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BRANCH : GEOINFORMATICS

LAB 2

PROGRAM 1

PROGRAM 1.1

```
In [17]: import numpy
empty_array = numpy.empty((5,5)) #Second argument is the datatype of the empty array
full_array = numpy.full((5,5),10) #Second argument is the value to be added.
print(empty_array)
print("\n")
print(full_array)
```

```
[[5.e-324 5.e-324 5.e-324 5.e-324 5.e-324]
 [5.e-324 5.e-324 5.e-324 5.e-324 5.e-324]
 [5.e-324 5.e-324 5.e-324 5.e-324 5.e-324]
 [5.e-324 5.e-324 5.e-324 5.e-324 5.e-324]
 [5.e-324 5.e-324 5.e-324 5.e-324 5.e-324]]
```

```
[[10 10 10 10 10]
 [10 10 10 10 10]
 [10 10 10 10 10]
 [10 10 10 10 10]
 [10 10 10 10 10]]
```

PROGRAM 1.2

```
In [16]: import numpy
zero_array = numpy.full((5,5),0)
one_array = numpy.full((5,5),1)
print(zero_array)
print("\n")
print(one_array)
```

```
[[0 0 0 0 0]
 [0 0 0 0 0]
 [0 0 0 0 0]
 [0 0 0 0 0]
 [0 0 0 0 0]]
```

```
[[1 1 1 1 1]
 [1 1 1 1 1]
 [1 1 1 1 1]
 [1 1 1 1 1]
 [1 1 1 1 1]]
```

PROGRAM 1.3

```
In [47]: import numpy
matrix_one = numpy.random.randint(0,100,[5,5]) #First 2 arguments are the range of
matrix_two = numpy.random.randint(0,100,[5,5])
print(matrix_one)
print("\n")
print(matrix_two)
print("\n")
matrix_multiply = numpy.multiply(matrix_one,matrix_two)
print(matrix_multiply)
```

```
[[49 15  9 79 42]
 [48 21 88 91 87]
 [89 56 23 81 17]
 [40 15 78 55 78]
 [84 78 46 66  1]]
```

```
[[42 38 68 77 42]
 [ 3 93 31 99 73]
 [ 5 92 83 94 34]
 [22  0 11 89 23]
 [18 81 99 26 29]]
```

```
[[2058  570  612 6083 1764]
 [ 144 1953 2728 9009 6351]
 [ 445 5152 1909 7614  578]
 [ 880    0  858 4895 1794]
 [1512 6318 4554 1716  29]]
```

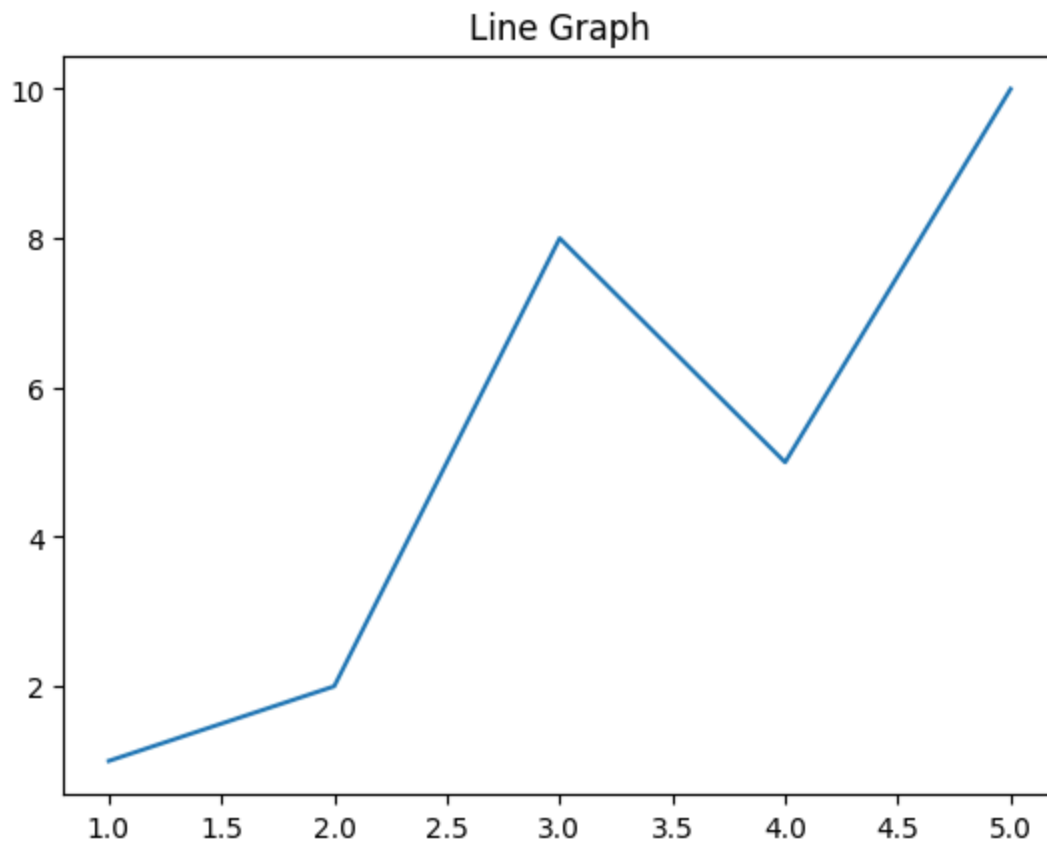
PROGRAM 1.4

```
In [1]: import numpy
array = numpy.array([1,2,3,4,5,6])
numpy.savetxt("test.csv",array)
file = open("test.csv")
for i in file:
    print(i)
```

1.0000000000000000e+00
2.0000000000000000e+00
3.0000000000000000e+00
4.0000000000000000e+00
5.0000000000000000e+00
6.0000000000000000e+00

PROGRAM 1.5

```
In [46]: import numpy
import matplotlib.pyplot as graph
x_values = numpy.array([1,2,3,4,5])
y_values = numpy.array([1,2,8,5,10])
graph.title("Line Graph")
graph.plot(x_values,y_values)
graph.show()
```



PROGRAM 2

```
In [12]: import math
def is_prime(num):
    for i in range(2,int(math.sqrt(num))+1):
        if num % i == 0:
            return False
    return True

def main():
    a = list()
    for i in range(2,100):
        if is_prime(i):
            a.append(i)
    print("Prime numbers in descending order : ", a[::-1])
    print("Number of primes : ", len(a))

main()
```

Prime numbers in descending order : [97, 89, 83, 79, 73, 71, 67, 61, 59, 53, 47, 43, 41, 37, 31, 29, 23, 19, 17, 13, 11, 7, 5, 3, 2]
 Number of primes : 25

PROGRAM 3

```
In [54]: import numpy
array = numpy.array([[1,2,3,4],[5,6,7,8],[9,10,11,12],[13,14,15,16]])
print(array)
print("\n")
print("Dimensions : ",array.shape)
print("\n")
print("Datatype : ",array.dtype)
```

```
[[ 1  2  3  4]
 [ 5  6  7  8]
 [ 9 10 11 12]
 [13 14 15 16]]
```

Dimensions : (4, 4)

Datatype : int64

PROGRAM 3.1

```
In [56]: import numpy
array = numpy.array([[1,2,3,4],[5,6,7,8],[9,10,11,12],[13,14,15,16]])
print(array)
print("\n")
print(array[0])
```

```
[[ 1  2  3  4]
 [ 5  6  7  8]
 [ 9 10 11 12]
 [13 14 15 16]]
```

```
[1 2 3 4]
```

PROGRAM 3.2

```
In [58]: import numpy
array = numpy.array([[1,2,3,4],[5,6,7,8],[9,10,11,12],[13,14,15,16]])
print(array)
print("\n")
print(array[:, -1])
```

```
[[ 1  2  3  4]
 [ 5  6  7  8]
 [ 9 10 11 12]
 [13 14 15 16]]
```

```
[ 4  8 12 16]
```

PROGRAM 3.3

```
In [64]: import numpy
array = numpy.array([[1,2,3,4],[5,6,7,8],[9,10,11,12],[13,14,15,16]])
print(array)
print("\n")
print("Sub Array : \n",array[:, -2:])
```

```
[[ 1  2  3  4]
 [ 5  6  7  8]
 [ 9 10 11 12]
 [13 14 15 16]]
```

Sub Array :

```
[[3 4]
 [7 8]]
```

PROGRAM 3.4

```
In [66]: import numpy
array = numpy.array([[1,2,3,4],[5,6,7,8],[9,10,11,12],[13,14,15,16]])
print(array)
print("\n")
print("Sub Array : \n",array[1, :-1])
```

```
[[ 1  2  3  4]
 [ 5  6  7  8]
 [ 9 10 11 12]
 [13 14 15 16]]
```

Sub Array :
[8 7 6 5]

PROGRAM 4

```
In [71]: import pandas
import numpy
file = pandas.read_csv("data.csv",encoding = 'ISO-8859-1')
#ISO-8859-1 is the western europe character set.
print(file)
```

	Unnamed: 0	Unnamed: 1	Month	Avg. Temperature °C (°F)	Unnamed: 4 \
0	NaN	NaN	January	25.6 °C (78) °F	
1	?	NaN	February	26.1 °C (78.9) °F	
2	NaN	NaN	March	26.6 °C (79.8) °F	
3	NaN	NaN	April	26.9 °C (80.4) °F	
4	NaN	NaN	May	26.6 °C (79.8) °F	
5	NaN	NaN	June	25.4 °C (77.7) °F	
6	NaN	NaN	July	25 °C (77) °F	
7	NaN	NaN	August	25 °C (77) °F	
8	NaN	NaN	September	25.3 °C (77.5) °F	
9	NaN	NaN	October	25.4 °C (77.7) °F	
10	NaN	NaN	November	25.4 °C (77.8) °F	
11	NaN	NaN	December	25.5 °C (77.9) °F	

	Min. Temperature °C (°F)	Unnamed: 6	Max. Temperature °C (°F)	Unnamed: 8 \
0	22.2 °C (71.9) °F		29.6 °C (85.2) °F	
1	22.6 °C (72.7) °F		30.1 °C (86.2) °F	
2	23.7 °C (74.6) °F		30 °C (86) °F	
3	24.8 °C (76.6) °F		29.6 °C (85.3) °F	
4	24.9 °C (76.8) °F		28.8 °C (83.9) °F	
5	24 °C (75.3) °F		27.4 °C (81.4) °F	
6	23.6 °C (74.5) °F		27.1 °C (80.7) °F	
7	23.5 °C (74.4) °F		27.1 °C (80.8) °F	
8	23.6 °C (74.5) °F		27.6 °C (81.7) °F	
9	23.5 °C (74.4) °F		27.9 °C (82.2) °F	
10	23.1 °C (73.6) °F		28.1 °C (82.6) °F	
11	22.6 °C (72.7) °F		28.7 °C (83.7) °F	

	Precipitation / Rainfall mm (in)	Unnamed: 10	Humidity(%)	Rainy days (d) \
0	34	-1.3	72%	4
1	57	-2.2	74%	7
2	125	-4.9	80%	14
3	190	-7.5	84%	19
4	236	-9.3	85%	19
5	319	-12.6	89%	20
6	224	-8.8	88%	19
7	186	-7.3	87%	18
8	172	-6.8	86%	16
9	317	-12.5	86%	19
10	252	-9.9	84%	16
11	85	-3.3	77%	8

	avg. Sun hours (hours)
0	9.6
1	9.4
2	8.7
3	7.7
4	6.5
5	6.1
6	6.6
7	6.7
8	7.0
9	7.2
10	8.0
11	8.9

PROGRAM 4.1

In [102...

```
import pandas
import numpy
preci_in = list()
temp_f = list()
file = pandas.read_csv("data.csv",encoding = 'ISO-8859-1')
#ISO-8859-1 is the western europe character set.
preci = file['Precipitation / Rainfall mm (in)']
temp = file['Avg. Temperature °C (°F)']
for i in preci:
    preci_in.append( float(i) * 0.03937008)
for i in temp:
    temp_f.append((float(i.split(" ")[0]) * 1.8) + 32)

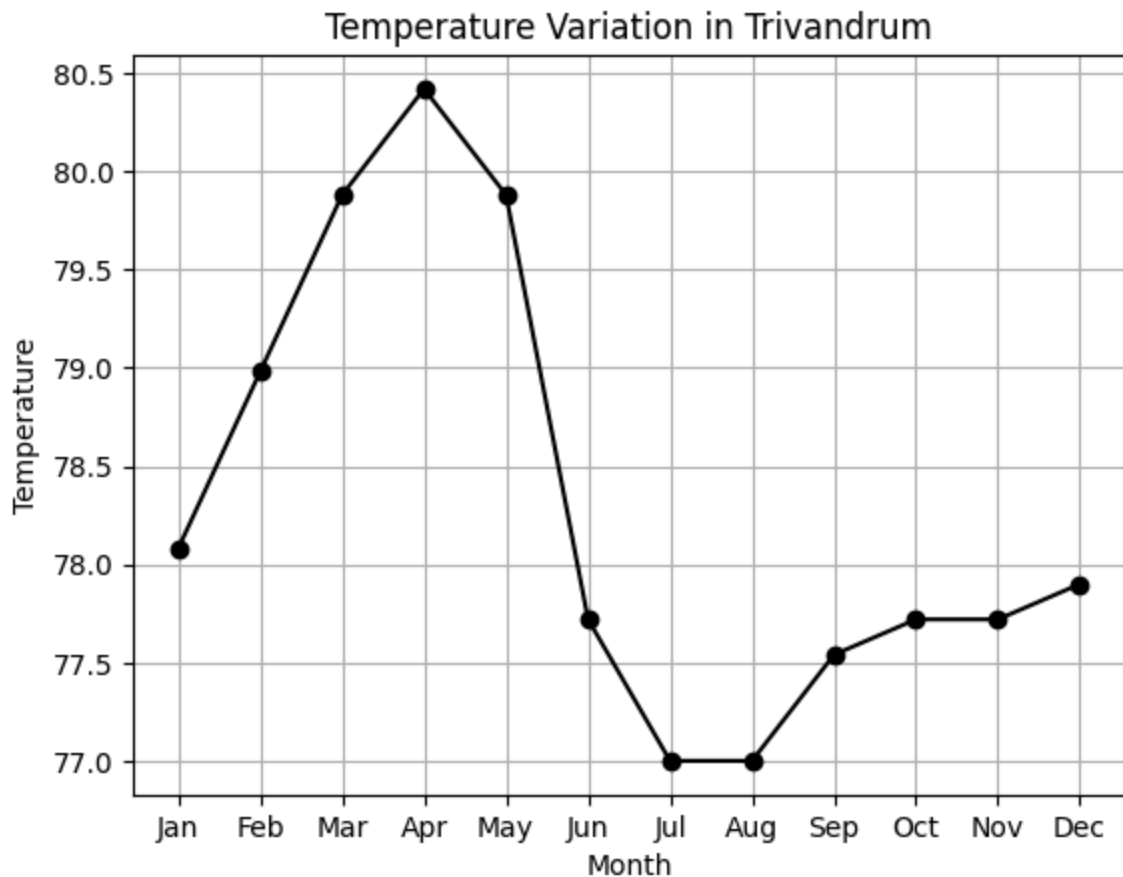
print("Temperature in Fahrenheit", " \tPrecipitation in inches")
for i in range(len(preci_in)):
    print('\t{0:.3g} \t\t\t\t {1:.3g}'.format(temp_f[i],preci_in[i]))
    #print(temp_f[i],"\t\t\t\t",preci_in[i])
```

Temperature in Fahrenheit	Precipitation in inches
78.1	1.34
79	2.24
79.9	4.92
80.4	7.48
79.9	9.29
77.7	12.6
77	8.82
77	7.32
77.5	6.77
77.7	12.5
77.7	9.92
77.9	3.35

PROGRAM 4.2

In [119...

```
import numpy
import matplotlib.pyplot as graph
months = file['Month']
month = list()
for i in months:
    month.append(i[:3])
x_values = numpy.array(month)
y_values = numpy.array(temp_f)
graph.title("Temperature Variation in Trivandrum")
graph.plot(x_values,y_values,marker = 'o',color = 'black')
graph.ylabel("Temperature")
graph.xlabel("Month")
graph.grid(True)
graph.show()
```

LEARNING OUTCOMES

Learnt how to use pandas, numpy and matplotlib modules to open and use csv files, manipulate numpy arrays and plot graphs respectively.

Starting from a basic introduction in creating and manipulating numpy arrays where the inbuilt functions of numpy arrays like `full()`, `empty()`, `zeroes()`, `ones()` were explored.

Opening and reading csv files to extract the necessary information and then doing the required operations to get information out of the data was done. And using matplotlib to use this data to plot graphs, to further lucidate the given information.