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Ex no: 1 **Working with Numpy arrays**

AIM

Working with Numpy arrays

ALGORITHM

Step1: Start
Step2: Import numpy module
Step3: Print the basic characteristics and operactions of array
Step4: Stop

PROGRAM

```
import numpy as np
  # Creating array object
arr = np.array( [[ 1, 2, 3],
                 [ 4, 2, 5]] )
  # Printing type of arr object
print("Array is of type: ", type(arr))
  # Printing array dimensions (axes)
print("No. of dimensions: ", arr.ndim)
  # Printing shape of array
print("Shape of array: ", arr.shape)
  # Printing size (total number of elements) of array
print("Size of array: ", arr.size)
# Printing type of elements in array
print("Array stores elements of type: ", arr.dtype)
```

OUTPUT

```
Array is of type:  <class 'numpy.ndarray'>
No. of dimensions:  2
Shape of array:  (2, 3)
Size of array:  6
Array stores elements of type:  int32
```

Program to Perform Array Slicing

```
a = np.array([[1,2,3],[3,4,5],[4,5,6]])
print(a)
print("After slicing")
print(a[1:])
```

Output

```
[[1 2 3]
 [3 4 5]
 [4 5 6]]
After slicing
[[3 4 5]
 [4 5 6]]
```

Program to Perform Array Slicing

```
# array to begin with
import numpy as np
a = np.array([[1,2,3],[3,4,5],[4,5,6]])
print('Our array is:' )
print(a)
 # this returns array of items in the second column
print('The items in the second column are:'  )
print(a[...,1])
print('\n'  )
# Now we will slice all items from the second row
print ('The items in the second row are:' )
print(a[1,...])
print('\n'  )
# Now we will slice all items from column 1 onwards
print('The items column 1 onwards are:' )
print(a[...,1:])
```

Output:

```
        Our array is:
[[1 2 3]
 [3 4 5]
 [4 5 6]]
The items in the second column are:
[2 4 5]
The items in the second row are:
[3 4 5]
The items column 1 onwards are:
[[2 3]
 [4 5]
 [5 6]]
```

Result:

Thus the working with Numpy arrays was successfully completed.

Ex no: 2 **Create a dataframe using a list of elements.**

Aim:

To work with Pandas data frames

ALGORITHM

Step1: Start
Step2: import numpy and pandas module
Step3: Create a dataframe using the dictionary
Step4: Print the output
Step5: Stop

PROGRAM

```
import numpy as np
import pandas as pd
data = np.array([['','Col1','Col2'],
                 ['Row1',1,2],
                 ['Row2',3,4]])

print(pd.DataFrame(data=data[1:,1:],
                   index = data[1:,0],
                   columns=data[0,1:]))
# Take a 2D array as input to your DataFrame
my_2darray = np.array([[1, 2, 3], [4, 5, 6]])
print(pd.DataFrame(my_2darray))

# Take a dictionary as input to your DataFrame
my_dict = {1: ['1', '3'], 2: ['1', '2'], 3: ['2', '4']}
print(pd.DataFrame(my_dict))

# Take a DataFrame as input to your DataFrame
my_df = pd.DataFrame(data=[4,5,6,7], index=range(0,4), columns=['A'])
print(pd.DataFrame(my_df))

# Take a Series as input to your DataFrame
my_series = pd.Series({"United Kingdom":"London", "India":"New Delhi", "United
States":"Washington", "Belgium":"Brussels"})
print(pd.DataFrame(my_series))
df = pd.DataFrame(np.array([[1, 2, 3], [4, 5, 6]]))

# Use the `shape` property
print(df.shape)
```

```
# Or use the `len()` function with the `index` property
print(len(df.index))
```

Output:

```
Col1 Col2
Row1    1    2
Row2    3    4
0  1  2
0  1  2  3
1  4  5  61  2  3
0  1  1  2
1  3  2  4A

0  4
1  5
2  6
3  7
0
United Kingdom      London
India           New Delhi
United States   Washington
Belgium         Brussels
(2, 3)
2
```

Result:

Thus the working with Pandas data frames was successfully completed.

Ex. No.:3 **Basic plots using Matplotlib**

Aim:

To draw basic plots in Python program using Matplotlib

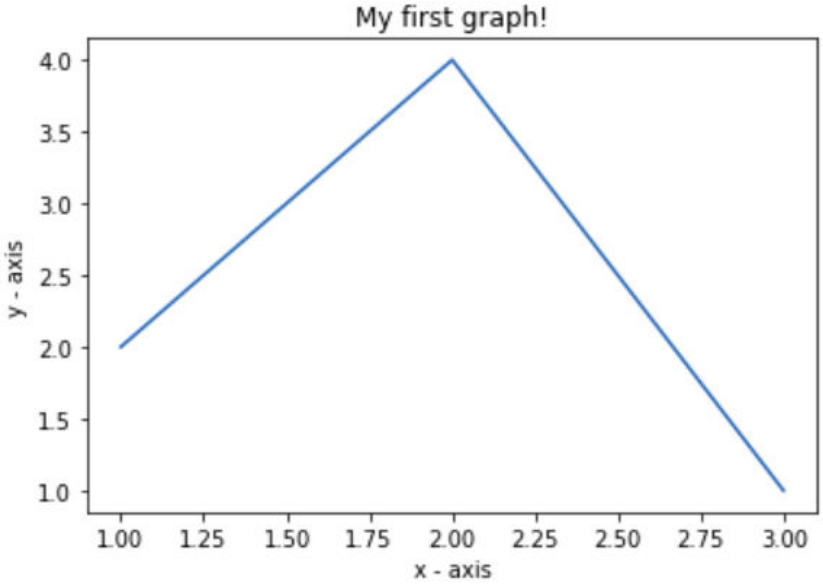
ALGORITHM

Step1: Start
Step2: import Matplotlib module
Step3: Create a Basic plots using Matplotlib
Step4: Print the output
Step5: Stop

Program:3a

```
# importing the required module
import matplotlib.pyplot as plt

# x axis values
x = [1,2,3]
# corresponding y axis values
y = [2,4,1]

# plotting the points
plt.plot(x, y)

# naming the x axis
plt.xlabel('x - axis')
# naming the y axis
plt.ylabel('y - axis')

# giving a title to my graph
plt.title('My first graph!')

# function to show the plot
plt.show()
```

Output:

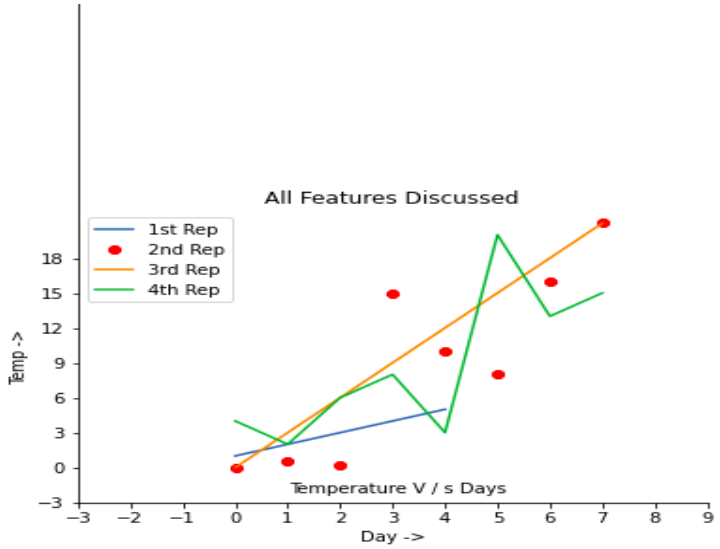


Program:3b

```
import matplotlib.pyplot as plt
a = [1, 2, 3, 4, 5]
b = [0, 0.6, 0.2, 15, 10, 8, 16, 21]
plt.plot(a)

# o is for circles and r is
# for red
plt.plot(b, "or")

plt.plot(list(range(0, 22, 3)))

# naming the x-axis
plt.xlabel('Day ->')

# naming the y-axis
plt.ylabel('Temp ->')

c = [4, 2, 6, 8, 3, 20, 13, 15]
plt.plot(c, label = '4th Rep')

# get current axes command
ax = plt.gca()

# get command over the individual
# boundary line of the graph body
ax.spines['right'].set_visible(False)
ax.spines['top'].set_visible(False)
```

```
# set the range or the bounds of
# the left boundary line to fixed range
ax.spines['left'].set_bounds(-3, 40)

# set the interval by which
# the x-axis set the marks
plt.xticks(list(range(-3, 10)))

# set the intervals by which y-axis
# set the marks
plt.yticks(list(range(-3, 20, 3)))

# legend denotes that what color
# signifies what
ax.legend(['1st Rep', '2nd Rep', '3rd Rep', '4th Rep'])

# annotate command helps to write
# ON THE GRAPH any text xy denotes
# the position on the graph
plt.annotate('Temperature V / s Days', xy = (1.01, -2.15))

# gives a title to the Graph
plt.title('All Features Discussed')
plt.show()
```

Output:

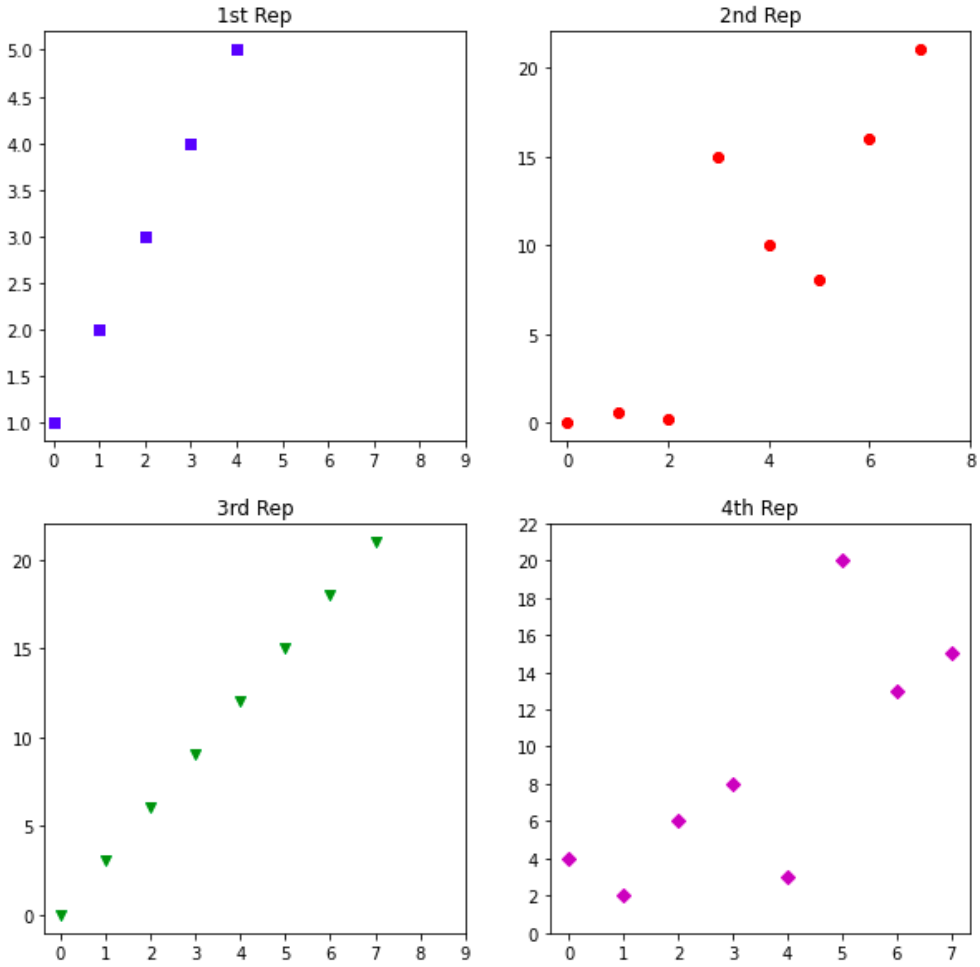


Program:4c

```
import matplotlib.pyplot as plt

a = [1, 2, 3, 4, 5]
b = [0, 0.6, 0.2, 15, 10, 8, 16, 21]
c = [4, 2, 6, 8, 3, 20, 13, 15]
```

```
# use fig whenever u want the
# output in a new window also
# specify the window size you
# want ans to be displayed
fig = plt.figure(figsize =(10, 10))

# creating multiple plots in a
# single plot
sub1 = plt.subplot(2, 2, 1)
sub2 = plt.subplot(2, 2, 2)
sub3 = plt.subplot(2, 2, 3)
sub4 = plt.subplot(2, 2, 4)

sub1.plot(a, 'sb')

# sets how the display subplot
# x axis values advances by 1
# within the specified range
sub1.set_xticks(list(range(0, 10, 1)))
sub1.set_title('1st Rep')

sub2.plot(b, 'or')

# sets how the display subplot x axis
# values advances by 2 within the
# specified range
sub2.set_xticks(list(range(0, 10, 2)))
sub2.set_title('2nd Rep')

# can directly pass a list in the plot
# function instead adding the reference
sub3.plot(list(range(0, 22, 3)), 'vg')
sub3.set_xticks(list(range(0, 10, 1)))
sub3.set_title('3rd Rep')

sub4.plot(c, 'Dm')

# similarly we can set the ticks for
# the y-axis range(start(inclusive),
# end(exclusive), step)
sub4.set_yticks(list(range(0, 24, 2)))
sub4.set_title('4th Rep')

# without writing plt.show() no plot
# will be visible
plt.show()
```

Output:



Result:

Thus the basic plots using Matplotlib in Python program was successfully completed.

Ex. No.:4 **Frequency distributions**

Aim:

To Count the frequency of occurrence of a word in a body of text is often needed during text processing.

ALGORITHM

Step 1: Start the Program

Step 2: Create text file blake-poems.txt

Step 3: Import the word_tokenize function and gutenberg

Step 4: Write the code to count the frequency of occurrence of a word in a body of text

Step 5: Print the result

Step 6: Stop the process

Program:

```
from nltk.tokenize import word_tokenize
from nltk.corpus import gutenberg

sample = gutenberg.raw("blake-poems.txt")

token = word_tokenize(sample)
wlist = []

for i in range(50):
   wlist.append(token[i])

wordfreq = [wlist.count(w) for w in wlist]
print("Pairs\n" + str(zip(token, wordfreq)))
```

Output:

[(['], 1), (Poems', 1), (by', 1), (William', 1), (Blake', 1), (1789', 1), (]', 1), (SONGS', 2), (OF', 3), (INNOCENCE', 2), (AND', 1), (OF', 3), (EXPERIENCE', 1), (and', 1), (THE', 1), (BOOK', 1), (of', 2), (THEL', 1), (SONGS', 2), (OF', 3), (INNOCENCE', 2), (INTRODUCTION', 1), (Piping', 2), (down', 1), (the', 1), (valleys', 1), (wild', 1), (,', 3), (Piping', 2), (songs', 1), (of', 2), (pleasant', 1), (glee', 1), (,', 3), (On', 1), (a', 2), (cloud', 1), (I', 1), (saw', 1), (a', 2), (child', 1), (,', 3), (And', 1), (he', 1), (laughing', 1), (said', 1), (to', 1), (me', 1), (:', 1), (``', 1)]

Result:

Thus the count the frequency of occurrence of a word in a body of text is often needed during text processing and Conditional Frequency Distribution program using python was successfully completed.

Ex. No.:5 **Averages**

Aim:

To compute weighted averages in Python either defining your own functions or using Numpy

ALGORITHM

Step 1: Start the Program

Step 2: Create the employees_salary table and save as .csv file

Step 3: Import packages (pandas and numpy) and the employees_salary table itself:

Step 4: Calculate weighted sum and average using Numpy Average() Function

Step 5 : Stop the process

Program:6c

```
#Method  Using Numpy Average() Function

weighted_avg_m3 = round(average( df['salary_p_year'], weights = df['employees_number']),2)

weighted_avg_m3
```

Output:

44225.35

Result:

Thus the compute weighted averages in Python either defining your own functions or using Numpy was successfully completed.

Ex. No.: 6. **Variability**

Aim:

To write a python program to calculate the variance.

ALGORITHM

Step 1: Start the Program

Step 2: Import statistics module from statistics import variance

Step 3: Import fractions as parameter values from fractions import Fraction as fr

Step 4: Create tuple of a set of positive and negative numbers

Step 5: Print the variance of each samples

Step 6: Stop the process

Program:

```
# Python code to demonstrate variance()
# function on varying range of data-types

# importing statistics module
from statistics import variance

# importing fractions as parameter values
from fractions import Fraction as fr

# tuple of a set of positive integers
# numbers are spread apart but not very much
sample1 = (1, 2, 5, 4, 8, 9, 12)

# tuple of a set of negative integers
sample2 = (-2, -4, -3, -1, -5, -6)

# tuple of a set of positive and negative numbers
# data-points are spread apart considerably
sample3 = (-9, -1, -0, 2, 1, 3, 4, 19)

# tuple of a set of fractional numbers
sample4 = (fr(1, 2), fr(2, 3), fr(3, 4),
                                        fr(5, 6), fr(7, 8))

# tuple of a set of floating point values
sample5 = (1.23, 1.45, 2.1, 2.2, 1.9)
```

```
# Print the variance of each samples
print("Variance of Sample1 is % s " %(variance(sample1)))
print("Variance of Sample2 is % s " %(variance(sample2)))
print("Variance of Sample3 is % s " %(variance(sample3)))
print("Variance of Sample4 is % s " %(variance(sample4)))
print("Variance of Sample5 is % s " %(variance(sample5)))
```

Output :

Variance of Sample 1 is 15.80952380952381

Variance of Sample 2 is 3.5

Variance of Sample 3 is 61.125

Variance of Sample 4 is 1/45

Variance of Sample 5 is 0.17613000000000006

Result:

Thus the computation for variance was successfully completed.

Ex. No.:7 **Normal Curve**

Aim:

To create a normal curve using python program.

ALGORITHM

Step 1: Start the Program

Step 2: Import packages scipy and call function scipy.stats

Step 3: Import packages numpy, matplotlib and seaborn

Step 4: Create the distribution

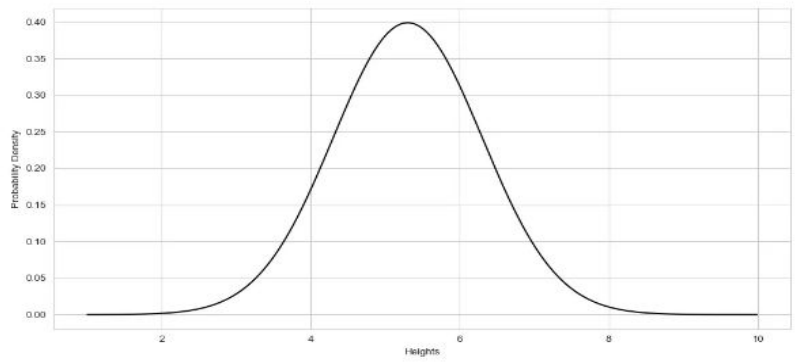
Step 5: Visualizing the distribution

Step 6: Stop the process

Program:

```
# import required libraries
from scipy.stats import norm
import numpy as np
import matplotlib.pyplot as plt
import seaborn as sb

# Creating the distribution
data = np.arange(1,10,0.01)
pdf = norm.pdf(data , loc = 5.3 , scale = 1 )

#Visualizing the distribution

sb.set_style('whitegrid')
sb.lineplot(data, pdf , color = 'black')
plt.xlabel('Heights')
plt.ylabel('Probability Density')
```

Output:



Result:

Thus the normal curve using python program was successfully completed.

Ex. No.: 8 **Correlation and scatter plots**

Aim:

To write a python program for correlation with scatter plot

ALGORITHM

Step 1: Start the Program

Step 2: Create variable y1, y2

Step 3: Create variable x, y3 using random function

Step 4: plot the scatter plot

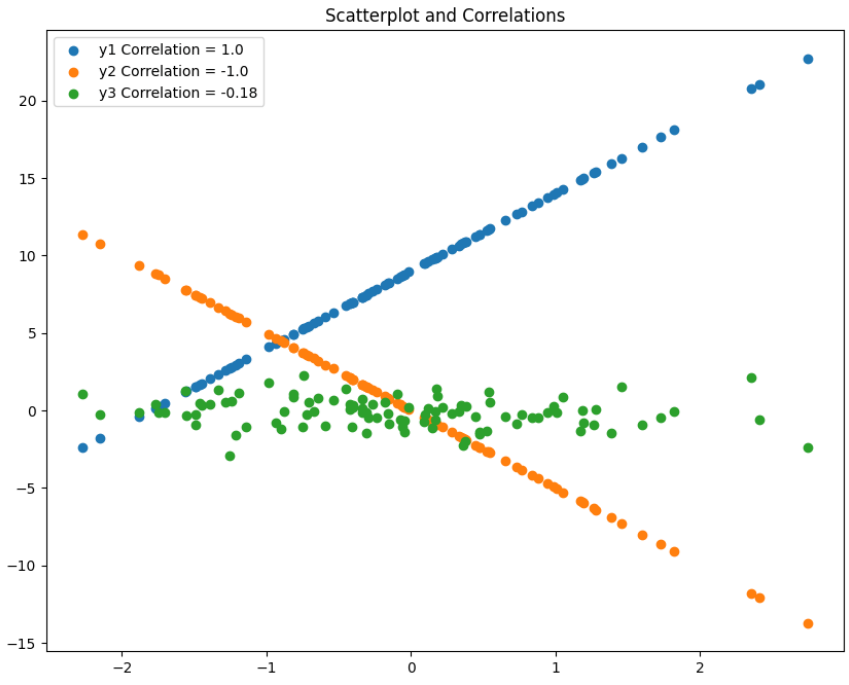
Step 5: Print the result

Step 6: Stop the process

Program:

```
# Scatterplot and Correlations

# Data

x-pp random randn(100)
yl=x*5+9
y2=-5°x
y3=no_random.randn(100)

#Plot

plt.reParams update('figure figsize' (10,8), 'figure dpi¹:100})
plt scatter(x, yl, label=fyl,  Correlation = {np.round(np.corrcoef(x,y1)[0,1], 2)})
plt scatter(x, y2, label=fy2 Correlation = (np.round(np.corrcoef(x,y2)[0,1], 2)})
plt scatter(x, y3, label=fy3 Correlation = (np.round(np.corrcoef(x,y3)[0,1], 2)})

# Plot


plt titlef('Scatterplot and Correlations')
plt(legend)
plt(show)
```

Output



Result:

Thus the Correlation and scatter plots using python program was successfully completed.

Ex. No.: 9 **Correlation coefficient**

Aim:

To write a python program to compute correlation coefficient.

ALGORITHM

Step 1: Start the Program

Step 2: Import math package

Step 3: Define correlation coefficient function

Step 4: Calculate correlation using formula

Step 5:Print the result

Step 6 : Stop the process

Program:

```
# Python Program to find correlation coefficient.
import math

# function that returns correlation coefficient.
def correlationCoefficient(X, Y, n) :
    sum_X = 0
    sum_Y = 0
    sum_XY = 0
    squareSum_X = 0
    squareSum_Y = 0

    i = 0
    while i < n :
        # sum of elements of array X.
        sum_X = sum_X + X[i]

        # sum of elements of array Y.
        sum_Y = sum_Y + Y[i]

        # sum of X[i] * Y[i].
        sum_XY = sum_XY + X[i] * Y[i]

        # sum of square of array elements.
        squareSum_X = squareSum_X + X[i] * X[i]
        squareSum_Y = squareSum_Y + Y[i] * Y[i]
```

```
        i = i + 1

    # use formula for calculating correlation
    # coefficient.
    corr = (float)(n * sum_XY - sum_X * sum_Y)/
           (float)(math.sqrt((n * squareSum_X -
           sum_X * sum_X)* (n * squareSum_Y -
           sum_Y * sum_Y)))
    return corr

# Driver function
X = [15, 18, 21, 24, 27]
Y = [25, 25, 27, 31, 32]

# Find the size of array.
n = len(X)

# Function call to correlationCoefficient.
print ('{0:.6f}'.format(correlationCoefficient(X, Y, n)))
```

Output :

```
0.953463
```

Result:

Thus the computation for correlation coefficient was successfully completed.

Ex. No.: 10 **Simple Linear Regression**

Aim:

To write a python program for Simple Linear Regression

ALGORITHM

Step 1: Start the Program

Step 2: Import numpy and matplotlib package

Step 3: Define coefficient function

Step 4: Calculate cross-deviation and deviation about x

Step 5: Calculate regression coefficients

Step 6: Plot the Linear regression and define main function

Step 7: Print the result

Step 8: Stop the process

Program:

```
import numpy as np
import matplotlib.pyplot as plt

def estimate_coef(x, y):
    # number of observations/points
    n = np.size(x)

    # mean of x and y vector
    m_x = np.mean(x)
    m_y = np.mean(y)

    # calculating cross-deviation and deviation about x
    SS_xy = np.sum(y*x) - n*m_y*m_x
    SS_xx = np.sum(x*x) - n*m_x*m_x

    # calculating regression coefficients
    b_1 = SS_xy / SS_xx
    b_0 = m_y - b_1*m_x

    return (b_0, b_1)
```

```
def plot_regression_line(x, y, b):
	# plotting the actual points as scatter plot
	plt.scatter(x, y, color = "m",
				marker = "o", s = 30)

	# predicted response vector
	y_pred = b[0] + b[1]*x

	# plotting the regression line
	plt.plot(x, y_pred, color = "g")

	# putting labels
	plt.xlabel('x')
	plt.ylabel('y')

	# function to show plot
	plt.show()

def main():
	# observations / data
	x = np.array([0, 1, 2, 3, 4, 5, 6, 7, 8, 9])
	y = np.array([1, 3, 2, 5, 7, 8, 8, 9, 10, 12])

	# estimating coefficients
	b = estimate_coef(x, y)
	print("Estimated coefficients:\nb_0 = {} \
		\nb_1 = {}".format(b[0], b[1]))

	# plotting regression line
	plot_regression_line(x, y, b)

if __name__ == "__main__":
	main()
```

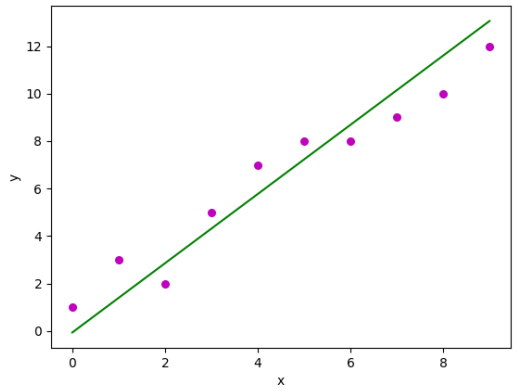
Output :

Estimated coefficients:

b_0 = -0.0586206896552

b_1 = 1.45747126437

Graph:



Result:

Thus the computation for Simple Linear Regression was successfully completed.