Packages and Modules

- A module is a single Python file
- A package is a collection of modules
- The import command is used to get access to the module that is out of the scope of the file in which the code is being written

Different ways to import

import <module_name>

from <module_name> import <name(s)>

from <module_name> import *

from <module_name> import <name> as <alt_name>

import <module_name> as <alt_name>

At any point if you want to know the list defined names in a namespace then use the built-in function dir(). The function can also be used with arguments.

Math

Try the following

```
import math
from math import sqrt
from math import *
from math import sqrt as squareRoot
import math as m
```

Numpy

- Numpy arrays are a type of highly structured list that you can use for doing common numerical and matrix calculations.

```
import numpy as np
a = np.array([0,10,20,30,40])
print(a[:])
print(a[1:3])
print(a[1] = 15)
b = np.arange(-5, 5, 0.5)
print(b ** 2)
print(1/b)
print(1/b[10])

#Multidimensional array
x = np.array([[1, 2, 3], [4, 5, 6]])
print(x[1,2])
```

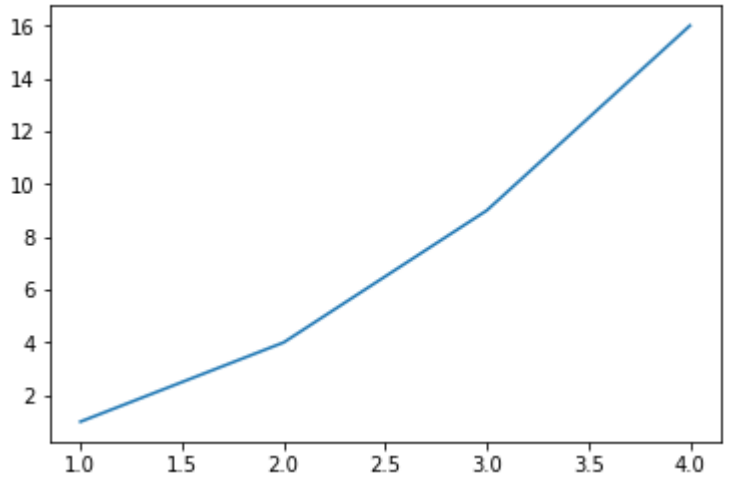
Matplotlib

- The most commonly used package in python for creating plots is called matplotlib

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

x = np.array([1,2,3,4])
y = np.array([1,4,9,16])

plt.plot(x,y)
plt.show()
```



Scipy

- Scipy contains a collection of functions that are helpful in performing basic scientific programming and data analysis

Integration using Scipy

```
import numpy as np
import scipy.integrate as integrate
result = integrate.quad(np.sin,0,np.pi)
print(result)
# Prints (2.0, 2.220446049250313e-14)
```

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Curve fitting using Scipy

```
import scipy.optimize as optimize
import numpy as np

def quadratic(x,a,b,c):
    return a*x**2 + b*x + c

xdata = [0,1,2,3,4,5]
ydata = [0,1.1,3.8,9.1,15.8,25.4]

popt, pcov = optimize.curve_fit(quadratic, xdata, ydata)
```

Pandas

- Pandas package provides an easy way to work with structured data, like, tables, multidimensional datasets, time series datasets, etc.
- Let us read a file with Pandas

Pandas

```
Customer ID,Marital Status,Kids,Annual Household Salary,Loan Amount,Car owner,Education Level,Loan Granted
1,0,0,106020,185913,1,0,0
2,0,2,1270279,4907598,1,0,0
3,1,3,1086365,3012855,1,0,1
4,1,2,516564,2493950,1,0,0
5,0,2,1291768,4870552,1,5,1
6,0,1,813425,1815248,0,0,0
7,1,0,940121,2039002,1,5,1
8,1,0,1211396,1373174,1,4,1
9,0,1,1508588,5926431,1,4,1
10,1,2,4458464,24451446,0,5,1
11,0,2,607875,1844438,0,0,0
12,0,0,477131,1372348,1,4,1
13,1,2,339217,918574,1,1,1
14,1,0,1183169,4281420,0,1,1
15,0,2,1455947,6360417,1,0,0
16,1,1,358692,1269449,1,0,1
17,0,0,652305,1465416,0,3,1
18,1,3,1650485,2022933,1,2,1
19,1,0,922497,1902438,0,2,1
20,1,2,1176313,4879822,0,5,1
```

Customer ID	Marital Status	Kids	Annual Household Salary	Loan Amount	Car owner	Education Level	Loan Granted
1	0	0	106020	185913	1	0	0
2	0	2	1270279	4907598	1	0	0
3	1	3	1086365	3012855	1	0	1
4	1	2	516564	2493950	1	0	0
5	0	2	1291768	4870552	1	5	1
6	0	1	813425	1815248	0	0	0
7	1	0	940121	2039002	1	5	1
8	1	0	1211396	1373174	1	4	1
9	0	1	1508588	5926431	1	4	1
10	1	2	4458464	24451446	0	5	1
11	0	2	607875	1844438	0	0	0
12	0	0	477131	1372348	1	4	1
13	1	2	339217	918574	1	1	1
14	1	0	1183169	4281420	0	1	1
15	0	2	1455947	6360417	1	0	0
16	1	1	358692	1269449	1	0	1
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Pandas

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```

```
import pandas as pd
csvfile = pd.read_csv(filename, usecols = np.arange(1,8))

print(csvfile["Marital Status"])
print(csvfile["Car owner"])
```