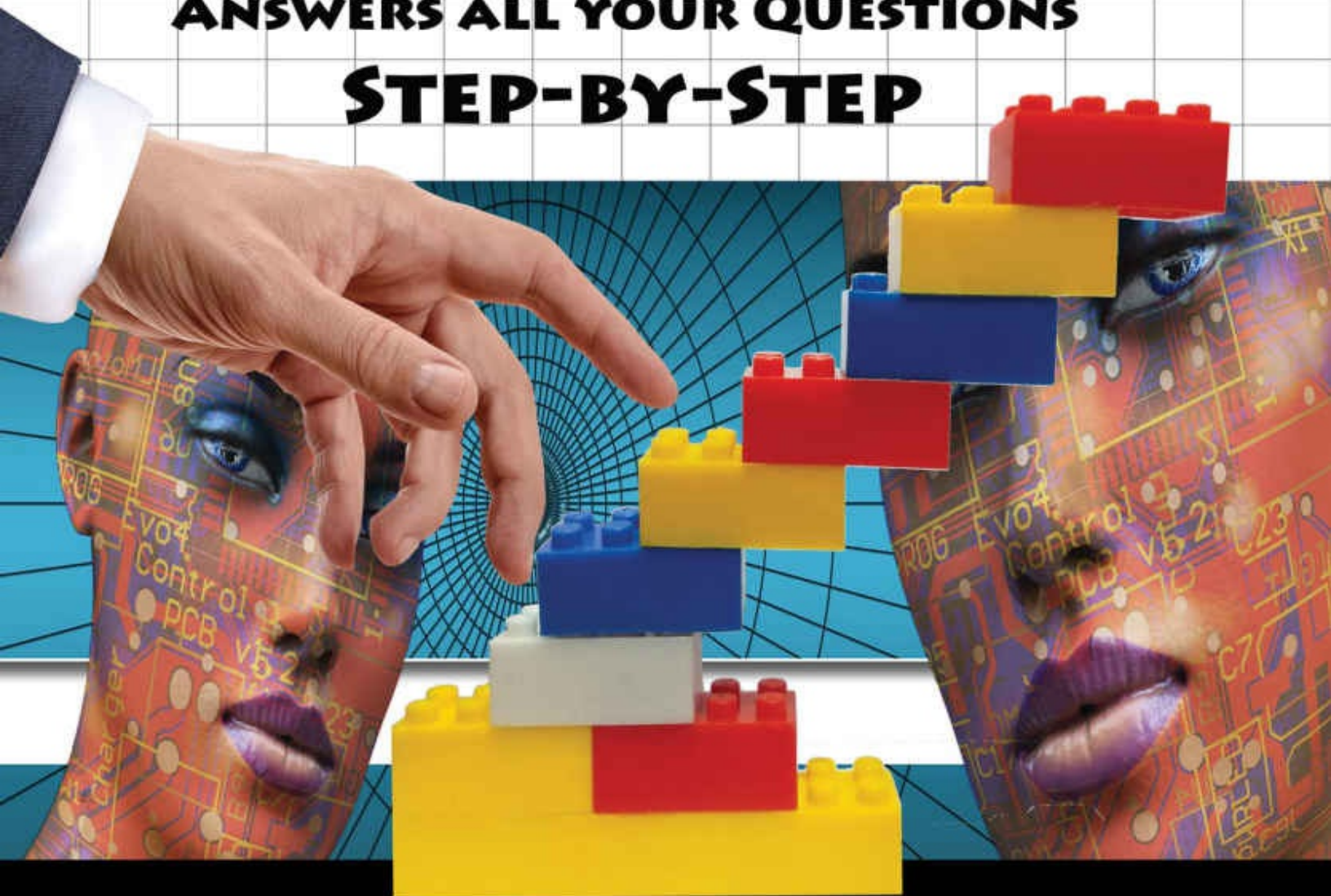


**A FRIENDLY Q & A GUIDE**

# **PYTHON** **FOR** **DATA ANALYSIS**

**MASTER THE BASICS OF DATA ANALYSIS**  
**IN PYTHON USING NUMPY & PANDAS**  
**ANSWERS ALL YOUR QUESTIONS**  
**STEP-BY-STEP**



**RYSHITH DOYLE**

**PYTHON**  
**FOR DATA ANALYSIS:**  
**Master the Basics of Data Analysis**  
**in Python Using**  
**Numpy & Pandas**  
**Answers all your Questions Step-by-Step**

**RYSHITH DOYLE**  
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## **The aim and objective of this book**

1. To help you master the basic of Python Data Analysis Concepts
2. To help you master Python Data Analysis Libraries
3. To equip you with the skill to work with Numpy library
4. To equip you with the skill to work with Panda library
5. To help you to effectively use Data Series objects to store and manipulate data
6. To help you to effectively use Data Frame objects to store and manipulate data
7. To help you effectively handle .csv files in Python programs
8. To help connect SQL Tables with Python programs using Pandas
9. To adopt the Q&A method so as to simplify the learning process
10. To Provide ample example to help you understand concepts easily

# CHAPTER 1: INTRODUCTION TO PYTHON PANDAS

## 1. What is Python Pandas?

**Ans:**

- a) Panda stands for : “Panel Data System”
- b) Pandas is a package for data analysis in the Python programming language.
- c) It is an Open Source Software.
- d) It provides ‘Data Structures’ and ‘Functions’ for efficient data manipulation and analysis.
- e) It was developed by Wes McKinney, an American software developer and businessman.

## 2. List the Salient Features of Python Pandas

**Ans:**

- a) It is an Open Source Software
- b) It is easy to work with Pandas data structures
- c) Python Pandas provides fast and flexible when compared to other Data Analysis Tools
- d) It is capable of handling Big Data applications
- e) It helps us handle missing data efficiently
- f) It makes data analysis more accurate and reliable
- g) It is easy to Import/Export data from/to other formats such as .csv, SQL Tables or Excel sheets.
- h) It supports Boolean Reduction in order to concise the larger data without losing its essence.
- i) Broadcasting Operation can be done in a seamless manner
- j) Pandas can integrate other modules such as, Numpy, Matplotlib to help in data analysis

### 3. How to use Pandas in Python?

**Ans:** In order to work with pandas in Python we need to import Pandas library into python by giving the following command.

**import pandas as pd**

### 4. What is meant by Data Structure?

**Ans:**

- i) Data Structure is the format of storing data.
- ii) Two popular data structures of Pandas are: 'Data Series' and 'DataFrame'.

Note: The **data** and the **index** are given a separate **list** of values. In case the index is not provided then the default index starts from 0 onwards.

### 5. Explain Python DataFrame with a simple example:

**Ans:**

- i) Python DataFrame stores data in a Two Dimensional Array (2-D Array)
- ii) It stores an ordered collection of columns
- iii) It supports both row-index and column-index
- iv) The row index is called the **index** and the column index is called the **column name**.
- v) It is similar to a spreadsheet
- vi) Example: The following program stores the price of 3 products available in two different sizes into a Data Series, and then displays it.

**Code:**

```
import pandas as pd
print('-----PRICE LIST OF THREE PRODUCTS BASED OF SIZE----')
price=pd.DataFrame(
{"Large":[75,200,55],"Medium":[50,120,30] },
```

```
index=['Ice Cream','Pizza','Coke']
print(price)
```

**Output:**

```
-----PRICE LIST OF THREE PRODUCTS BASED OF SIZE-----
--
```

	Large	Medium
Ice Cream	75	50
Pizza	200	120
Coke	55	30

**Note:** Series and DataFrame will be covered in detail later in the chapter. Before getting into the details of Series and DataFrame we will cover NumPy arrays, because both Series and DataFrame always return the output in the form of NumPy arrays.

## CHAPTER 2: working with NumPy module

### 1. **What is NumPy?**

**Ans:**

- i) NumPy is short for “Numeric Python”
- ii) NumPy is an Open Source Software module that can be integrated into Python
- iii) Python programming language was not initially designed for numerical computing, so NumPy is integrated to help implement high-level mathematical functions using Arrays
- iv) It supports both 1-D Arrays(Vectors) and Multi-Dimensional Arrays(Matrices)

### 2. **How to use NumPy in Python?**

Ans: In order to work with NumPy in Python we need to import NumPy library into python by giving the following command.

```
import numpy as np
```

### 3. **Explain how to create a one dimensional array using Numpy with a simple example.**

Ans: The following program creates an One dimensional Numpy array and stores the Name of three Employees:

Code:

```
import numpy as np
Names=['Harry','Muller','Chang']
EMP_List=np.array(Names)
print(EMP_List)
```

Output:

```
['Harry' 'Muller' 'Chang']
```

4. **Explain how to create a Multidimensional (2D) array using Numpy with a simple example.**

Ans: The following program creates Multidimensional (2D) Numpy array and stores the Name of three Employees and their Ages:

Code:

```
import numpy as np
Names=['Harry','Muller','Chang']
Age=[45,36,38]
EMP_List=np.array([Names,Age])
print(EMP_List)
```

Output:

```
[['Harry' 'Muller' 'Chang']
 [45' 36' 38']]
```

5. **Explain ‘Empty Array’ using a simple example.**

**Ans:**

- i) Empty Array means an array with no values filled as yet
- ii) Numpy uses the empty() to create an empty array
- iii) Example : The following program creates an empty array

Code:

```
import numpy as np
Sal=np.empty([3,3])
print(Sal)
```

**Output:**

```
[[ 0.00000000e+000  6.91843266e-310  6.91842637e-310]
 [ 6.91842638e-310  6.91843265e-310  6.91843265e-310]
```



[ 6.91843265e-310 6.91843265e-310 4.67417184e-310]]

Note: If we print the empty array it will display junk values.

6. **State the difference between NumPy Array and Python Lists:**

**Ans:**

SN	Numpy Array	Python List
1	<b>Memory Space:</b> Numpy arrays take up less memory space	Python lists take up much more space as compared to Numpy Arrays
2	<b>Resize:</b> NumPy array size cannot be changed	Python lists size cannot be changed
3	<b>Speed:</b> They execute faster than Python Lists	They are slower
4	<b>Built-in functions:</b> Numpy arrays have more advanced built-in functions, such as linear algebra operations	Python lists have limited built-in functions as compared to Numpy Arrays
5	<b>Data Type:</b> All the elements need to be of the same data type	The elements of a Python List can be of different data types.  Example: import numpy as np Age=np.array([20,45,35]) MyList=['Cat', 2 ,'Dog']

7. **Explain 'Zero Array' using a simple example.**

**Ans:**

i) Zero Array means an array with 0 as the default values filled in all its cells

ii) Numpy uses the zeros() to create a Zero array

iii) Example : The following program creates a Zero array

Code:

```
import numpy as np
Sal=np.zeros([3,3])
print(Sal)
```

Output:

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

Note: Similarly a ones array can be created using np.ones( )

8. **Explain how to populate a Numpy array with a series of values with Fixed Interval:**

**Ans:**

i) The arange() is used to fill a numpy array with a series of values with Fixed Interval

ii) Syntax: numpy.arange([start, ]stop, [step, ]dtype=None)

iii) Example: The following program populates a numpy array with Student Roll Numbers from 1 to 10.

Code:

```
import numpy as np
RollNo=np.arange(1,11,1)
print(RollNo)
```

Output:

```
[ 1  2  3  4  5  6  7  8  9 10]
```

Note: the stop value is mentioned as 11 because, the stop value is not included.

9. **Explain how to populate a Numpy array with a series of values with Fixed Interval using linspace():**

**Ans:**

- i) The linspace() is used to fill a numpy array with a series of values with Fixed Interval
- ii) Unlike arrange in linspace() we need to specify the **number of values** we require.
- iii) Syntax: numpy.linspace(start, stop, num=<number of values>)
- iv) Example: The following program places 3 points from 1 to 10

Code:

```
import numpy as np
pt=np.linspace(1,10,4)
print(pt)
```

Output:

```
[ 1.  4.  7. 10.]
```

10. **Explain how display the data type of a Numpy Array.**

**Ans:**

- i) The type() function is used to display the data type of the Numpy Array.

- ii) Example:

```
import numpy as np
List=[1,2,3,4]
a1=np.array(List)
print(type(a1))
```

```
import numpy as np
Nam=np.array('Paul','Luker','Stev')
Age=np.array(45,24,16)
print(type(Names))
print(type(Age))
```

Output:

```
<type 'numpy.ndarray'>
```

11. **How to display the shape of a Numpy array?**

**Ans:**

i) The Numpy array attribute shape method can be used to display the shape of a Numpy array

ii) Example:

Code:

```
import numpy as np
EMP=np.array(['Steve','Joe',"Ocean"])
print(EMP.shape)
```

Output: (3,)

## 12. How to display the size of a Numpy array?

**Ans:**

i) The Numpy array attribute itemsize can be used to display the size of a Numpy array

ii) Example:

Code:

```
import numpy as np
EMP=np.array(['Steve','Joe',"Ocean"])
print(EMP.itemsize)
```

Output: 5  
Note: it returns the length of each element in bytes

## 13. How to display the Data type of a Numpy array?

**Ans:**

i) The Numpy array attribute dtype can be used to display the data type of a Numpy array

ii) Example:

Code:

```
import numpy as np
Age=np.array([20,45,35])
print(Age.dtype)
```

Output: int64

## CHAPTER 3: Python Pandas Data Series

1. Explain Python **Data Series** with a simple example:

Ans:

- i) Python Data Series is a popular Data Structure used in Pandas
- ii) Python Data Series stores data in an One Dimensional Array (1-D Array)
- iii) Each element of the array is associated with data labels called 'index'.
- iv) Example: The following program stores the price of 3 products into a Data Series, and then displays it.

Code:

```
import pandas as pd
print('-----PRICE LIST OF THREE PRODUCTS-----')
price=pd.Series(
data=[30,60,20],
index=['Ice Cream','Pizza','Coke']
)
print(price)
```

Output:

```
-----PRICE LIST OF THREE PRODUCTS-----
Ice Cream    30
Pizza        60
Coke         20
```

2. How to create a Data Series with a sequence of numbers.

Ans:

- i) We can create a Data Series with a sequence of numbers using the

range():

ii) Example: The following program stores a sequence of 2 to 20 ( 2 times tables) into a Data Series using the range().

Code:

```
import pandas as pd
Two_Tables=pd.Series(range(2,21,2))
print('----- 2 Times Tables -----')
print(Two_Tables)
```

Output:

0	2
1	4
2	6
3	8
4	10
5	12
6	14
7	16
8	18
9	20

### 3. How to create a Data Series using a Python Dictionary?

Ans:

Example: The following program display the Book Number and the Number of pages the book contains.

Code:

```
import pandas as pd
book=pd.Series({'B001':301,'B002':205,'B003':456})
print(book)
```

Output:

B001	301
B002	205
B003	456

### 4. How to create a Data Series and store just a single value (scalar) in

it?

Ans:

Example of creating Series and storing the price of 1\$ for all 3 products:

Code:

```
import pandas as pd
price=pd.Series(data='1$',index=['Pen','Pencil','Pins'])
print(price)
```

Output:

Pen	1\$
Pencil	1\$
Pins	1\$

5. How to create a Series that include Missing values using NaN (that stands for Not a Number):

Ans:

Example: The following program stores Students Age, with some information that is missing.

Code:

```
import pandas as pd
import numpy as np
stud_age=pd.Series(data=[16,17,np.NaN,16], index=
['Sam','Ron','Steve','Dan'])
print(stud_age)
```

Output:

Sam	16.0
Ron	17.0
Steve	NaN
Dan	16.0

6. How to create Data Series using Arithmetic Operators:

Ans:

Example: The following program displays the square of all numbers from 1 to 5

Code:

```
import pandas as pd
import numpy as np
var1=np.arange(1,6)
sqr=pd.Series(index=var1, data=var1*var1 )
print(sqr)
```

Output:

```
1    1
2    4
3    9
4   16
5   25
```

7. How to display the Values and Index separately?

Ans:

i) We can use the .value and .index attributes to do so.

ii) Example:

Code:

```
import pandas as pd
book=pd.Series({'B001':301,'B002':205,'B003':456})
print('-----All the details -----')
print(book)
print('-----Only the Values-----')
print(book.values)
print('-----Only the Index-----')
print(book.index)
```

Output:

```
-----All the details -----
B001    301
B002    205
B003    456
dtype: int64
-----Only the Values-----
[301 205 456]
-----Only the Index-----
```



```
Index([u'B001', u'B002', u'B003'], dtype='object')
```

8. How to display the data type of a Series?

Ans:

i) The .dtype attribute of the series object is used to display the data type .

ii) Example:

```
import pandas as pd
Book_Pages=pd.Series([150,420,180,117,220])
Book_Price=pd.Series([12.99,16.95,25,17.25,20.99])
print('-----Data Type of the Book_Pages Data Series-----')
print(Book_Pages.dtype)
print('-----Data Type of the Book_Price Data Series-----')
print(Book_Price.dtype)
```

Output:

```
-----Data Type of the Book_Pages Data Series-----
int64
-----Data Type of the Book_Price Data Series-----
float64
```

9. How to display the itemsize of a Series?

Ans:

i) The .itemsize attribute of the series object is used to display the data type .

ii) The item size is the size allotted to the data in bytes

iii) Example

```
import pandas as pd
Product_Code=pd.Series([101,102,103])
Product_Desc=pd.Series(['Cake','Cola','Doughnut'])
print('-----Item Size of the Product_Code Data Series-----')
print(Product_Code.itemsize)
print('-----Item_Size of the Product_Code Data Series-----')
```

```
print(Product_Desc.itemsize)
```

Output:

```
-----Item Size of the Product_Code Data Series-----  
8  
-----Item_Size of the Product_Code Data Series-----  
8
```

10. How to display the Shape of a Series?

Ans:

i) The .shape attribute of the series object is used to display the Shape

ii) Example

```
import pandas as pd
```

```
Product_Code=pd.Series([101,102,103])
```

```
Product_Desc=pd.Series(['Cake','Cola','doughnut'])
```

```
print('-----Item Size of the Product_Code Data Series-----')
```

```
print(Product_Code.shape)
```

```
print('-----Item_Size of the Product_Code Data Series-----')
```

```
print(Product_Desc.shape)
```

Output:

```
-----Item Size of the Product_Code Data Series-----  
(3,)  
-----Item_Size of the Product_Code Data Series-----  
(3,)
```

11. How to check if a Data Series is empty or not?

Ans:

i) The .empty attribute of the series object is used to check if a Data Series is empty or not

ii) Example:

```
import pandas as pd
```

```
Product_Code=pd.Series()
```

```
Product_Desc=pd.Series(['Cake','Cola','doughnut'])
```

```
print('-----Checking if Product_Code Data Series is Empty-----')
```

```
print(Product_Code.empty)
print('-----Checking if Product_Desc Data Series is Empty-----')
print(Product_Desc.empty)
```

Output:

```
-----Checking if Product_Code Data Series is Empty-----
True
-----Checking if Product_Desc Data Series is Empty-----
False
```

12. How to check if the series has NaN values in it?

Ans:

i) The .hasnans attribute of the series object is used to check if a Data Series is NaN or not

ii) Example:

```
import pandas as pd
import numpy as np
Product_Code=pd.Series([101,np.NaN,103])
Product_Desc=pd.Series(['Cake','Cola','doughnut'])
print('-----Checking if Product_Code Data Series has NaN Values-
-----')
print(Product_Code.hasnans)
print('-----Checking if Product_Desc Data Series NaN Values-----
--')
print(Product_Desc.hasnans)
```

Output:

```
-----Checking if Product_Code Data Series has NaN Values--
-----
True
-----Checking if Product_Desc Data Series NaN Values-----
False
```

13. How to display element of a Data Series?

Ans:

```
import pandas as pd
Product_Desc=pd.Series(['Cake','Cola','Doughnut','Pizza'])
print('-----Displaying individual element of a Data Series-----')
print(Product_Desc[2])
print('-----Displaying Range of elements of a Data Series-----')
print(Product_Desc[1:3])
print('-----Displaying All of elements of a Data Series-----')
print(Product_Desc)
```

Output:

```
-----Displaying individual element of a Data Series-----
Doughnut
-----Displaying Range of elements of a Data Series-----
1    Cola
2  Doughnut
-----Displaying All of elements of a Data Series-----
0    Cake
1    Cola
2  Doughnut
3    Pizza
```

14. How to modify the value of a Data series? Give an Example.

Ans:

Example:

```
import pandas as pd
Product_Desc=pd.Series(['Cake','Cola','Doughnut','Pizza'])
#-----Modifying individual element of a Data Series-----')
Product_Desc[2]='Ice Cream'
print('-----Displaying to Check if the modification has taken place -----')
print(Product_Desc)
```

Oputput:

```
0    Cake
1    Cola
2  Ice Cream
```

### 3 Pizza

15. Explain the head() of Data Series.

Ans:

i) head(<n>) retrieves the first 'n' numbers of rows from data series

ii) if <n> is not specified then the top 5 values are retrieved.

iii) Example:

```
import pandas as pd
```

```
book=pd.Series({'B001':301,'B002':205,'B003':456,'B004':400,'B005':354
```

```
print('-----Default retrieves first 5 rows ')
```

```
print(book.head())
```

```
print('-----Retrieves first 3 rows ')
```

```
print(book.head(3))
```

```
print('-----Default retrieves first 6 rows ')
```

```
print(book.head(6))
```

Output:

-----Default retrieves first 5 rows

B001	301
B002	205
B003	456
B004	400
B005	354

-----Retrieves first 3 rows

B001	301
B002	205
B003	456

-----Default retrieves first 6 rows

B001	301
B002	205
B003	456
B004	400
B005	354
B006	100

16. Explain the tail() of Data Series.

Ans:

i) tail (<n>) retrieves the last 'n' numbers of rows from data series

ii) if <n> is not specified then the bottom 5 values are retrieved.

iii) Example:

```
import pandas as pd
```

```
book=pd.Series({'B001':301,'B002':205,'B003':456,'B004':400,'B005':354,'B006':100})
```

```
print('-----Default retrieves last 5 rows ')
```

```
print(book.tail())
```

```
print('-----Retrieves last 3 rows ')
```

```
print(book.tail(3))
```

```
print('-----Default retrieves first 6 rows ')
```

```
print(book.tail(6))
```

Output:

```
-----Default retrieves last 5 rows
```

```
B002    205
```

```
B003    456
```

```
B004    400
```

```
B005    354
```

```
B006     100
```

```
-----Retrieves last 3 rows
```

```
B004    400
```

```
B005    354
```

```
B006     100
```

```
-----Default retrieves first 6 rows
```

```
B001    301
```

```
B002    205
```

```
B003    456
```

```
B004    400
```

```
B005    354
```

```
B006     100
```

17. Explain (+) Vector operations on Data Series using Example:

Ans:

i) Vector operations means operations that are done value-by-value in a

data series

ii) Looping constructs are not required

iii) Example: Displaying Marks After Increasing 2 Marks per student

```
import pandas as pd
```

```
#Marks of 4 students
```

```
MARK=pd.Series({'SAM':80,'STEVE':75,'LUKE':94,'BOB':88})
```

```
print('-----Original Marks-----')
```

```
print(MARK)
```

```
print('-----Displaying Marks After Increasing 2 Marks per student-----')
```

```
print(MARK+2)
```

Output:

```
-----Original Marks-----
```

```
BOB    88
```

```
LUKE   94
```

```
SAM    80
```

```
STEVE  75
```

```
dtype: int64
```

```
-----Displaying Marks After Increasing 2 Marks per student-----
```

```
BOB    90
```

```
LUKE   96
```

```
SAM    82
```

```
STEVE  77
```

18. Explain (>) Vector operations on Data Series using Example:

Ans:

Example: Displaying if the marks are above 85 marks or not.

```
import pandas as pd
```

```
#Marks of 4 students
```

```
MARK=pd.Series({'SAM':80,'STEVE':75,'LUKE':94,'BOB':88})
```

```
print('-----Original Marks-----')
```

```
print(MARK)
```

```
print('-----Displaying if the Marks are Greater than 85-----')
```

```
print(MARK>85)
```

Output:

-----Original Marks-----

BOB 88

LUKE 94

SAM 80

STEVE 75

dtype: int64

-----Displaying if the Marks are Greater than 85-----

BOB True

LUKE True

SAM False

STEVE False

19. Explain how to do Arithmetic operation on two Data Series.

Ans:

Example: In the following program, the Sum and Average marks present in two Data Series is computed.

```
import pandas as pd
```

```
#Marks of 4 students
```

```
MARK_TEST1=pd.Series({'SAM':80,'STEVE':75,'LUKE':94,'BOB':88})
```

```
MARK_TEST2=pd.Series({'SAM':72,'STEVE':71,'LUKE':90,'BOB':90})
```

```
print('----- Marks of Test 1 -----')
```

```
print(MARK_TEST1)
```

```
print('----- Marks of Test 2 -----')
```

```
print(MARK_TEST2)
```

```
print('-----Sum of Marks of Test1 and Test2-----')
```

```
print(MARK_TEST1+MARK_TEST2)
```

```
print('-----Average Marks of Test1 and Test2-----')
```

```
print((MARK_TEST1+MARK_TEST2)/2)
```

Output:

----- Marks of Test 1 -----

BOB 88

LUKE 94

SAM 80



```

STEVE  75
----- Marks of Test 2 -----
BOB    90
LUKE   90
SAM    72
STEVE  71
-----Sum of Marks of Test1 and Test2-----
BOB    178
LUKE   184
SAM    152
STEVE  146
-----Average Marks of Test1 and Test2-----
BOB    89.0
LUKE   92.0
SAM    76.0
STEVE  73.0

```

20. Explain the drop () of a series with a simple example.

Ans:

- i) The drop() is used to return all rows except the index that is specified
- ii) Example:

```

import pandas as pd
#Marks of 4 students
MARK_TEST=pd.Series({'SAM':80,'STEVE':75,'LUKE':94,'BOB':88})
print('-----All the rows of the MARK_TEST Data Series-----')
print(MARK_TEST)
#delete the 3th element

print('-----All rows except LUKE from MARK_TEST Data Series ----')
print(MARK_TEST.drop('LUKE'))

```

# CHAPTER 4 : Python Pandas Data FRames

1. What is meant by a DataFrame in Python?

Ans:

- a) DataFrames are used to store data in rows and columns.
- b) It is of two dimensions. The rows as x-axis and columns as the y-axis.
- c) It can be compared to a table or a spreadsheet.
- d) The row heading is called 'index'.
- e) The column heading is called 'column name'.

2. Explain DataFrame diagrammatically.

Ans:

- a) The following diagram shows how values are stored in a DataFrame. Column index starts with 0, and the row index also starts with 0.
- b) In order to access the values the row and column index is used as a reference:
- c) `CARS[0][0]` contains "BMW" and `CARS[1][0]` contains 100.

	CARS			
	Col-0	Col-1	Col-2	Col-3
Row - 0	BMW	100	150	125
Row - 1	AUDI	200	225	300
Row - 2	GM	130	120	150

2. How can we create a DataFrame along with Column name?

Ans: The following program declares a DataFrame named EmpDetails. The row index is 0,1 and 2 which is the default. The column name is set as EmpName and EmpSal. The index and data are set using a dictionary. The dictionary's Index will act as the Column Name and the dictionary's content will provide the values for the column.

Example:

```
import pandas as pd
EmpDetails=pd.DataFrame(
{
'EmpName':['Sam','Aaron','Joel'] ,
'EmpSal':[1000,2000,3000]
}
)
print(EmpDetails)
```

Output:

```
EmpName EmpSal
0  Sam   1000
1  Aaron  2000
2  Joel   3000
```

3. How can we create a DataFrame along with both Column name and

Row name (also called index)?

Ans: The following program declares a DataFrame named CarSales using dictionaries.

Example:

```
import pandas as pd
```

```
Data1={'BMW':1000, 'Chrysler':3020, 'Toyota ':4505}
```

```
Data2={'BMW':2000, 'Chrysler':4203, 'Toyota ':3920}
```

```
Data3={'BMW':2200, 'Chrysler':3900, 'Toyota ':4620}
```

```
Sale={2016: Data1, 2017: Data2, 2018: Data3}
```

```
CarSales=pd.DataFrame(Sale)
```

```
print('-----DISPLAYING ONE COLUMN-----\n')
```

```
print(CarSales[2016])
```

```
print('-----DISPLAYING TWO COLUMNS-----\n')
```

```
print(CarSales[[2016,2018]])
```

Output:

4) Example of selecting one row:

```
print(df1.loc['Qtr1',:]).
```

Output:

```
2015    300
```

```
2016    250
```

```
2017    100
```

```
Name: Qtr1, dtype: int64
```

5) Example of selecting range of rows:

```
print(df1.loc['Qtr1':'Qtr2',:])
```

Output:

```
2015 2016 2017
```

```
Qtr1 300 250 100
```

```
Qtr2 200 300 250
```

6) Example of selecting one column using loc:

```
print(df1.loc[:,2016])
```

Output:

```
Qtr1    250
```

```
Qtr2    300
```

```
Qtr3    450
```

```
Qtr4    250
```

Name: 2016, dtype: int64

7) Example of selecting range of columns using loc:

```
print(df1.loc[:,2016:2017])
```

Output:

```
Qtr1    250
```

```
Qtr2    300
```

```
Qtr3    450
```

```
Qtr4    250
```

Name: 2016, dtype: int64

8) Example of selecting range of rows and columns using loc:

```
print(df1.loc['Qtr1':'Qtr2',2016:2017])
```

Output:

```
      2016  2017
```

```
Qtr1    250   100
```

```
Qtr2    300   250
```

9) Example of selecting range of rows and columns using iloc"

```
print(df1.iloc[1:3,1:3])
```

Output:

```
      2016  2017
```

```
Qtr2    300   250
```

```
Qtr3    450   350
```

10) Example to select individual values using at:

```
print(df1.at['Qtr2',2015])
```

Output:

```
200
```

11) Example to select individual values using iat:

```
print(df1.iat[1,2])
```

Output:

250

12) Example to change the data of the entire column:

```
df1[2015]=150
```

Output:

The entire 2015 column gets the value 150

13) Example to change the data of the particular or range of row using at or loc:

```
df1.at['Qtr1',2015]=500
```

14) Example to add columns to a DataFrame:

```
df1[2018]=[400,500,200,600]
```

```
print(df1)
```

Output:

	2015	2016	2017	2018
Qtr1	300	250	100	400
Qtr2	200	300	250	500
Qtr3	400	450	350	200
Qtr4	100	250	350	600

15) Example to delete columns to a DataFrame:

```
del df1[2017]
```

```
print(df1)
```

output:

	2015	2016
Qtr1	300	250
Qtr2	200	300
Qtr3	400	450
Qtr4	100	250

16) Example of iteration on rows using iterrow():

```
import pandas as pd
```

```
import numpy as np
```

```
yr2015={'Qtr1':300, 'Qtr2':200, 'Qtr3':400, 'Qtr4':100}
```

```
yr2016={'Qtr1':250, 'Qtr2':300, 'Qtr3':450, 'Qtr4':250}
```

```
yr2017={'Qtr1':100, 'Qtr2':250, 'Qtr3':350, 'Qtr4':350}
```

```
disables={2015: yr2015, 2016: yr2016, 2017: yr2017}
```

```
df1=pd.DataFrame(disables)
```

```
for (row,rowseries) in df1.iterrows():  
    print("Row",row)  
    print("content")  
    print(rowseries)
```

Output:

```
('Row', 'Qtr1')  
content  
2015    300  
2016    250  
2017    100  
Name: Qtr1, dtype: int64  
('Row', 'Qtr2')  
content  
2015    200  
2016    300  
2017    250  
Name: Qtr2, dtype: int64  
('Row', 'Qtr3')  
content  
2015    400  
2016    450  
2017    350  
Name: Qtr3, dtype: int64  
('Row', 'Qtr4')  
content  
2015    100  
2016    250  
2017    350  
Name: Qtr4, dtype: int64
```

17)Example to display all the content only using iterrows():

```
import pandas as pd  
import numpy as np  
yr2015={'Qtr1':300, 'Qtr2':200, 'Qtr3':400, 'Qtr4':100}  
yr2016={'Qtr1':250, 'Qtr2':300, 'Qtr3':450, 'Qtr4':250}
```

```
yr2017={'Qtr1':100, 'Qtr2':250, 'Qtr3':350, 'Qtr4':350}
disables={2015: yr2015, 2016: yr2016, 2017: yr2017}
```

```
df1=pd.DataFrame(disables)
```

```
for (row,rowseries) in df1.iterrows():
    for val in rowseries:
        print(val)
```

OutPut:

```
300
250
100
200
300
250
400
450
350
100
250
350
```

18)Example to display all the content only using iteritems():

```
import pandas as pd
import numpy as np
yr2015={'Qtr1':300, 'Qtr2':200, 'Qtr3':400, 'Qtr4':100}
yr2016={'Qtr1':250, 'Qtr2':300, 'Qtr3':450, 'Qtr4':250}
yr2017={'Qtr1':100, 'Qtr2':250, 'Qtr3':350, 'Qtr4':350}
disables={2015: yr2015, 2016: yr2016, 2017: yr2017}
```

```
df1=pd.DataFrame(disables)
for (col,colseries) in df1.iteritems():
    print("col",col)
    print("content")
    print(colseries)
```

Output:

```
('col', 2015)
```



```
content
Qtr1  300
Qtr2  200
Qtr3  400
Qtr4  100
Name: 2015, dtype: int64
('col', 2016)
content
Qtr1  250
Qtr2  300
Qtr3  450
Qtr4  250
Name: 2016, dtype: int64
('col', 2017)
content
Qtr1  100
Qtr2  250
Qtr3  350
Qtr4  350
Name: 2017, dtype: int64
```

19) What is meant by Binary Operations in a DataFrame?

Ans:

- a) When two values are required to perform any operation it is called Binary Operations.
- b) Binary Operations can be used to perform Addition, Subtraction, Multiplications and Division between two DataFrames.

20) List the various Binary operations available in Pandas.

Ans:

- a) `add()` – Addition binary operation
- b) `radd()` – Reverse add binary operation
- c) `sub()` – Subtraction binary operation
- d) `rsub()` – Reverse `rsub()` binary operation
- e) `mul()` – Multiply binary operation
- f) `div()` – Divide binary operation

21) Give an example of using add() or simply + operator and radd().

Ans:

The following example adds the marks obtained in two terms by three students in Accounts, BST and ECO in order to come up with the total marks obtained in two terms:

Term1 – Marks out of 10

	ACCOUNT	BST	ECO
0	9	8	7
1	7	9	8
2	5	6	9

Term2 - Marks out of 10

	ACCOUNT	BST	ECO
0	8	8	9
1	9	5	8
2	8	9	9

Code:

```
import pandas as pd
import numpy as np
#Students Term 1 Test Marks out of 10
data1=pd.DataFrame({'ACCOUNTS':[9,7,5],'BST':[8,9,6],'ECO':
[7,8,9]})
#Students Term 2 Test Marks out of 10
data2=pd.DataFrame({'ACCOUNTS':[8,9,8],'BST':[8,5,9],'ECO':
[9,8,9]})
print("-----Students Term 1 Test Marks out of 10-----")
print(data1)
print("-----Students Term 2 Test Marks out of 10-----")
print(data2)
print("-----Students Term1 + Term 2 Test Marks out of 20----Using +
----")
print(data1+data2)
print("-----Students Term1 + Term 2 Test Marks out of 20----Using
add() ---Same Result----")
```

```

print(data1.add(data2))
print("-----Students Term1 + Term 2 Test Marks out of 20----Using
radd() ---Same Result in this case since no negative numbers----")
print(data1.radd(data2))

```

Output:

```

-----Students Term 1 Test Marks out of 10-----

```

```

ACCOUNTS BST ECO

```

```

0      9  8  7

```

```

1      7  9  8

```

```

2      5  6  9

```

```

-----Students Term 2 Test Marks out of 10-----

```

```

ACCOUNTS BST ECO

```

```

0      8  8  9

```

```

1      9  5  8

```

```

2      8  9  9

```

```

-----Students Term1 + Term 2 Test Marks out of 20----Using + --

```

```

--

```

```

ACCOUNTS BST ECO

```

```

0     17 16 16

```

```

1     16 14 16

```

```

2     13 15 18

```

```

-----Students Term1 + Term 2 Test Marks out of 20----Using
add() ---Same Result----

```

```

ACCOUNTS BST ECO

```

```

0     17 16 16

```

```

1     16 14 16

```

```

2     13 15 18

```

```

-----Students Term1 + Term 2 Test Marks out of 20----Using
radd() ---Same Result in this case since no negative numbers----

```

```

ACCOUNTS BST ECO

```

```

0     17 16 16

```

```

1     16 14 16

```

```

2     13 15 18

```

22) Give an example of using sub() or simply – operator and rsub()

Ans:

The following example subtracts the Practical Marks obtained by three students in Accounts, BST and ECO from the Total Marks in order to come up with the Theory marks obtained by them respectively:

Total Marks out of 100 (includes 80 Mark Theory + 20 Mark Practicals)

	ACCOUNT	BST	ECO
0	90	80	70
1	70	90	80
2	50	60	90

Practical Marks out of 20

	ACCOUNT	BST	ECO
0	18	18	19
1	19	15	18
2	18	19	19

Code:

```
import pandas as pd
import numpy as np
#Total Marks out of 100 (includes 80 Mark Theory + 20 Mark Practicals)
data1=pd.DataFrame({'ACCOUNTS':[90,70,50],'BST':[80,90,60],'ECO':[70,80,90]})
#Students Term 2 Test Marks out of Practical Marks out of 20
data2=pd.DataFrame({'ACCOUNTS':[18,19,18],'BST':[18,15,19],'ECO':[19,18,19]})
print("-----Total Marks out of 100 (includes 80 Mark Theory + 20 Mark Practicals)-----")
print(data1)
print("-----Practical Marks out of 20-----")
print(data2)
print("-----Theory Marks out of 80----Using '-'")
print(data1-data2)
print("-----Theory Marks out of 80----Using----Using sub() ---")
```

```

Same Result----")
print(data1.sub(data2))
print("-----Theory Marks out of 80----Using-----Using rsub() -----")
#please note data2.rsub is used
print(data2.rsub(data1))

```

output:

-----Total Marks out of 100 (includes 80 Mark Theory + 20 Mark  
Practicals)-----

	ACCOUNTS	BST	ECO
0	90	80	70
1	70	90	80
2	50	60	90

-----Practical Marks out of 20-----

	ACCOUNTS	BST	ECO
0	18	18	19
1	19	15	18
2	18	19	19

-----Theory Marks out of 80----Using '-'

	ACCOUNTS	BST	ECO
0	72	62	51
1	51	75	62
2	32	41	71

-----Theory Marks out of 80----Using----Using sub() ---  
Same Result----

	ACCOUNTS	BST	ECO
0	72	62	51
1	51	75	62
2	32	41	71

-----Theory Marks out of 80----Using-----Using rsub() -----

	ACCOUNTS	BST	ECO
0	72	62	51
1	51	75	62
2	32	41	71

23) Give an example of using `mul()` or simply `*` operator.

Ans:

The following example display the 2 times table from 1 to 9.

Example:

```
import pandas as pd
import numpy as np
data1=pd.DataFrame({'A':[2,2,2],'B':[2,2,2],'C':[2,2,2]})
data2=pd.DataFrame({'A':[1,2,3],'B':[4,5,6],'C':[7,8,9]})
print(data1)
print(data2)
print(data1*data2)
print(data1.mul(data2))
```

Output:

```
   A  B  C
0  2  2  2
1  2  2  2
2  2  2  2
```

```
   A  B  C
0  1  4  7
1  2  5  8
2  3  6  9
```

```
   A  B  C
0  2  8 14
1  4 10 16
2  6 12 18
```

```
   A  B  C
0  2  8 14
1  4 10 16
2  6 12 18
```

24) Give an example of using div() or simply / operator

Ans:

The following example calculated the number of days that 3 employees have worked for using the formula:

“Wages Earned by Employees in 3 months / Per-Day Wage given to Employees”

Wages Earned by Employees in 3 months

	BOB	HARI	SAM
0	43500	56000	30000
1	42500	44000	34800
2	44000	55000	30000

Per-Day Wage given to Employees

	BOB	HARI	SAM
0	1500	2000	1000
1	1700	2200	1200
2	2000	2500	1500

Example:

```
import pandas as pd
import numpy as np
# Wages Earned by Employees in 3 months
data1=pd.DataFrame({'SAM':[30000,34800,30000],'BOB':
[43500,42500,44000],'HARI':[56000,44000,55000]})
#Per-Day Wage given to Employees
data2=pd.DataFrame({'SAM':[1000,1200,1500],'BOB':
[1500,1700,2000],'HARI':[2000,2200,2500]})
print("-----Wages Earned by Employees in 3 months-----")
print(data1)
print("-----Wages Earned by Employees in 3 monthPer-Day Wage
given to Employees-----")
print(data2)
print("-----Total wages / Per day wages-----using '/'----")
print(data1/data2)
print("-----Total wages / Per day wages-----using 'div()'----")
print(data1.div(data2))
```

Output:

```
-----Wages Earned by Employees in 3 months-----
      BOB  HARI  SAM
0  43500  56000  30000
1  42500  44000  34800
2  44000  55000  30000
```

-----Wages Earned by Employees in 3 month Per-Day Wage  
given to Employees-----

	BOB	HARI	SAM
0	1500	2000	1000
1	1700	2200	1200
2	2000	2500	1500

-----Total wages / Per day wages-----using '/'-

	BOB	HARI	SAM
0	29.0	28.0	30.0
1	25.0	20.0	29.0
2	22.0	22.0	20.0

-----Total wages / Per day wages-----using 'div()'-

	BOB	HARI	SAM
0	29.0	28.0	30.0
1	25.0	20.0	29.0
2	22.0	22.0	20.0

25)What is meant by Matching Operations?

Ans: While performing binary operation in DataFrames or Series, in case the shape of both the objects are the same then the data is matched index to index. This is the default method by which binary operation are done.

26)Give an example of Matching Operations using mul().

Ans:

The following example display the 2 times table from 1 to 9. As you will see in the output the values of the first DataFrame are matched with the same index value of the second DataFrame to produce the result. This is called Matching.

Example:

```
import pandas as pd
import numpy as np
data1=pd.DataFrame({'A':[2,2,2],'B':[2,2,2],'C':[2,2,2]})
data2=pd.DataFrame({'A':[1,2,3],'B':[4,5,6],'C':[7,8,9]})
print(data1)
print(data2)
```



```
print(data1*data2)
print(data1.mul(data2))
```

Output:

	A	B	C
--	---	---	---

0	2	2	2
---	---	---	---

1	2	2	2
---	---	---	---

2	2	2	2
---	---	---	---

	A	B	C
--	---	---	---

0	1	4	7
---	---	---	---

1	2	5	8
---	---	---	---

2	3	6	9
---	---	---	---

	A	B	C
--	---	---	---

0	2	8	14
---	---	---	----

1	4	10	16
---	---	----	----

2	6	12	18
---	---	----	----

	A	B	C
--	---	---	---

0	2	8	14
---	---	---	----

1	4	10	16
---	---	----	----

2	6	12	18
---	---	----	----

27)What is meant by Broadcasting Operation?

Ans: Broadcasting is the method wherein one value or one row or one column is used to performing arithmetic operations with all the other rows or columns of another object.

28)Give an example of Broadcasting a Value using mul().

Ans:

In the earlier example that displayed the 2 time table. The first DataFrame had all 2s only. This was done, so that 2 will be matched up with all the values of the second DataFrame. We can use the method of Broadcasting to associate 2 with all the values of a given DataFrame, as shown below:

Code:

```
import pandas as pd
```

```
data1=pd.DataFrame({'A':[1,2,3],'B':[4,5,6],'C':[7,8,9]})
```

```
print(data1)
```

```
print("-----Broadcasting 2 to all values of DataFrame-----")
print(data1.mul(2))
```

Output:

```

  A B C
0 1 4 7
1 2 5 8
2 3 6 9
-----Broadcasting 2 to all values of DataFrame-----
  A B C
0 2 8 14
1 4 10 16
2 6 12 18
```

29) Give an example of Broadcasting a Row using sub().

Ans:

In the given example, the first Dataframe contains the money spent by 3 customers on 3 Items

Items Purchased by 3 customers

	ICE CREAM	PIZZA	POP CORN
Customer 0	100	250	50
Customer 1	200	300	100
Customer 2	300	400	125

The following shows the Discount provides for the products as Slabs.  
The Slabs may be used in different offers.

Discounts for each slab

	ICE CREAM	PIZZA	POP CORN
Slab 0	10	5	15
Slab 1	15	10	20
Slab 2	20	15	25

In order to display the price that each customer will pay per product if 'slab 1' discount is offered, we can use Broadcasting a Row using sub().

Example :

```
import pandas as pd
import numpy as np
# Items Purchased by 3 customers
data1=pd.DataFrame({'ICE CREAM':[100,200,300],'PIZZA':
[250,300,400],'POP CORN':[50,100,125]})
#Percentage of Discounts for each slab
data2=pd.DataFrame({'ICE CREAM':[10,15,20],'PIZZA':[5,10,15],'POP
CORN':[15,20,25]})
r=data2.loc[1,:]
print("-----Items Purchased by 3 customers-----")
print(data1)
print("-----Discounts for each slab-----")
print(data2)
print("-----slab 1 discount----")
print(r)
print("----- if slab 1 discount is offered-----")
print(data1.sub(r))
```

Output:

```
-----Items Purchased by 3 customers-----
  ICE CREAM  PIZZA  POP CORN
0      100    250     50
1      200    300    100
2      300    400    125
-----Discounts for each slab-----
  ICE CREAM  PIZZA  POP CORN
0       10     5     15
1       15    10     20
2       20    15     25
-----slab 1 discount----
ICE CREAM    15
PIZZA        10
POP CORN     20
Name: 1, dtype: int64
----- if slab 1 discount is offered-----
```

	ICE CREAM	PIZZA	POP CORN
0	85	240	30
1	185	290	80
2	285	390	105

30) Give an example of Broadcasting a Column using add().

Ans:

In the given example, the first Dataframe contains the money spent by 3 customers on 3 Items

Items Purchased by 3 customers

	ICE CREAM	PIZZA	POP CORN
Customer 0	100	250	50
Customer 1	200	300	100
Customer 2	300	400	125

The following shows the Discount provides for the products as Slabs. The Slabs may be used in different offers.

Discounts for each slab

	ICE CREAM	PIZZA	POP CORN
Slab 0	10	5	15
Slab 1	15	10	20
Slab 2	20	15	25

In order to display the price that each customer will pay if the discount of ICE CREAM is offered even for PIZZA and POP CORN, we can use Broadcasting a Column using sub().

Code:

```
import pandas as pd
import numpy as np
# Items Purchased by 3 customers
data1=pd.DataFrame({'ICE CREAM':[100,200,300],'PIZZA':
[250,300,400],'POP CORN':[50,100,125]})
#Discounts for each slab
data2=pd.DataFrame({'ICE CREAM':[10,15,20],'PIZZA':[5,10,15],'POP
CORN':[15,20,25]})
```

```

#Extracting the discount offered for ICE CREAM
c=data2.loc[:, 'ICE CREAM']

print("-----Items Purchased by 3 customers-----")
print(data1)
print("-----Discounts for each slab-----")
print(data2)
print("-----Discount offered for ICE CREAM----")
print(c)
print("----- if discount offered for ICE CREAM is offered for all
products-----")

print(data1.sub(c,axis='rows'))

```

Output:

```

-----Items Purchased by 3 customers-----

```

```

    ICE CREAM  PIZZA  POP CORN

```

```

0      100    250      50

```

```

1      200    300     100

```

```

2      300    400     125

```

```

-----Discounts for each slab-----

```

```

    ICE CREAM  PIZZA  POP CORN

```

```

0       10      5      15

```

```

1       15     10      20

```

```

2       20     15      25

```

```

-----Discount offered for ICE CREAM----

```

```

0    10

```

```

1    15

```

```

2    20

```

```

Name: ICE CREAM, dtype: int64

```

```

----- if discount offered for ICE CREAM is offered for all
products-----

```

```

    ICE CREAM  PIZZA  POP CORN

```

```

0       90    240     40

```

```

1      185    285     85

```

```

2      280    380    105

```

Note: The default matching is done using columns, in order to match the

rows we use axis='rows' along with the sub ().

31)What is meant by missing data?

Ans:

- a) Missing data is are the values that are not significant for the computation.
- b) Missing data as the name suggest, is the data that has either no value (blank) or meaningless data (such as NaN, NULL, or None), thus is cannot help the data analysis process.

32)What is meant of Handling Missing data?

Ans:

- a) Since missing data can adversely affect the data analysis process, we have to handle missing data.
- b) Following steps can be done to handle missing data:
  - i) Identifying missing data using isnull()
  - ii) Dropping : Removing missing data using dropna()
  - iii) Imputation : Filling missing data with relevant data using fillna()

33)Explain how to identify missing data using isnull().

Ans:

By using the isnull() we can identify the values that are null. The values that are null will display as 'True' and all other values will appear as 'False'.

Example:

```
import pandas as pd
import numpy as np
data1=pd.DataFrame({'ITEM':['Pen','Pencil','Ruler'],'PRICE':
[7,np.nan,6],'QTY':[90,np.nan,80]})
print(data1)

print('----identify null values----\n')
print(data1.isnull())
```

print('True is displayed for all the null values') Output:

ITEM	PRICE	QTY
------	-------	-----

```

0   Pen   7.0  90.0
1  Pencil  NaN  NaN
2   Ruler   6.0  80.0
----identify null values----

```

```

      ITEM PRICE  QTY
0  False  False  False
1  False   True   True
2  False  False  False
True is displayed for all the null values

```

34) Explain how to drop missing data using dropna().

Ans:

By using the dropna() we can drop all the rows that have null values.

Example:

```

import pandas as pd
import numpy as np
data1=pd.DataFrame({'ITEM':['Pen','Pencil','Ruler'],'PRICE':
[7,np.nan,6],'QTY':[90,np.nan,80]})
print(data1)

```

```

print('----identify null values----\n')
print(data1.dropna())

```

```

print('True is displayed for all the null values')

```

Output:

```

      ITEM PRICE  QTY
0   Pen   7.0  90.0
1  Pencil  NaN  NaN
2   Ruler   6.0  80.0
----identify null values----

```

```

      ITEM PRICE  QTY
0   Pen   7.0  90.0
2  Ruler   6.0  80.0
True is displayed for all the null values

```

Note: Even if one value is NaN the entire row is dropped, it is not necessary for the entire row to be NaN

35) Explain how to fill missing data with relevant data using fillna().

Ans:

By fillna() all the null values can be filled with relevant data.

Example 1:

```
import pandas as pd
import numpy as np
data1=pd.DataFrame({'ITEM':['Pen','Pencil','Ruler'],'PRICE':
[7,np.nan,6],'QTY':[90,np.nan,80]})
print(data1)
```

```
print('----identify null values----\n')
print(data1.fillna({'ITEM':'-', 'PRICE':'x', 'QTY':'*'}))
```

Output:

	ITEM	PRICE	QTY
0	Pen	7.0	90.0
1	Pencil	NaN	NaN
2	Ruler	6.0	80.0

----identify null values----

	ITEM	PRICE	QTY
0	Pen	7	90
1	Pencil	x	*
2	Ruler	6	80

Example 2:

```
import pandas as pd
import numpy as np
data1=pd.DataFrame({'EMP':[1,np.nan,3],'EMP_NAME':
[4,np.nan,6],'SAL':[7,np.nan,9]})
print(data1)
da1=data1.fillna({'EMP':'0','EMP_NAME':'xxx','SAL':'000'})
print(da1)
```

Output:



	EMP	EMP_NAME	SAL
0	1.0	4.0	7.0
1	NaN	NaN	NaN
2	3.0	6.0	9.0

	EMP	EMP_NAME	SAL
0	1	4	7
1	0	xxx	000
2	3	6	9

36) Explain the equals() function of Pandas with example.

Ans:

- a) equals() function is used to compare two objects (DataFrame or Series) in Pandas.
- b) Since the == comparison operator does not work when NaN values are present.
- c) Example:

```
import pandas as pd
import numpy as np
data1=pd.DataFrame([])
data2=pd.DataFrame({'A':[1,2,3],'B':[4,5,6],'C':[7,8,9]})
data1.equals(data2)
```

Output:

True

37) Explain what is meant by Boolean Reductions.

Ans:

- a) Boolean Reduction is the process of reduction a 2D array of Boolean values (True/False) into a 1D array of Boolean values.
- b) Example 1: Result without Boolean Reduction:

```
import pandas as pd
import numpy as np
data1=pd.DataFrame({'A':[1,2,3],'B':[4,5,6],'C':[7,8,9]})
data1>5
```

Output:

	A	B	C
0	False	False	True

```
1 FalseFalse True
2 False    True True
```

c) Example 2: Result using Boolean Reduction using all():

```
import pandas as pd
import numpy as np
data1=pd.DataFrame({'A':[1,2,3],'B':[4,5,6],'C':[7,8,9]})
print(data1)
print (data1>5).all()
```

Output:

	A	B	C
0	1	4	7
1	2	5	8
2	3	6	9

A	False
B	False
C	True

38. List the Boolean Reduction Functions.

Ans:

- i) any()
- ii) all()
- iii) sum()

39. Give an example of any() function.

Ans:

```
import pandas as pd
import numpy as np
data1=pd.DataFrame({'A':[1,2,3],'B':[4,5,6],'C':[7,8,9]})
print (data1>5).any()
```

Output:

	A	B	C
0	1	4	7

```
1 2 5 8
2 3 6 9
```

A False  
B True  
C True

40. Explain the sum() along with an example.

Ans:

```
import pandas as pd
import numpy as np
data1=pd.DataFrame({'A':[1,2,3],'B':[4,5,6],'C':[7,8,9]})
print (data1>5).sum()
```

Output:

```
   A  B  C
0  1  4  7
1  2  5  8
2  3  6  9
```

```
   A  0
   B  1
   C  3
```

41. Explain what is meant by Combining Dataframes.

Ans: Combining Dataframes is the process of using two Dataframes with similar values in order to overcome the problem of missing values.

42. List the functions that can be used for combining Dataframes:

Ans:

- 1) combine\_first()
- 2) concat()
- 3) merge()

43. Explain the use of `combine_first()` with example:

Ans: `combine_first()` is used with two Dataframes with similar values. If some values are missing in one Dataframe and present in the other Dataframe then the value is picked-up to fill the missing data. The process is also called Patching.

Example:

```
import pandas as pd
import numpy as np
data1=pd.DataFrame({'EMP':[101,np.nan,103,104],'EMP_NAME':
['SAM','JOHN','MARK','LUKE'],'SAL':[7000,np.nan,9000,8000]})
data2=pd.DataFrame({'EMP':[101,102,103],'EMP_NAME':
['SAM',np.nan,'MARK'],'SAL':[7000,8000,9000]})
print(data1)
print(data2)
print(data1.combine_first(data2))
```

Output:

	EMP	EMP_NAME	SAL
0	101.0	SAM	7000.0
1	NaN	JOHN	NaN
2	103.0	MARK	9000.0
3	104.0	LUKE	8000.0

	EMP	EMP_NAME	SAL
0	101	SAM	7000
1	102	NaN	8000
2	103	MARK	9000

	EMP	EMP_NAME	SAL
0	101.0	SAM	7000.0
1	102.0	JOHN	8000.0
2	103.0	MARK	9000.0
3	104.0	LUKE	8000.0

44. Explain the use of `concat()` with example:

Ans: `concat()` is used with two Dataframes with similar structure. It

appends values of one Dataframe to another Dataframe.

Example:

```
import pandas as pd
import numpy as np
data1=pd.DataFrame({'EMP':[101,102,103],'EMP_NAME':
['SAM','JOHN','MARK'],'SAL':[7000,np.nan,9000]})
data2=pd.DataFrame({'EMP':[101,102,103],'EMP_NAME':
['SAM',np.nan,'MARK'],'SAL':[7000,8000,9000]})
print(data1)
print(data2)
print(pd.concat([data1,data2]))
```

Output:

	EMP	EMP_NAME	SAL
0	101	SAM	7000.0
1	102	JOHN	NaN
2	103	MARK	9000.0

	EMP	EMP_NAME	SAL
0	101	SAM	7000
1	102	NaN	8000
2	103	MARK	9000

	EMP	EMP_NAME	SAL
0	101	SAM	7000.0
1	102	JOHN	NaN
2	103	MARK	9000.0
0	101	SAM	7000.0
1	102	NaN	8000.0
2	103	MARK	9000.0

45. Explain the use of merge() with example:

Ans: merge() is used to merge two Dataframes which have at least one common column name. It uses the common column as reference to merge all the values available in the two Dataframes.

Example:

```
import pandas as pd
import numpy as np
data1=pd.DataFrame({'EMP':[101,102,103],'EMP_NAME':
['SAM','JOHN','MARK']})
data2=pd.DataFrame({'EMP':[101,102,103],'SAL':[7000,8000,9000]})
print(data1)
print(data2)
print(pd.merge(data1,data2))
```

Output:

	EMP	EMP_NAME
0	101	SAM
1	102	JOHN
2	103	MARK

	EMP	SAL
0	101	7000
1	102	8000
2	103	9000

	EMP	EMP_NAME	SAL
0	101	SAM	7000
1	102	JOHN	8000
2	103	MARK	9000

## CHAPTER 5 : Python Pandas along with .csv and sql tables

1. Explain how to save Dataframes to .csv files using an example?

Ans: The following example shows how dataframe named data1 can be saved to mydata.csv file in the local drive.

Example:

```
import pandas as pd
import numpy as np
data1=pd.DataFrame({'A':[1,2,3],'B':[4,5,6],'C':[7,8,9]})
print(data1)
data1.to_csv("d:\\mydata.csv")
```

Output:

mydata.csv will contain the data of the dataframe

2. Explain how to save .csv files to Dataframes using an example?

Ans: The following example shows how to read the data of mydata.csv file from the local disk to data1 dataframe:

Code:

```
import pandas as pd
import numpy as np
data1= pd.read_csv("d:\\mydata.csv")
```

3. How to read a .csv file into a DataFrame and display it?

Ans:

i) Use the .read\_csv()

ii) Example: The following example reads the contents from “d:\Library.csv”, and stores it in a DataFrame.

“d:\Library.csv”

<b>B_No</b>	<b>Title</b>	<b>Pages</b>
101	The Duck Catcher	105
102	Noah's Law	200
103	Ghost Club series	250

Code:

```
import pandas as pd
book=pd.read_csv("D:\\Library.csv")
print(book)
book.to_csv("D:\\Library1.csv")
```

Output:

	B_No	Title	Pages
0	101	The Duck Catcher	105
1	102	Noah's Law	200
2	103	Ghost Club series	250

Note: .csv file can be created by entering data in MS Excel and saving it as .csv format. Also notice \\ is used instead of \ in the path.

4. How to write the content of a DataFrame into a .csv file?

Ans:

i) Use the .to\_csv ()

ii) Example: The following example write the content of a DataFrame into a .csv file “d:\Library1.csv”



Code:

```
import pandas as pd
Stud_details=pd.Series({'SAM':80,'STEVE':75,'LUKE':94,'BOB':88})
print(Stud_details)
Stud_details.to_csv("D:\\Library1.csv")
```

Output:

```
SAM    80
STEVE  75
LUKE   94
BOB    88
```

Note: The data is saved in D:\\Library1.csv

SAM	80
STEVE	75
LUKE	94
BOB	88

5. How to read SQL table(s) into a Python Data Frame?

Ans:

- i) Use read\_sql() function of the Data Frame Object to read SQL Table(s)
- ii) Example: The following program reads a table called shipping which is present in a database named Blue\_Dart in the location “E:\\ SQL Lite \\ Blue\_Dart”. The data that is read is feed into a Data Frame and then displayed on the screen.

The screenshot shows a database application window. On the left, a 'Databases' pane shows a tree structure with 'Blue Dart (SQLite 3)' expanded, containing 'Tables (1)' and 'Shipping'. The main area displays a table in 'Grid view' mode. The table has 8 columns: 'index', 'Order ID', 'Ship Date', 'City', 'Postal Code', 'Category', and 'Tariff'. There are 5 rows of data. A toolbar at the top includes icons for various database operations and a search bar containing 'emp'. Below the table, a status bar indicates 'Total rows loaded: 5'.

index	Order ID	Ship Date	City	Postal Code	Category	Tariff
1	0	C101	11/11/2016	Los Angeles	90032	Bookcases 21.91
2	1	C102	11/11/2016	Henderson	42420	Chairs 102.58
3	2	C103	6/16/2016	Los Angeles	90031	Labels 4.87
4	3	C104	10/18/2015	Fort Lauderdale	33311	Tables 150.03
5	4	C105	10/18/2015	Los Angeles	90036	Storage 140.52

Code:

```
import pandas as pd
import sqlite3 as sq# sqlite3 is used to manipulate SQL databases
```

```
#connection established
con=sq.connect('E:\\SQL Lite\\ Blue_Dart')
```

```
#fetching data from table
ship=pd.read_sql("select * from shipping;",con)
```

```
#printing the data frame on the screen
print(ship)
```

Output:

	index	Order ID	Ship Date	City	Postal Code	Category	Tariff
0	0	C101	11/11/2016	Los Angeles	90032	Bookcases	21.91
1	1	C102	11/11/2016	Henderson	42420	Chairs	102.58
2	2	C103	6/16/2016	Los Angeles	90031	Labels	

4.87						
3	3	C104	10/18/2015	Fort Lauderdale	33311	Tables
150.03						
4	4	C105	10/18/2015	Los Angeles	90036	Storage
140.52						

6. How to write the content of a Data Frame into a SQL table?

Ans:

- i) Use **to\_sql()** function of the Data Frame Object to read SQL Table
- ii) Example: The following program writes a Data Frame called empdata into a SQL Table named 'emptable' in a database named emp.

**Code:**

```
import pandas as pd
import sqlite3 as sq
#creating a data from called empdata
empdata=pd.Series({'eno':104,'ename':'John','age':36,'sal':5000})
#printing the empdata data frame
print(empdata)
#creating a connection
con=sq.connect('E:\\SQL Lite\\emp')
#storing the data frame into a table called emptable
empdata.to_sql("emptable",con)
```

**Output:**

eno	104
ename	John
age	36
sal	5000

The emptable is created in sqlite with the supplied data from the Data Frame:

Databases

Filter by name

emp (SQLite 3)

Tables (1)

emptable

Views

Structure

Data

Constraint

Grid view

Form view

+

▼

-

✓

✕

	index	0
1	eno	104
2	ename	John
3	age	36
4	sal	5000

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