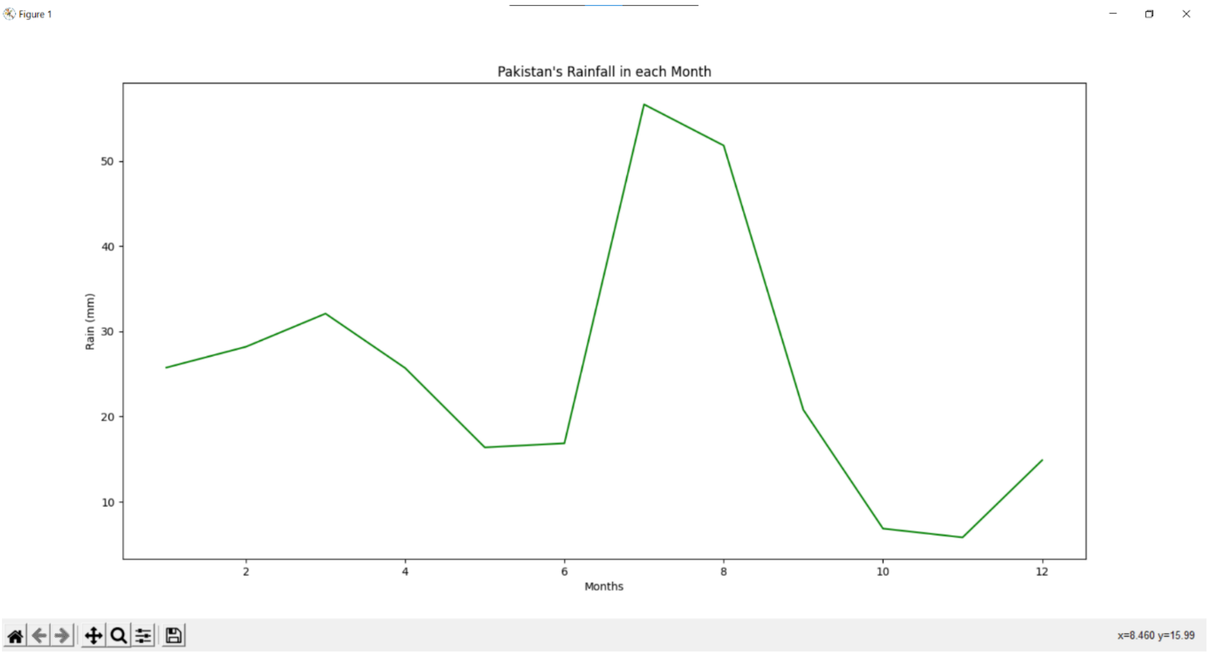


Figure 1
Pakistan's Rainfall in each Month
Rain (mm)
50
40
30
20
10
2
4
6
8
10
12
Months
x=8.460 y=15.99

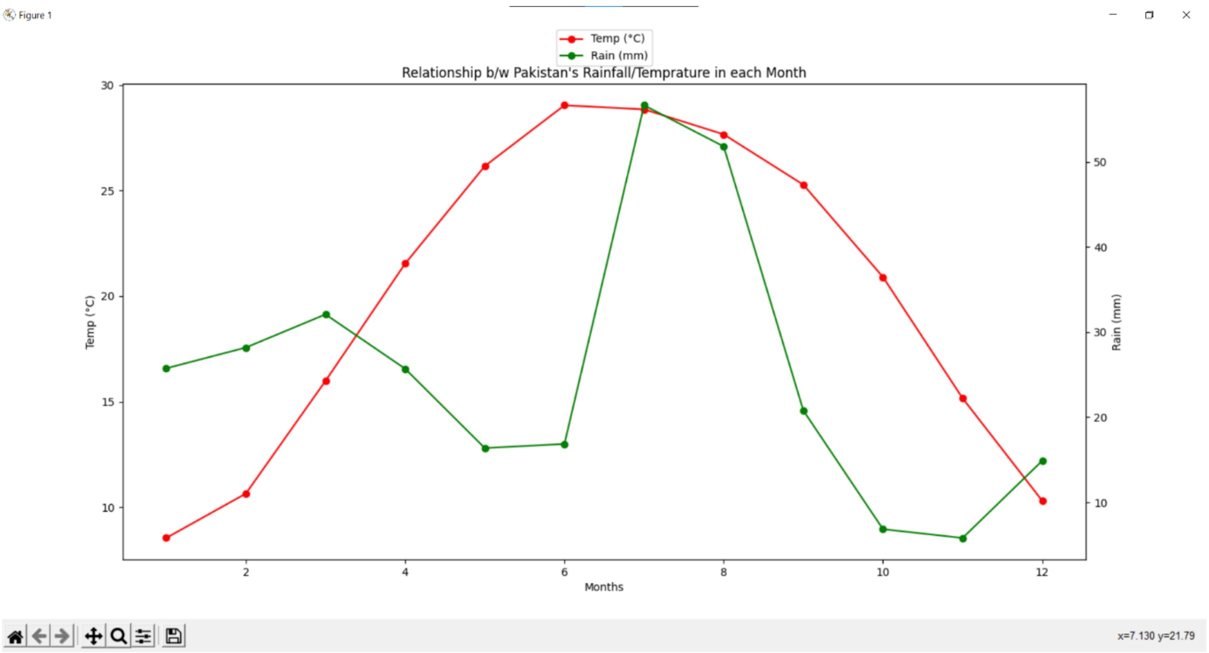


Figure 1
Temp (°C)
Rain (mm)
Relationship b/w Pakistan's Rainfall/Temprature in each Month
30
25
20
15
10
Temp (°C)
50
40
30
20
10
Rain (mm)
2
4
6
8
10
12
Months
x=7.130 y=21.79

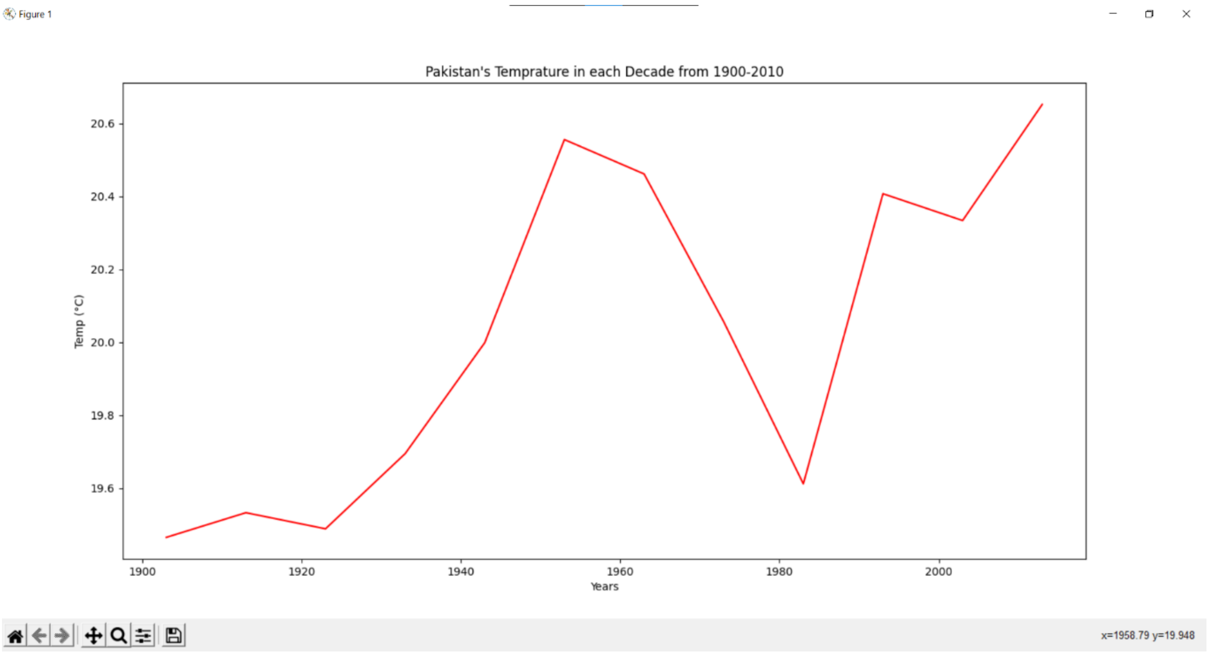


Figure 1
Pakistan's Temprature in each Decade from 1900-2010
20.6
20.4
20.2
20.0
19.8
19.6
Temp (°C)
1900
1920
1940
1960
1980
2000
Years
x=1958.79 y=19.948

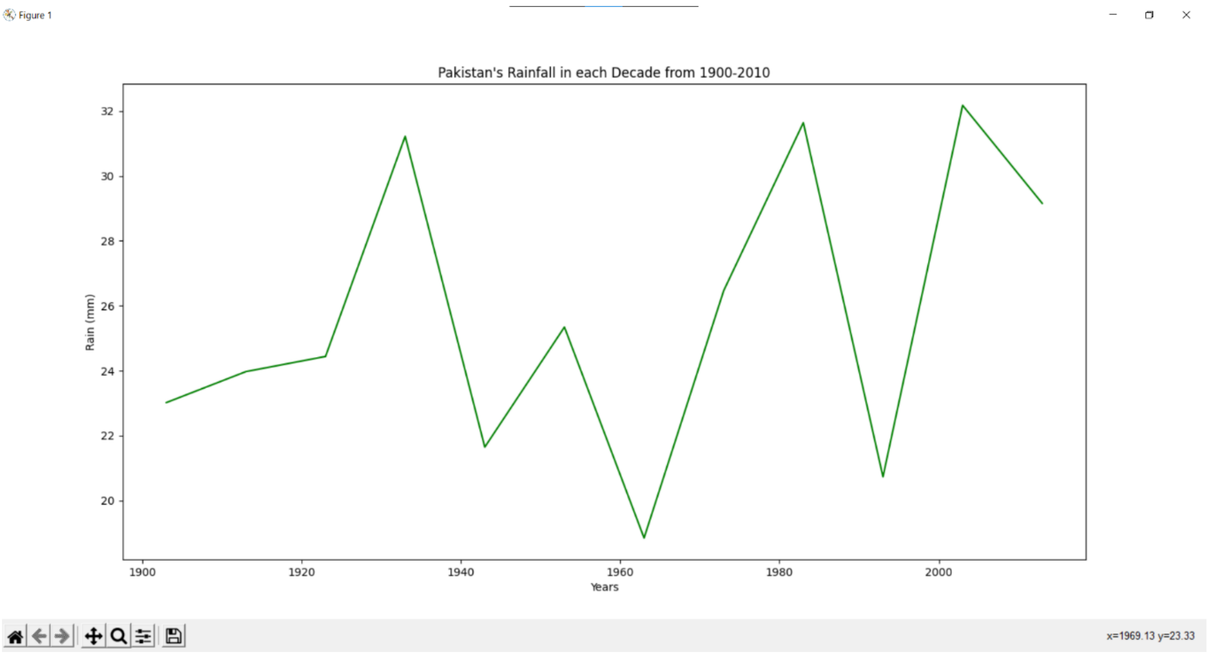


Figure 1
Pakistan's Rainfall in each Decade from 1900-2010
Rain (mm)
32
30
28
26
24
22
20
1900
1920
1940
1960
1980
2000
Years
x=1969.13 y=23.33

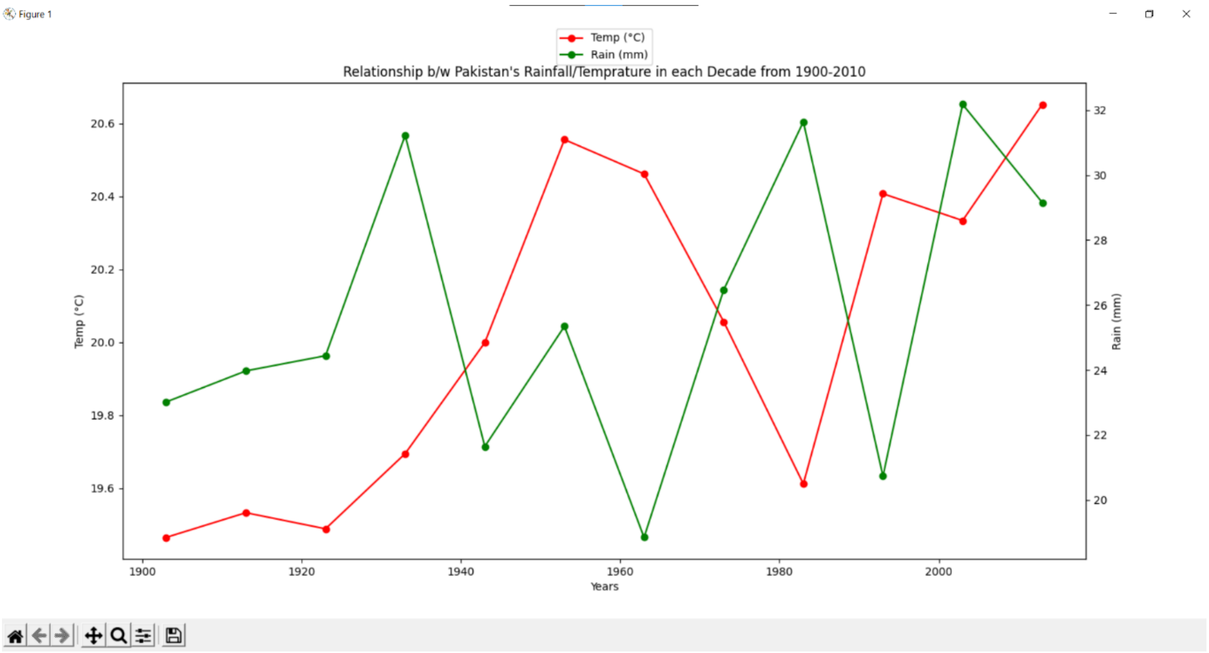


Figure 1
Temp (°C)
Rain (mm)
Relationship b/w Pakistan's Rainfall/Temprature in each Decade from 1900-2010
Temp (°C)
20.6
20.4
20.2
20.0
19.8
19.6
Rain (mm)
32
30
28
26
24
22
20
1900
1920
1940
1960
1980
2000
Years

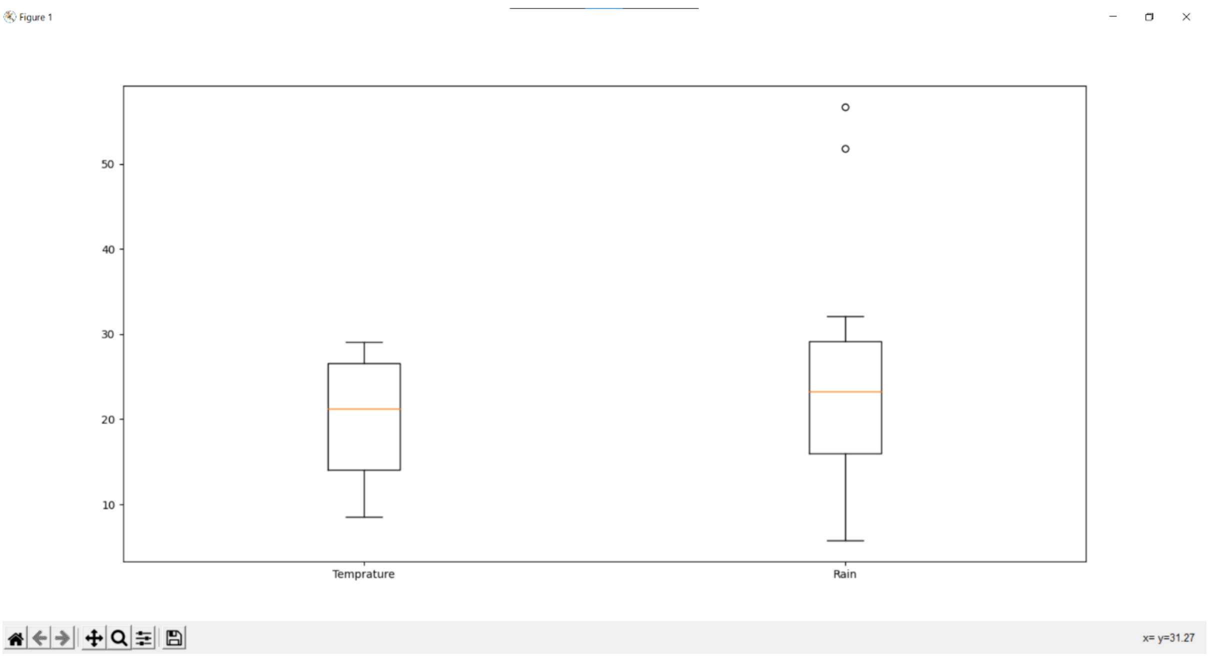


Figure 1
50
40
30
20
10
Temprature
Rain
x= y=31.27

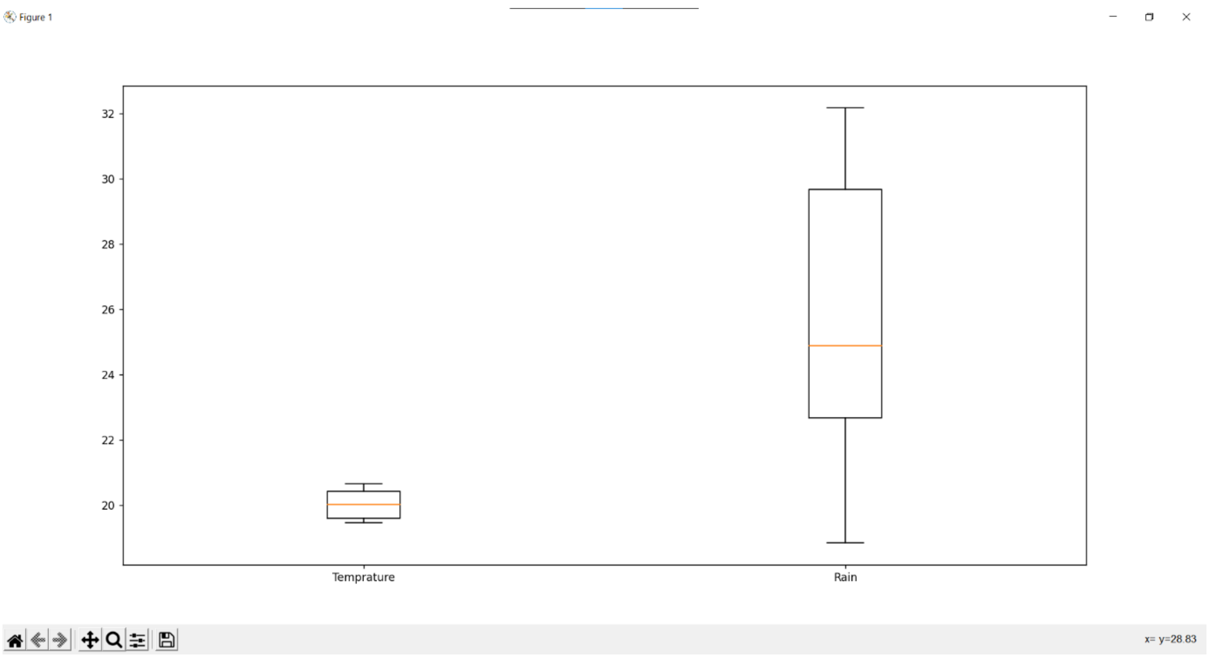


Figure 1
32
30
28
26
24
22
20
Temprature
Rain
x= y=28.83

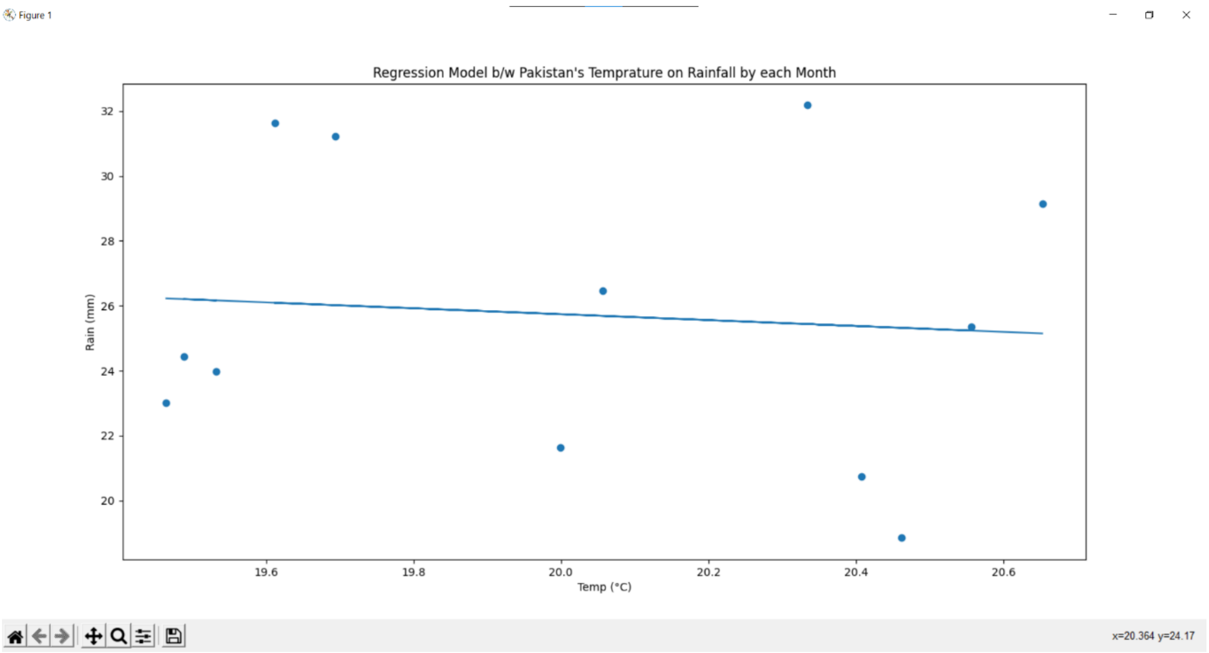


Figure 1
Regression Model b/w Pakistan's Temprature on Rainfall by each Month
Rain (mm)
32
30
28
26
24
22
20
19.6
19.8
20.0
20.2
20.4
20.6
Temp (°C)
x=20.364 y=24.17

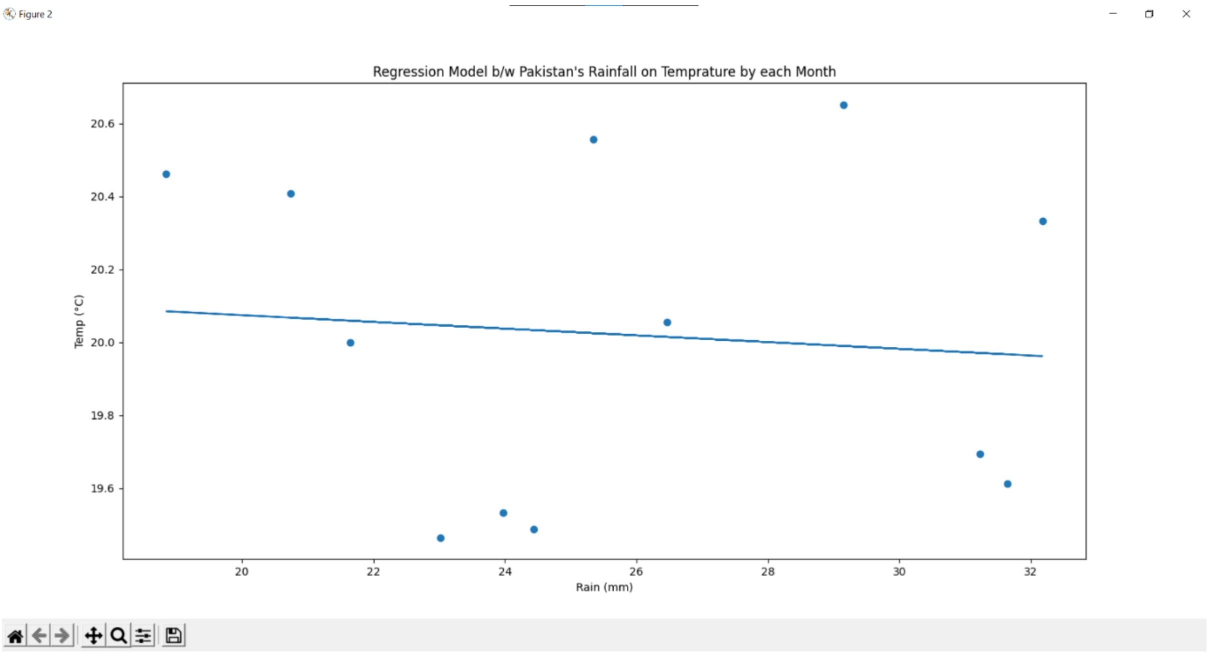
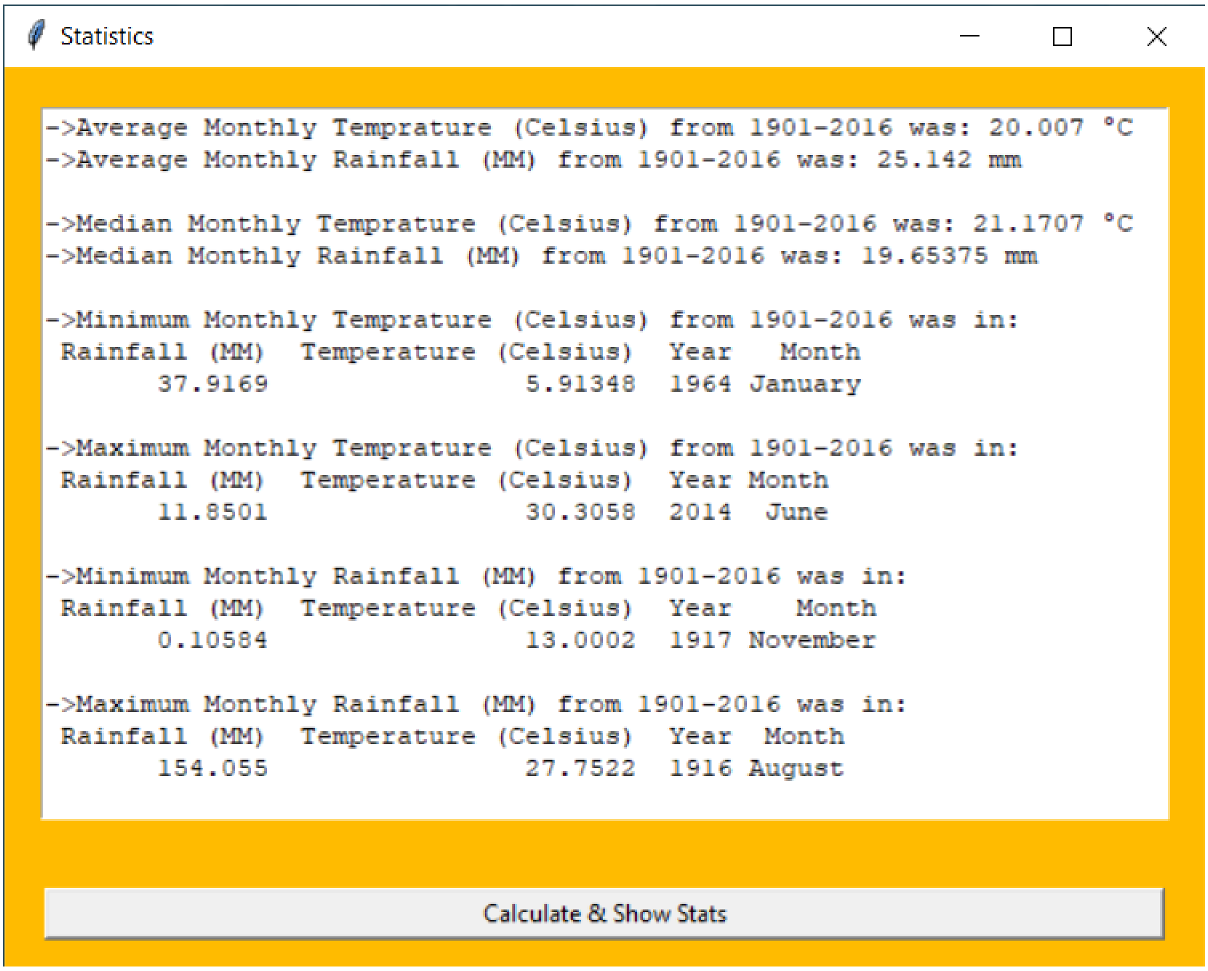


Figure 2
Regression Model b/w Pakistan's Rainfall on Temprature by each Month
Temp (°C)
20.6
20.4
20.2
20.0
19.8
19.6
20
22
24
26
28
30
32
Rain (mm)



```
->Average Monthly Temprature (Celsius) from 1901-2016 was: 20.007 °C
->Average Monthly Rainfall (MM) from 1901-2016 was: 25.142 mm

->Median Monthly Temprature (Celsius) from 1901-2016 was: 21.1707 °C
->Median Monthly Rainfall (MM) from 1901-2016 was: 19.65375 mm

->Minimum Monthly Temprature (Celsius) from 1901-2016 was in:
 Rainfall (MM)  Temperature (Celsius)  Year   Month
      37.9169              5.91348  1964 January

->Maximum Monthly Temprature (Celsius) from 1901-2016 was in:
 Rainfall (MM)  Temperature (Celsius)  Year Month
      11.8501              30.3058  2014  June

->Minimum Monthly Rainfall (MM) from 1901-2016 was in:
 Rainfall (MM)  Temperature (Celsius)  Year    Month
      0.10584              13.0002  1917 November

->Maximum Monthly Rainfall (MM) from 1901-2016 was in:
 Rainfall (MM)  Temperature (Celsius)  Year  Month
      154.055              27.7522  1916 August
```

Thank you.