Numpy:

1.It is a mathematical module in python which has various mathematical functions.
2.It is used to create multidimensional array.

NumPy is a library for the Python programming language, adding support for large, multi-dimensional arrays and matrices, along with a large collection of high-level mathematical functions to operate on these arrays.

Why Numpy?

The traditional python list serve the purpose of creating array but they are very much slower.So the great alternative for list is using Numpy. They aim to provide an array object that is more times faster than list. Numpy are faster than list because numpy arrays are stored in one continuous place in memory unlike lists.

Creating arrays using numpy:

We can create numpy ndarray using the array() function.

Eg:

```
import numpy as np
a=np.array( [ [ 1,2,3,4 ],[ 5,6,7,8 ] ] )
print (a)
```

Numpy array indexing:

We can access the array elements by using the index number associated with it either it can be a one dimensional or two dimensional array.

Eg:

```
For one dimensional array => a[0]
For two dimensional array => a[0,1]
For three dimensional array => a[0,1,2]
Negative indexing => a[1,-1]
```

To find shape of the array:

Using the shape attribute we can find the number of elements present in the array.

Eg:

```
print (a.shape)
```

The example above returns (2,4) where the array has 2 dimensions and the first dimension has 2 elements and the second dimension has 4 elements.

Exercise codes click here:

Hackerrank problem -1(Hard)

Starting with a 1-indexed array of zeros and a list of operations, for each operation add a value to each the array element between two given indices, inclusive. Once all operations have been performed, return the maximum value in the array.

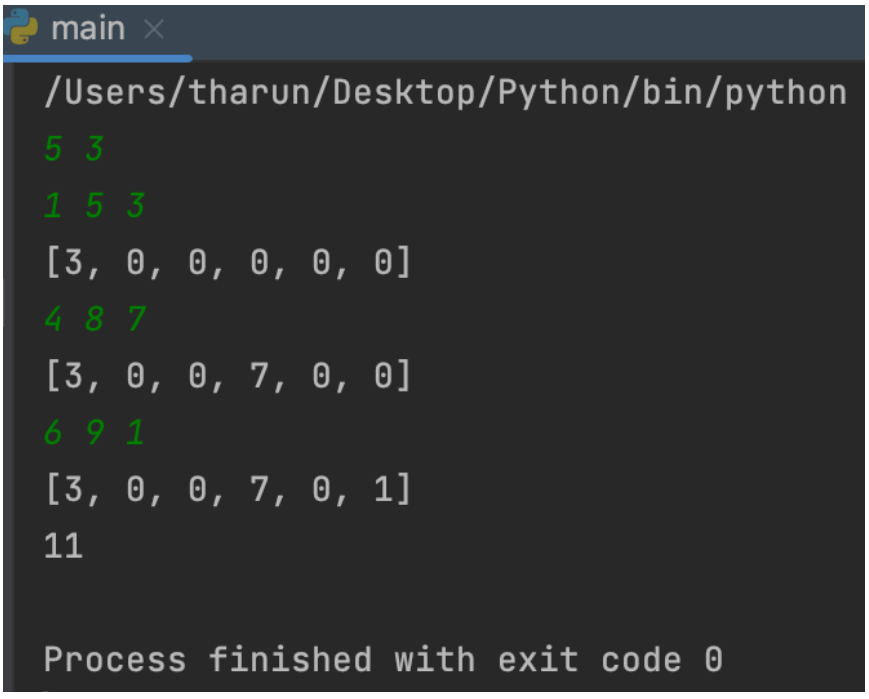
Queries are interpreted as follows:

a b k
1 5 3
4 8 7
6 9 1

Solution:

```
n, m = map(int, input().split())
a = [0]*(n+1)
m_val = temp = 0
for _ in range(m):
    f, l, val = [int(n) for n in input().split()]
    a[f-1] += val
    if l < n:
        a[l] -= val
    print(a)
for i in a:
    temp += i
    if m_val < temp:
        m_val = temp
print(m_val)
```

Output:



Caption

Hackerrank problem -2(medium)

Sparse arrays:
There is a collection of input strings and a collection of query strings. For each query string, determine how many times it occurs in the list of input strings. Return an array of the results.

Solution:

```
def matchingStrings(stringList, queries):
    result=[]
    for q in queries:
        arr=[x for x in stringList if x==q]
        result.append(len(arr))
    return result
```

Input (stdin)

```
4
aba
baba
aba
xzxb
3
aba
xzxb
ab
```

Your Output (stdout)

```
2
1
0
```

Caption

Plots and types:

Plot:

Plots also known as charts is the visual representation of data in a graphical format for the better understanding of the data.By representing the data in graphical form we can get a fair idea of what the data is trying to show.

We can use the Matplotlib visualization library in Python to portray the graphs.

Types:

The various types of plots are as follows,

- Scatter plot
- Bar plot
- Pie plot
- Line plot
- Histogram plot

1)Scatter plot:

We use scatter() function to plot one dot for each observation.It requires both x and y arrays are of the same length.

2)Bar plot:

We use bar() function to represent data with rectangular bars with length and height that is proportional to the value which they represent.They can be plotted both horizontally and vertically.

3)Pie plot:

A Pie plot is a circular statistical plot that can display only one series of data. The area of the chart is the total percentage of the given data. The area of slices of the pie represents the percentage of the parts of the data. The slices of pie are called wedges.

4)Line plot:

The relationship between the data can be represented in the form of line plotted against x and y axis.

5)Histogram plot:

A histogram is a graph showing *frequency* distributions.It is a graph showing the number of observations within each given interval.

It is a type of bar plot where X-axis represents the bin ranges while Y-axis gives information about frequency.

Exercise codes click here:

CSV files:

CSV is a comma separated value that has plain text

1) We can read or write a csv file
2) CSV file can be imported using pandas
3) All the datas can be stored in an organised manner in a csv file.
4) Each line of file is called a record .
5) The commonly used delimiter is comma but we can use other delimiters also like semicolon, colon, etc….

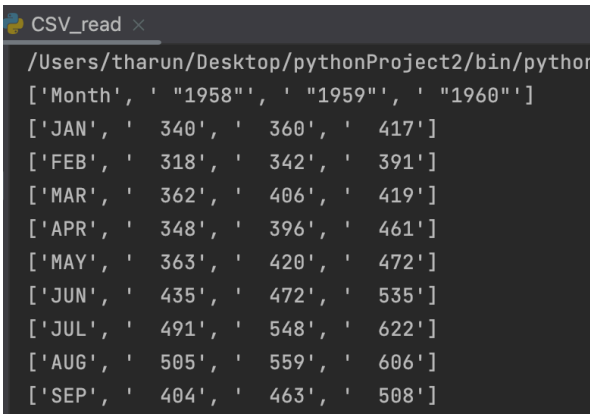
Creating a CSV file:

So a CSV file can be created by simply saving the file with the extension (.csv) and the content of the files should be seperated with the delimiter comma or any desired delimiter which should be specified as a delimiter.

Reading a CSV file:

First we import the CSV file then open that csv file in read mode and assign a variable csv_read to call csv file.Now using for loop we can print each line of the csv file.

Reading airtravel.csv file in read mode



Output

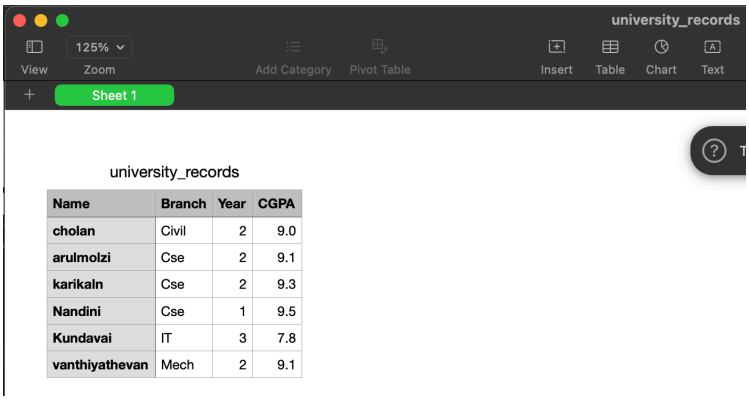
Writing a CSV file:

To write data into a csv file we use the write method.First we import csv file and then we define the field names and the dats to be inserted into the rows and also define the filename.Now we write the fields and row data using writerow() method.

CSV_write.py

```
1   import csv
2   feilds=['Name','Branch','Year','CGPA']
3   rows=[ ['cholan', 'Civil', '2', '9.0'],
4          ['arulmolzi', 'Cse', '2', '9.1'],
5          ['karikaln', 'Cse', '2', '9.3'],
6          ['Nandini', 'Cse', '1', '9.5'],
7          ['Kundavai', 'IT', '3', '7.8'],
8          ['vanthiyathevan', 'Mech', '2', '9.1']]
9   filename = "university_records.csv"
10  with open(filename,'w') as csvfile:
11      csvwriter = csv.writer(csvfile)
12      csvwriter.writerow(feilds)
13      csvwriter.writerows(rows)
```

Writing to university_records.csv



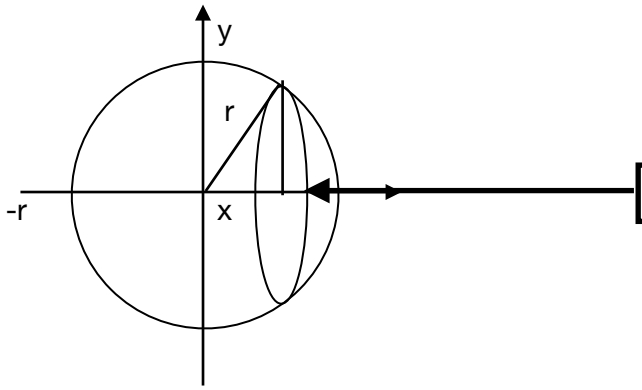
university_records

Name	Branch	Year	CGPA
cholan	Civil	2	9.0
arulmolzi	Cse	2	9.1
karikaln	Cse	2	9.3
Nandini	Cse	1	9.5
Kundavai	IT	3	7.8
vanthiyathevan	Mech	2	9.1

Data written in university_record.csv

Volume of sphere:

To find the volume of the sphere first we consider a circle of radius 'h' in any part of the sphere.



Now we find the area of that circle inside the sphere,

$$A(x) = \pi \times (r^2)$$
$$= \pi \times (y^2) \longrightarrow \text{Eq 1}$$

To get in terms of y by using pythagoras theorem,

$$r^2 = x^2 + y^2$$
$$y^2 = r^2 - x^2$$
$$y = \sqrt{(r^2 - x^2)}$$

Substitute y in eq 1

$$A(x) = \pi \times (\sqrt{(r^2 - x^2)})^2$$
$$A(x) = \pi \times (r^2 - x^2)$$

The volume of the sphere is,

$$V = \int \pi (r^2 - x^2) dx$$
$$= \pi \int (r^2 - x^2) dx \quad (\text{limit} => -r \text{ to } r)$$

on solving this we get,

$$\therefore \textbf{ Volume of the sphere } = \frac{4}{3}\pi r^3$$