Sane's STATS Academy of Statistics

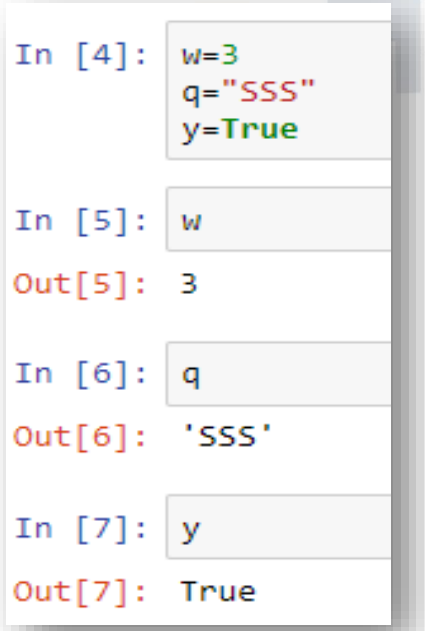
Python Basics

Lists, Functions, Packages, Dictionaries

Sane's STATS Academy of Statistics

Data Types

- float : real numbers
- int : integer numbers
- str : text
- bool : True, False



Sane's STATS Academy of Statistics

Arithmetic Operations

- Python console can be used like a calculator (just like R)
- Apart from routine arithmetic calculations, Python allows us to perform some operations on strings also using some arithmetic operators

```
a = "Data"
b = "Science"
print(a+b)
```

```
DataScience
```

```
a = "Data"
print(a * 3)
```

```
DataDataData
```

```
print('Data' 'Science')
```

```
DataScience
```

Sane's STATS Academy of Statistics

Lists

Creating & Managing

Sane's STATS Academy of Statistics

List

- Convenient for storing many values
- Stores values with different data types in a single object

```
In [4]: custList = ["Suvarna",42,"Amit",32,"Rohit",41,"Janhavi",42,"Deepa",49]
   ...:
   ...: custList
Out[4]: ['Suvarna', 42, 'Amit', 32, 'Rohit', 41, 'Janhavi', 42, 'Deepa', 49]
```

```
In [19]: prodList = [["Pen",10],
    ...:             ["Pencil",8],
    ...:             ["Eraser",5],
    ...:             ["Sharpner",10]]

In [20]: prodList
Out[20]: [['Pen', 10], ['Pencil', 8], ['Eraser', 5], ['Sharpner', 10]]
```

Sane's STATS Academy of Statistics

Indexing of Lists

- Lists in Python have zero based indexing. i.e. index 0 corresponds to 1st element, index 1 corresponds to 2nd element etc.
- Similarly, reversely indexing is negative.

```
In [4]: custList = ["Suvarna",42,"Amit",32,"Rohit",41,"Janhavi",42,"Deepa",49]
   ...:
   ...: custList
Out[4]: ['Suvarna', 42, 'Amit', 32, 'Rohit', 41, 'Janhavi', 42, 'Deepa', 49]
```

0	1	2	3	4	5	6	7	8	9
-10	-9	-8	-7	-6	-5	-4	-3	-2	-1

```
In [5]: custList[3]
Out[5]: 32

In [6]: custList[-7]
Out[6]: 32
```

Sane's STATS Academy of Statistics

List Slicing

- For sequentially sub-setting the list we need to specify the indices as [start : end], where start index is inclusive and end index is exclusive

```
In [4]: custList = ["Suvarna",42,"Amit",32,"Rohit",41,"Janhavi",42,"Deepa",49]
   ...:
   ...: custList
Out[4]: ['Suvarna', 42, 'Amit', 32, 'Rohit', 41, 'Janhavi', 42, 'Deepa', 49]
```

0	1	2	3	4	5	6	7	8	9
-10	-9	-8	-7	-6	-5	-4	-3	-2	-1

Index 0	Index 1	Index 2	Index 3	Index 4
Element 0	Element 1	Element 2	Element 3	

```
In [7]: custList[3:7]
Out[7]: [32, 'Rohit', 41, 'Janhavi']

In [8]: custList[-5:-2]
Out[8]: [41, 'Janhavi', 42]

In [9]: custList[:6]
Out[9]: ['Suvarna', 42, 'Amit', 32, 'Rohit', 41]

In [10]: custList[6:]
Out[10]: ['Janhavi', 42, 'Deepa', 49]
```

Sane's STATS Academy of Statistics

List Slicing

- Increments can be specified by writing third index

```
In [3]: custList = ["Suvarna",42,"Amit",32,"Rohit",41,"Janhavi",42,"Deepa",49]

In [4]: custList[0:5:2]
Out[4]: ['Suvarna', 'Amit', 'Rohit']

In [5]: custList[::2]
Out[5]: ['Suvarna', 'Amit', 'Rohit', 'Janhavi', 'Deepa']
```

Sane's STATS Academy of Statistics

Changing the list elements

- The list elements can be changed by specifying the corresponding indices
- The elements can be added with "+" operator or by calling append method and can be removed using del()

```
In [4]: custList = ["Suvarna",42,"Amit",32,"Rohit",41,"Janhavi",42,"Deepa",49]
   ...:
   ...: custList
Out[4]: ['Suvarna', 42, 'Amit', 32, 'Rohit', 41, 'Janhavi', 42, 'Deepa', 49]
```

0	1	2	3	4	5	6	7	8	9
-10	-9	-8	-7	-6	-5	-4	-3	-2	-1

```
In [13]: custList=custList+["Girija",13]

In [24]: del(custList[6:8])
    ...: custList
Out[24]: ['Suvarna', 42, 'Amit', 32, 'Rohit', 41, 'Deepa', 49]

In [25]: custList.append(["Deepika",32])
    ...: print(custList)
['Suvarna', 42, 'Amit', 32, 'Rohit', 41, 'Deepa', 49, ['Deepika', 32]]
```

Sane's STATS Academy of Statistics

Calling by Reference

- The lists are stored by reference

```
In [17]: Customers=custList

In [18]: Customers[1]=36

In [19]: Customers
Out[19]: ['Sumedha', 36, 'Amit', 34, 'Rohit', 41, 'Deepa', 49, 'Girija', 13]

In [20]: Customers.index("Rohit")
Out[20]: 4

In [21]: custList
Out[21]: ['Sumedha', 36, 'Amit', 34, 'Rohit', 41, 'Deepa', 49, 'Girija', 13]
```

Sane's STATS Academy of Statistics

Packages

Sane's STATS Academy of Statistics

Why Packages?

- Many Functions
- Lots of diversity
- Maintaining the compartmental divisions in the code can be done with packages
- Package examples
  - Numpy
  - Matplotlib
  - Scikit-learn

Sane's STATS Academy of Statistics

Using Packages

- For using any package, you need to
  - Install that package
  - Import that package
- Installing Package
  - Go to http://pip.readthedocs.org/en/stable/installing/
  - Download get-pip.py
  - Or at Terminal type:
  - python3 get-pip.py
  - pip3 install numpy (for package numpy)

Sane's STATS Academy of Statistics

Importing package

- We can import package with keyword import as

```
In [68]: import numpy
    ...: numpy.absolute(-8)
Out[68]: 8
```

- Abbreviation / alias for a package name can also be used

```
In [69]: import numpy as np
    ...: np.absolute(-8)
Out[69]: 8
```

- Or just a function can be imported from a package as

```
In [70]: from numpy import absolute
    ...: absolute(-8)
Out[70]: 8
```

Sane's STATS Academy of Statistics

Package numpy

Sane's STATS Academy of Statistics

Calculations with lists

- Arithmetic calculations with lists cannot be performed

```
In [3]: length = [23,34.5,6.7,90.4,45.3]

In [4]: breadth = [21,23,45,65,12.3]

In [5]: area = length * breadth
Traceback (most recent call last):

  File "<ipython-input-5-ea519f670ae6>", line 1, in <module>
    area = length * breadth

TypeError: can't multiply sequence by non-int of type 'list'


In [6]: length + breadth
Out[6]: [23, 34.5, 6.7, 90.4, 45.3, 21, 23, 45, 65, 12.3]
```

Sane's STATS Academy of Statistics

Package numpy

- Package numpy allows us to perform mathematical calculations on lists
- We need to import numpy and then create a numpy array out of the list

```
In [7]: import numpy

In [8]: lg = numpy.array(length)

In [9]: bd = numpy.array(breadth)

In [10]: area = lg * bd

In [11]: area
Out[11]: array([  483.  ,   793.5 ,   301.5 ,  5876.  ,   557.19])

In [12]: lg + bd
Out[12]: array([  44. ,   57.5,   51.7,  155.4,   57.6])
```

```
In [13]: import numpy as np

In [14]: lg = np.array(length)

In [15]: bd = np.array(breadth)

In [16]: area = lg * bd

In [17]: area
Out[17]: array([  483.  ,   793.5 ,   301.5 ,  5876.  ,   557.19])

In [18]: lg + bd
Out[18]: array([  44. ,   57.5,   51.7,  155.4,   57.6])
```

Sane's STATS Academy of Statistics

Subsetting the numpy array

```
In [28]: lg
Out[28]: array([ 23. ,  34.5,   6.7,  90.4,  45.3])

In [29]: lg>30
Out[29]: array([False,  True, False,  True,  True], dtype=bool)

In [30]: lg[lg>30]
Out[30]: array([ 34.5,  90.4,  45.3])
```

Sane's STATS Academy of Statistics

2D Arrays

```
In [37]: a1 = np.array([[12,23,29,34],[89,92,82,56]])

In [38]: a1
Out[38]:
array([[12, 23, 29, 34],
       [89, 92, 82, 56]])

In [39]: a1.shape
Out[39]: (2, 4)

In [40]: type(a1)
Out[40]: numpy.ndarray

In [41]: a1[0]
Out[41]: array([12, 23, 29, 34])

In [42]: a1[0][2]
Out[42]: 29

In [43]: a1[0,2]
Out[43]: 29

In [44]: a1[:,1:3]
Out[44]:
array([[23, 29],
       [92, 82]])
```

Sane's STATS Academy of Statistics

Invoking Functions and Calling Attributes

- Functions and attributes can be called using "." period operator on the object of the respective class e.g. object of class numpy has functions mean(), median(), sort()

```
In [59]: lg
Out[59]: array([ 23. ,  34.5,   6.7,  90.4,  45.3])
In [60]: type(np)
Out[60]: module
In [61]: np.mean(lg)
Out[61]: 39.980000000000004
In [62]: np.median(lg)
Out[62]: 34.5
In [63]: np.sort(lg)
Out[63]: array([  6.7,  23. ,  34.5,  45.3,  90.4])
In [63]:

In [64]: lg
Out[64]: array([ 23. ,  34.5,   6.7,  90.4,  45.3])
In [65]: type(np)
Out[65]: module
In [66]: lg.mean()
Out[66]: 39.980000000000004
In [67]: lg.size
Out[67]: 5
In [68]: lg.sort()

In [69]: lg
Out[69]: array([  6.7,  23. ,  34.5,  45.3,  90.4])
```

Sane's STATS Academy of Statistics

Importing files with numpy

- Function `numpy.loadtxt()` can be used to load the data into 2D numpy array
- Only numbers allowed

```
In [42]: boston = np.loadtxt("G:/Statistics (Python)/Datasets/Boston.csv",
    ...:                     delimiter=",",skiprows=1)
    ...: boston.shape
Out[42]: (506, 14)
```

Sane's STATS Academy of Statistics

Dictionaries

Sane's STATS Academy of Statistics

Indexed Values

- Lists are indexed values
- If want to retrieve data from list by index, it can be done calling index() on list object
- Suppose that you have two different lists countries and pop

```
countries=["India","China","US","Indonesia"]
pop=[1339180127,1409517397,324459463,263991379]

#### Calling by Index
ch_ind=countries.index("China")
pop_ch=pop[ch_ind]
pop_ch
```

Sane's STATS Academy of Statistics

Dictionaries

- Key-Value pairs can be easily stored and retrieved in Python using dictionary
- You need to specify the key-value pairs in curly brackets and separate each key with value by ":"

```
In [14]: populations={ "India":1339180127,
    ...:                "China":1409517397,
    ...:                   "US":324459463,
    ...:                   "Indonesia":263991379
    ...:          }
    ...:
    ...: populations['China']
    ...:
Out[14]: 1409517397
```

Adding and Removing

- You can add element in the dictionary by just specifying it in the assignment

```
In [15]: populations['Brazil']=209288278

In [16]: populations
Out[16]:
{'Brazil': 209288278,
 'China': 1409517397,
 'India': 1339180127,
 'Indonesia': 263991379,
 'US': 324459463}
```

- You can remove element from the dictionary calling the function del()

```
In [17]: del(populations['Brazil'])

In [18]: populations
Out[18]:
{'China': 1409517397,
 'India': 1339180127,
 'Indonesia': 263991379,
 'US': 324459463}
```

Sane's STATS Academy of Statistics

Dictionary of Dictionaries

- Dictionary can be nested inside a dictionary

```
In [26]: demog = { 'India': { 'capital':'Delhi', 'population':1339180127 },
    ...:             'China': { 'capital':'Beijing', 'population':1409517397 },
    ...:             'US': { 'capital':'Washington', 'population':324459463 },
    ...:             'Indonesia': { 'capital':'Jakarta', 'population':263991379 } }
    ...:

In [27]: demog['US']['capital']
Out[27]: 'Washington'

In [28]: data={
    ...:     'capital':'Brasilia',
    ...:     'population':209288278
    ...: }

In [29]: demog['Brazil']=data
    ...:
    ...: demog
Out[29]:
{'Brazil': {'capital': 'Brasilia', 'population': 209288278},
 'China': {'capital': 'Beijing', 'population': 1409517397},
 'India': {'capital': 'Delhi', 'population': 1339180127},
 'Indonesia': {'capital': 'Jakarta', 'population': 263991379},
 'US': {'capital': 'Washington', 'population': 324459463}}
```

Sane's STATS Academy of Statistics

Difference Between Lists and Dictionaries

List

- Stored values with index of numbers
- You can use list when order of values matter

Dictionaries

- Stored values with keys, no necessarily numbers
- You can use dictionaries when you want to retrieve values by a “look-up” table logic

Sane's STATS Academy of Statistics

Questions ?