Marwadi University Marwadi Chandarana Group NAAC A+	**Marwadi University** **Faculty of Engineering & Technology** **Department of Information and Communication Technology**	
Subject: Programming With Python (01CT1309)	**Aim:** Practical based on Pandas Data Structures	
Experiment No: 09	**Date:26/08/2025**	**Enrollment No:92510133011**

Aim: Practical based on Pandas Data Structures

IDE:

What is Python Pandas?

Pandas is a powerful, open-source data analysis and manipulation package for Python. It provides data structures and functions needed to work on structured data seamlessly and efficiently.

What Is Pandas Used For?

Pandas is extensively used for:

- Data Cleaning: Handling missing values, duplications, and incorrect data formats.
- Data Manipulation: Filtering, transforming, and merging datasets.
- Data Analysis: Performing statistical analysis and aggregations.
- Data Visualization: Creating plots and charts to visualize data trends and patterns.
- Time Series Analysis: Handling and manipulating time series data.

Run the following command to install Pandas:

pip install pandas

import pandas as pd

print(pd.__version__)

Pandas Series

A Pandas Series is a one-dimensional labeled array capable of holding any data type. It is similar to a column in a spreadsheet or a SQL table.

Example:

```
import pandas as pd
# Creating a Series
data = [1, 2, 3, 4, 5]
series = pd.Series(data)
print(series)
```

Output:

Marwadi University Marwadi Chandarana Group NAAC A+	**Marwadi University** **Faculty of Engineering & Technology** **Department of Information and Communication Technology**	
Subject: Programming With Python (01CT1309)	**Aim:** Practical based on Pandas Data Structures	
Experiment No: 09	**Date:26/08/2025**	**Enrollment No:92510133011**

```
PS C:\Users\trupa\OneDrive\Documents\PWP> & C:/Users/trupa/AppData/Local/Programs/Python/Python313/python.exe "c:/Users/trupa/OneDrive/Document
s/PWP/PWP EXP 9.py"
0    1
1    2
2    3
3    4
4    5
dtype: int64
```

Basic Operations on Series

Perform various operations on Series, such as arithmetic operations, filtering, and statistical calculations.

Example:

```
# Arithmetic Operations
series2 = series + 10
print(series2)
# Filtering
filtered_series = series[series > 2]
print(filtered_series)
# Statistical Calculations
mean_value = series.mean()
print(mean_value)
```

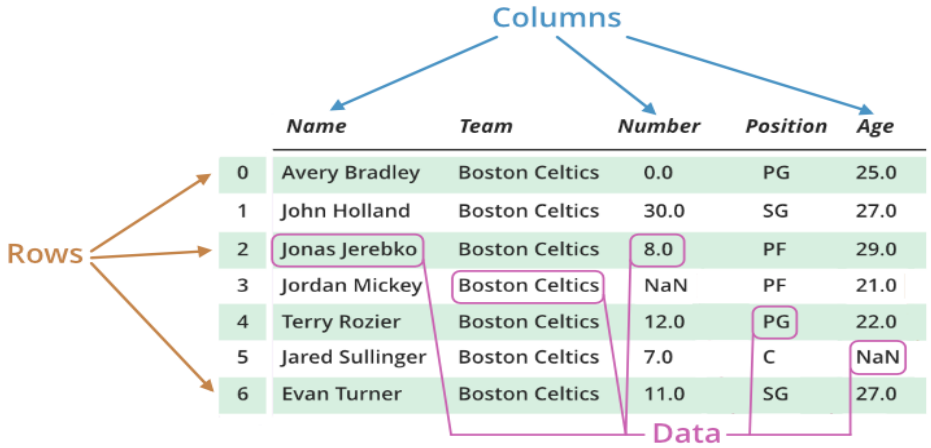
Output:

```
PS C:\Users\trupa\OneDrive\Documents\PWP> & C:/Users/trupa/AppData/Local/Programs/Python/Python313/python.exe "c:/Users/trupa/OneDrive/Document
s/PWP/PWP EXP 9.py"
0    11
1    12
2    13
3    14
4    15
dtype: int64
2    3
3    4
4    5
dtype: int64
3.0
```

Pandas Dataframe

Pandas DataFrame is two-dimensional size-mutable, potentially heterogeneous tabular data structure with labeled axes (rows and columns). A Data frame is a two-dimensional data structure, i.e., data is aligned in a

tabular fashion in rows and columns. Pandas DataFrame consists of three principal components, the data, rows, and columns.



	Name	Team	Number	Position	Age
0	Avery Bradley	Boston Celtics	0.0	PG	25.0
1	John Holland	Boston Celtics	30.0	SG	27.0
2	Jonas Jerebko	Boston Celtics	8.0	PF	29.0
3	Jordan Mickey	Boston Celtics	NaN	PF	21.0
4	Terry Rozier	Boston Celtics	12.0	PG	22.0
5	Jared Sullinger	Boston Celtics	7.0	C	NaN
6	Evan Turner	Boston Celtics	11.0	SG	27.0

```
# Creating a DataFrame
data = {
   'Name': ['Alice', 'Bob', 'Charlie'],
   'Age': [25, 30, 35],
   'City': ['New York', 'Los Angeles', 'Chicago']
}
df = pd.DataFrame(data)
print(df)
```

Output :

```
PS C:\Users\trupa\OneDrive\Documents\PWP> & C:/Users/trupa/AppData/Local/Programs/Python/Python313/python.exe "c:/Users/trupa/OneDrive/Documents/PWP/PWP EXP 9.py"
      Name  Age         City
0    Alice   25     New York
1      Bob   30  Los Angeles
2  Charlie   35      Chicago
```

Basic Operations on Dataframes

DataFrames support a wide range of operations for data manipulation and analysis.

Marwadi University Marwadi Chandarana Group NAAC A+	**Marwadi University** **Faculty of Engineering & Technology** **Department of Information and Communication Technology**	
Subject: Programming With Python (01CT1309)	**Aim:** Practical based on Pandas Data Structures	
Experiment No: 09	**Date:26/08/2025**	**Enrollment No:92510133011**

# Accessing Columns (# select one column)
print(df[['Name']])
Output:

```
PS C:\Users\trupa\OneDrive\Documents\PWP> & C:/Users/trupa/AppData/Local/Programs/Python/Python313/python.exe "c:/Users/trupa/OneDrive/Documents/PWP/PWP EXP 9.py"
      Name
0    Alice
1      Bob
2  Charlie
```

Adding a New Column
df['Salary'] = [70000, 80000, 90000]
print(df)
Output:

```
PS C:\Users\trupa\OneDrive\Documents\PWP> & C:/Users/trupa/AppData/Local/Programs/Python/Python313/python.exe "c:/Users/trupa/OneDrive/Documents/PWP/PWP EXP 9.py"
      Name  Age         City  Salary
0    Alice   25     New York   70000
1      Bob   30  Los Angeles   80000
2  Charlie   35      Chicago   90000
```

# Dropping a Column
df = df.drop('City', axis=1)
print(df)
Output:

```
PS C:\Users\trupa\OneDrive\Documents\PWP> & C:/Users/trupa/AppData/Local/Programs/Python/Python313/python.exe "c:/Users/trupa/OneDrive/Documents/PWP/PWP EXP 9.py"
      Name  Age
0    Alice   25
1      Bob   30
2  Charlie   35
```

The DataFrame is like a table with rows and columns.
Pandas use the loc attribute to return one or more specified row(s)
# Return row 0:
print(df.loc[[0]])
Output:

Marwadi University Marwadi Chandarana Group NAAC A+	**Marwadi University** **Faculty of Engineering & Technology** **Department of Information and Communication Technology**	
Subject: Programming With Python (01CT1309)	**Aim:** Practical based on Pandas Data Structures	
Experiment No: 09	**Date:26/08/2025**	**Enrollment No:92510133011**

```
PS C:\Users\trupa\OneDrive\Documents\PWP> & C:/Users/trupa/AppData/Local/Programs/Python/Python313/python.exe "c:/Users/trupa/OneDrive/Documents/PWP/PWP EXP 9.py"
    Name  Age      City
0  Alice   25  New York
```

#Return row 0 and 1:
#use a list of indexes:
print(df.loc[[0, 1]])
Output:

```
PS C:\Users\trupa\OneDrive\Documents\PWP> & C:/Users/trupa/AppData/Local/Programs/Python/Python313/python.exe "c:/Users/trupa/OneDrive/Documents/PWP/PWP EXP 9.py"
    Name  Age         City
0  Alice   25     New York
1    Bob   30  Los Angeles
```

Named Indexes

With the index argument, you can name your own indexes.
Example:
Add a list of names to give each row a name:

```
import pandas as pd
data = {
  "calories": [420, 380, 390],
  "duration": [50, 40, 45]
}
df = pd.DataFrame(data, index = ["day1", "day2", "day3"])
print(df)
```

Output:

```
PS C:\Users\trupa\OneDrive\Documents\PWP> & C:/Users/trupa/AppData/Local/Programs/Python/Python313/python.exe "c:/Users/trupa/OneDrive/Documents/PWP/PWP EXP 9.py"
      calories  duration
day1       420        50
day2       380        40
day3       390        45
```

Marwadi University Marwadi Chandarana Group NAAC A+	**Marwadi University** **Faculty of Engineering & Technology** **Department of Information and Communication Technology**	
Subject: Programming With Python (01CT1309)	**Aim:** Practical based on Pandas Data Structures	
Experiment No: 09	**Date:26/08/2025**	**Enrollment No:92510133011**

Explanation of Key Pandas Functions
Reading and Writing Data:

Reading Data: Read a CSV file into a DataFrame.
Example:

```
dat = pd.read_csv("data.csv")
print(dat)
```

Output:

```
PS C:\Users\trupa\OneDrive\Documents\PWP> & C:/Users/trupa/AppData/Local/Programs/Python/Python313/python.exe "c:/Users/trupa/OneDrive/Documents/PWP/PWP EXP 9.py"
   Name City  Number
0     A    M       1
1     B    N       4
2     C    V       5
3     D    B       7
4     E    J       8
5     F    G       9
6     G    F       7
7     H    D       5
8     I    C       6
9     J    X       7
10    K    Z       3
11    L    S       4
12    M    R       6
```

Writing Data: Write a DataFrame to a CSV file.
Note: Other Ways to Save Pandas DataFrames (to_excel(), to_json(), to_hdf(), to_sql(), to_pickle())

Example:

```
Biodata = {'Name': ['John', 'Emily', 'Mike', 'Lisa'],
        'Age': [28, 23, 35, 31],
        'Gender': ['M', 'F', 'M', 'F']
        }
df = pd.DataFrame(Biodata)
# Save the dataframe to a CSV file
df.to_csv('Biodata.csv', index=False)
```

Output:

```
Name,Age,Gender
John,28,M
Emily,23,F
Mike,35,M
Lisa,31,F
```

	Marwadi University **Faculty of Engineering & Technology** **Department of Information and Communication Technology**	
Subject: Programming With Python (01CT1309)	**Aim:** Practical based on Pandas Data Structures	
Experiment No: 09	**Date:26/08/2025**	**Enrollment No:92510133011**

Data Inspection:

`df.head()`: Display the first few rows of the DataFrame.
`df.tail()`: Display the last few rows of the DataFrame.
`df.info()`: Display a summary of the DataFrame.
`df.describe()`: Provide descriptive statistics for numerical columns. (count: the number of non-null entries, mean: the mean value, std: the standard deviation, min: the minimum value, 25%, 50%, 75%: the lower, median, and upper quartiles, max: the maximum value)

Example:

```
dat = pd.read_csv("data.csv")
print(dat.info())
# shows first and last five rows
print(dat.head())
print(dat.tail())
print(dat.describe())
```

Output:

Marwadi University Marwadi Chandarana Group NAAC A+	**Marwadi University** **Faculty of Engineering & Technology** **Department of Information and Communication Technology**	
Subject: Programming With Python (01CT1309)	**Aim:** Practical based on Pandas Data Structures	
Experiment No: 09	**Date:26/08/2025**	**Enrollment No:92510133011**

```
PS C:\Users\trupa\OneDrive\Documents\PWP> & C:/Users/trupa/AppData/Local/Programs/Python/Python313/python.exe "c:/Users/trupa/OneDrive/Documents/PWP/PWP EXP 9.py"
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 13 entries, 0 to 12
Data columns (total 3 columns):
 #   Column  Non-Null Count  Dtype
---  ------  --------------  -----
 0   Name    13 non-null     object
 1   City    13 non-null     object
 2   Number  13 non-null     int64
dtypes: int64(1), object(2)
memory usage: 444.0+ bytes
None
  Name City  Number
0    A    M       1
1    B    N       4
2    C    V       5
3    D    B       7
4    E    J       8
   Name City  Number
8     I    C       6
9     J    X       7
10    K    Z       3
11    L    S       4
12    M    R       6
          Number
count  13.000000
mean    5.538462
std     2.183857
min     1.000000
25%     4.000000
50%     6.000000
75%     7.000000
max     9.000000
```

Data Selection and Indexing:

`dat[['A']]`: Select a column.

`dat[['A', 'B']]`: Select multiple columns.

`dat.loc[[0]]`: Select a row by label.

Example:

```
print(dat[['Name']])
print(dat[['Name','Number']])
print(dat.loc[[1]])
```

Output:

Marwadi University Marwadi Chandarana Group NAAC A+	**Marwadi University** **Faculty of Engineering & Technology** **Department of Information and Communication Technology**	
Subject: Programming With Python (01CT1309)	**Aim:** Practical based on Pandas Data Structures	
Experiment No: 09	**Date:26/08/2025**	**Enrollment No:92510133011**

```
PS C:\Users\trupa\OneDrive\Documents\PWP> & C:/Users/trupa/AppData/Local/Programs/Python/Python313/python.exe "c:/Users/trupa/OneDrive/Document
s/PWP/PWP EXP 9.py"
   Name
0     A
1     B
2     C
3     D
4     E
5     F
6     G
7     H
8     I
9     J
10    K
11    L
12    M
   Name  Number
0     A       1
1     B       4
2     C       5
3     D       7
4     E       8
5     F       9
6     G       7
7     H       5
8     I       6
9     J       7
10    K       3
11    L       4
12    M       6
  Name City  Number
1    B    N       4
```

Data Manipulation:

dat['A'] = dat['A'] * 2: Modify a column.

dat['F'] = dat['A'] + dat['B']: Create a new column based on existing columns.

dat.drop(columns=['A']): Drop a column.

dat.drop(index=[0]): Drop a row.

Task

Create a DataFrame with 5 numeric columns

```
data = {
   'A': [np.nan, 2, 3, 4, 5, 6, 7, 8, 9, 10],
   'B': np.random.normal(50, 15, 10),
```

Marwadi University Marwadi Chandarana Group NAAC A+	**Marwadi University** **Faculty of Engineering & Technology** **Department of Information and Communication Technology**	
Subject: Programming With Python (01CT1309)	**Aim:** Practical based on Pandas Data Structures	
Experiment No: 09	**Date:26/08/2025**	**Enrollment No:92510133011**

```
    'C': np.random.rand(10) * 100,
    'D': np.linspace(1, 10, 10),
    'E': np.logspace(1, 2, 10)
}
df = pd.DataFrame(data)
```

Output:

```
PS C:\Users\trupa\OneDrive\Documents\PWP> & C:/Users/trupa/AppData/Local/Programs/Python/Python313/python.exe "c:/Users/trupa/OneDrive/Documents/PWP/PWP EXP 9.py"
     A          B          C    D           E
0   NaN  56.779407  82.403524  1.0   10.000000
1   2.0  53.440913  35.707254  2.0   12.915497
2   3.0  57.533071  93.802474  3.0   16.681005
3   4.0  65.975166  23.207421  4.0   21.544347
4   5.0  59.065975  37.539291  5.0   27.825594
5   6.0  72.259753   7.271053  6.0   35.938137
6   7.0  75.220656  82.729679  7.0   46.415888
7   8.0  49.709125  83.410287  8.0   59.948425
8   9.0  10.758139   5.753396  9.0   77.426368
9  10.0  56.752852  48.832324 10.0  100.000000
```

Post Lab Exercise:

a. Write a Pandas program to add, subtract, multiple and divide two Pandas Series.

Marwadi University Marwadi Chandarana Group NAAC A+	**Marwadi University** **Faculty of Engineering & Technology** **Department of Information and Communication Technology**	
Subject: Programming With Python (01CT1309)	**Aim:** Practical based on Pandas Data Structures	
Experiment No: 09	**Date:26/08/2025**	**Enrollment No:92510133011**

```
PS C:\Users\trupa\OneDrive\Documents\PWP> & C:/Users/trupa/AppData/Local/Programs/Python/Python313/python.exe "c:/Users/trupa/OneDrive/Documents/PWP/PWP EXP 9.py"
Addition:
 0    15
1    30
2    45
3    60
dtype: int64
Subtraction:
 0     5
1    10
2    15
3    20
dtype: int64
Multiplication:
 0     50
1    200
2    450
3    800
dtype: int64
Division:
 0    2.0
1    2.0
2    2.0
3    2.0
dtype: float64
```

b. Write a Pandas program to convert a dictionary to a Pandas series.

```
PS C:\Users\trupa\OneDrive\Documents\PWP> & C:/Users/trupa/AppData/Local/Programs/Python/Python313/python.exe "c:/Users/trupa/OneDrive/Documents/PWP/PWP EXP 9.py"
a    100
b    200
c    300
d    400
```

c. Write a Pandas program to create a series from a list, numpy array and dict

```
PS C:\Users\trupa\OneDrive\Documents\PWP> & C:/Users/trupa/AppData/Local/Programs/Python/Python313/python.exe "c:/Users/trupa/OneDrive/Documents/PWP/PWP EXP 9.py"
Series from list:
 0    10
1    20
2    30
3    40
dtype: int64

Series from NumPy array:
 0    1
1    2
2    3
3    4
dtype: int64

Series from dictionary:
 a    10
b    20
c    30
dtype: int64
```

d. Write a Pandas program to stack two series vertically and horizontally

Marwadi University Marwadi Chandarana Group NAAC A+	**Marwadi University** **Faculty of Engineering & Technology** **Department of Information and Communication Technology**	
Subject: Programming With Python (01CT1309)	**Aim:** Practical based on Pandas Data Structures	
Experiment No: 09	**Date:26/08/2025**	**Enrollment No:92510133011**

```
PS C:\Users\trupa\OneDrive\Documents\PWP> & C:/Users/trupa/AppData/Local/Programs/Python/Python313/python.exe "c:/Users/trupa/OneDrive/Document
s/PWP/PWP EXP 9.py"
Vertical Stack:
 0   1
1   2
2   3
3   4
4   5
5   6
dtype: int64

Horizontal Stack:
   0  1
0  1  4
1  2  5
2  3  6
```