Practical-1

Aim:Understanding Python environment Setup: Installing python with anaconda, Introduction to various Python IDEs like IDLE, Jupyter notebook, Pycharm , spyder.

Introduction: AnIDE(Integrated Development Environment) is asoftwareapplicationthatprovidesasetoftoolsforsoftwaredevelopmentwithaspecificprogramminglanguage,suchasPython.AnIDEtypically includes features like code editing, syntax highlighting, code completion, debugging, testing, and project management. There are many IDEs available for Python programming, each with its own advantages and disadvantages. Some of the most popular ones are:

Jupyter: Aweb-basedIDEthatallowsyoutocreateandshareinteractivenotebooksthatcontaincode,text, images,andgraphs.Itiswidelyusedfordatascience,machinelearning,andscientificcomputing.Itsupports many programming languages besides Python, such as R, Julia, and Scala.

PyCharm: ApowerfulandversatileIDEthatsupportsmanywebdevelopmentframeworks,scientifictools, cross-technology development, remotedevelopment, and database integration. Ithasaprofessionaledition that requires a license and a free community edition that is open source.

Spyder: A scientific IDE that is designed for data analysis, visualization, and exploration. It has a user-friendly interface that features a code editor, a console, a variable explorer, a plot pane, and a help pane. It integrates with popular scientific packages like NumPy, SciPy, Matplotlib, and Pandas.

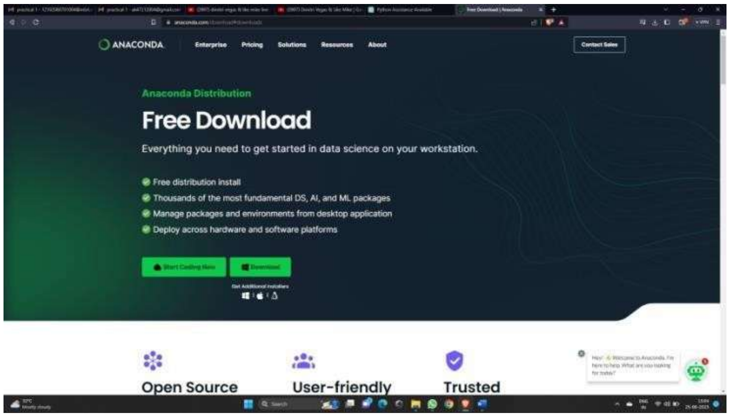
InstallationGuideforAnacondaNavigatorIn

troduction:

AnacondaNavigatorisapowerfultoolforPythondevelopmentanddatascience.Thisinstallationguidewill walk you through the steps to install Anaconda Navigator on your computer.

Step 1:VisittheAnaconda website: https://www.anaconda.com/products/individual

Step2: Clickonthe"Download"buttontoaccessthedownload page.



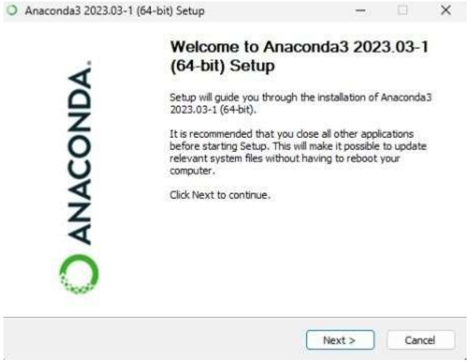
Anaconda Distribution

Free Download

Everything you need to get started in data science on your workstation.

- Free distribution install
- Thousands of the most fundamental DS, AI, and ML packages
- Manage packages and environments from desktop application
- Deploy across hardware and software platforms

Step 3: Choose the appropriate installer for your operating system. Anaconda supports both 32-bit and 64-bit systems.


Anaconda3 2023.03-1 (64-bit) Setup

Welcome to Anaconda3 2023.03-1 (64-bit) Setup

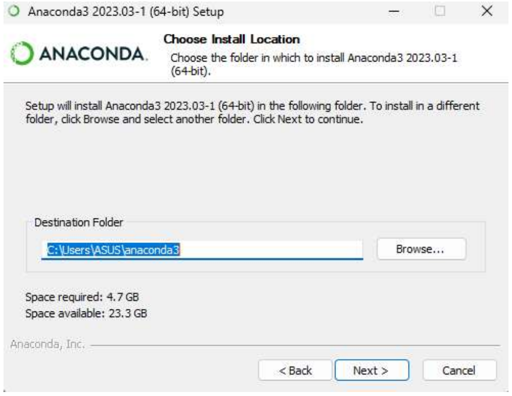
Setup will guide you through the installation of Anaconda3 2023.03-1 (64-bit).

It is recommended that you close all other applications before starting Setup. This will make it possible to update relevant system files without having to reboot your computer.

Click Next to continue.

Locatethedownloadedinstallerfileonyourcomputer.Double-clickontheinstallerfiletolaunchthe installation.Read and accept the license agreement.

Step4: Choosetheinstallationlocation(youcanusuallyleavethedefaultlocationasis).


Anaconda3 2023.03-1 (64-bit) Setup

Choose Install Location

Choose the folder in which to install Anaconda3 2023.03-1 (64-bit).

Setup will install Anaconda3 2023.03-1 (64-bit) in the following folder. To install in a different folder, click Browse and select another folder. Click Next to continue.

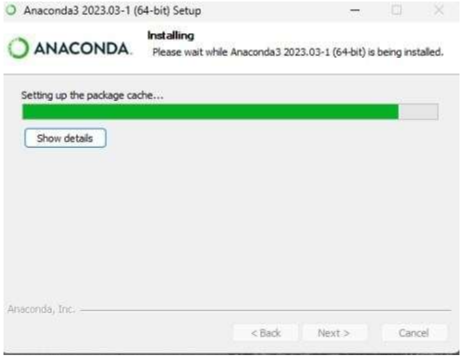
Destination Folder: C:\Users\ASUS\anaconda3

Space required: 4.7 GB
Space available: 23.3 GB

Anaconda, Inc.

Starttheinstallationprocessbyclickingthe“Next”button.

Step5: Waitfortheinstallationtocomplete:


Anaconda3 2023.03-1 (64-bit) Setup

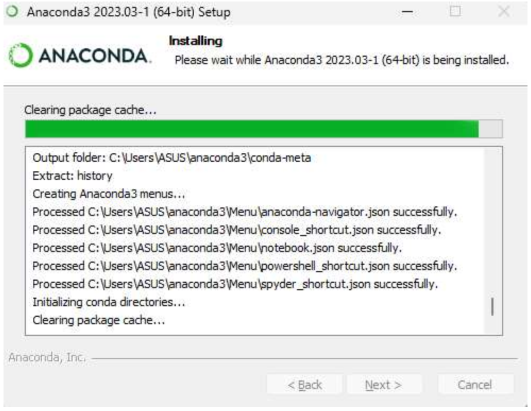
Installing

Please wait while Anaconda3 2023.03-1 (64-bit) is being installed.

Setting up the package cache...

Anaconda, Inc.

Theinstallerwillextractandinstallallthenecessaryfiles.Thismaytakeafewminutes.



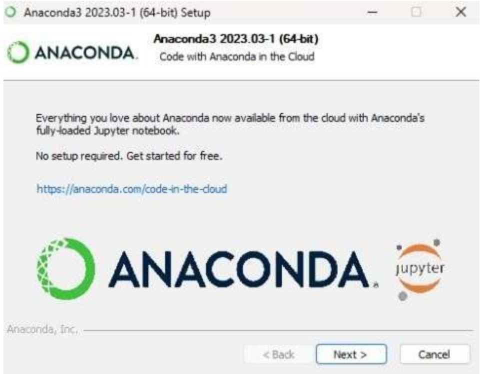
Anaconda3 2023.03-1 (64-bit) Setup

Installing
Please wait while Anaconda3 2023.03-1 (64-bit) is being installed.

Clearing package cache...

```
Output folder: C:\Users\ASUS\anaconda3\conda-meta
Extract: history
Creating Anaconda3 menus...
Processed C:\Users\ASUS\anaconda3\Menu\anaconda-navigator.json successfully.
Processed C:\Users\ASUS\anaconda3\Menu\console_shortcut.json successfully.
Processed C:\Users\ASUS\anaconda3\Menu\notebook.json successfully.
Processed C:\Users\ASUS\anaconda3\Menu\powershell_shortcut.json successfully.
Processed C:\Users\ASUS\anaconda3\Menu\spyder_shortcut.json successfully.
Initializing conda directories...
Clearing package cache...
```

Step6: Aftertheinstallationcompletes,youcanlaunchAnacondaNavigator byclickingthe“Next” button.



Anaconda3 2023.03-1 (64-bit) Setup

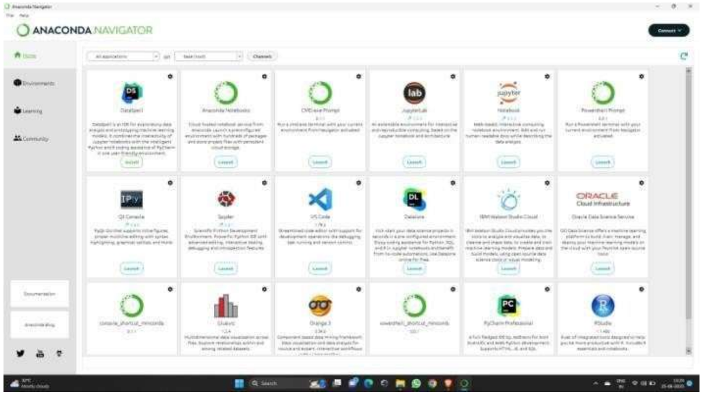
Anaconda3 2023.03-1 (64-bit)
Code with Anaconda in the Cloud

Everything you love about Anaconda now available from the cloud with Anaconda's fully-loaded Jupyter notebook.

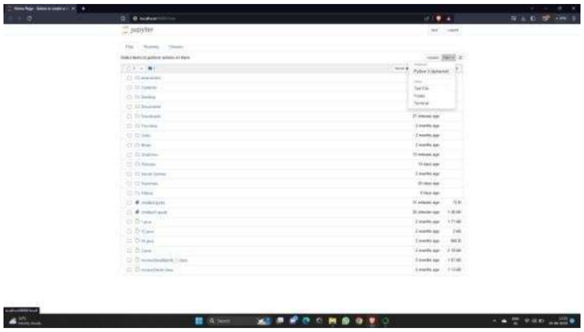
No setup required. Get started for free.

https://anaconda.com/code-in-the-cloud

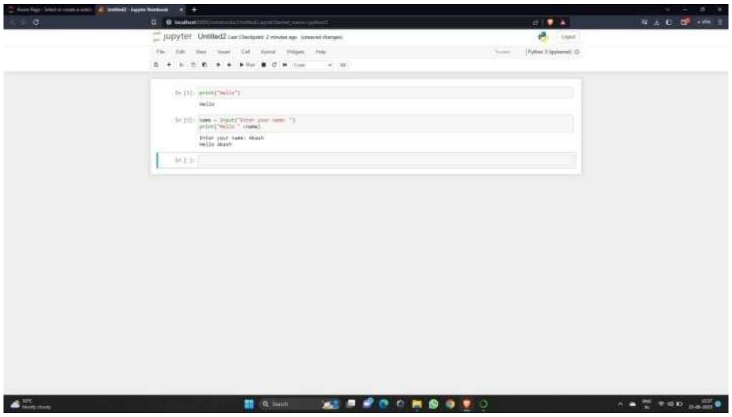
Step7:Open“Jupyter Notebook”.



Step8: Nowclickto“new”,thenclickon“Python3(ipykernal)”.



StartCodingwith python.



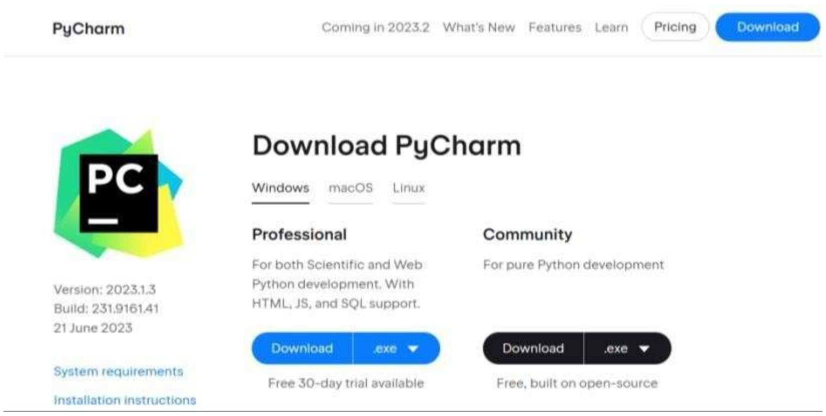
```
In [1]: print("Hello")
        Hello

In [2]: name = input("Enter your name: ")
        print("Hello " +name)
        Enter your name: Akash
        Hello Akash

In [ ]:
```

InstallationGuideforPycharmIntroduction

PyCharmisawidelyusedintegrateddevelopmentenvironment(IDE)forPythonprogramming.Developed by JetBrains, it offers a range of features including an intelligent code editor, powerful debugging capabilities, and code refactoring tools. With its user-friendly interface, PyCharm is a popular choice for Python developers to write, debug, and manage their code efficiently.

Step1: GotothefficialPyCharmwebsiteathttps://www.jetbrains.com/pycharm/.

Step 2: Choose the edition you want (Community or Professional) and click on the respective downloadbutton.



Download PyCharm

Version: 2023.1.3
Build: 231.9161.41
21 June 2023

System requirements
Installation instructions

Professional

For both Scientific and Web Python development. With HTML, JS, and SQL support.

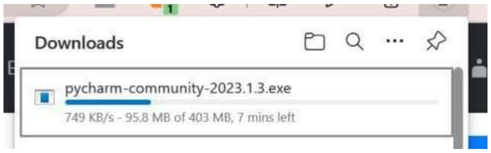
Free 30-day trial available

Community

For pure Python development

Free, built on open-source

Step 3: Once the download is complete, locate the installer file.

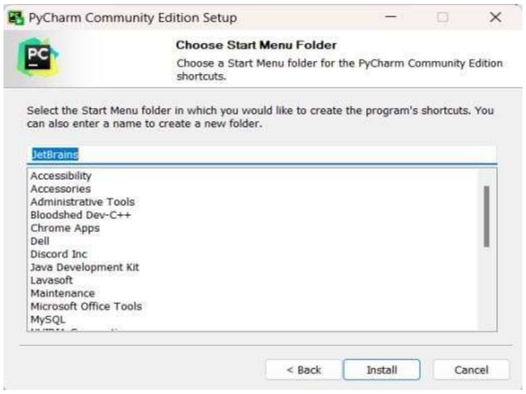


Downloads

pycharm-community-2023.1.3.exe

749 KB/s - 95.8 MB of 403 MB, 7 mins left

Double-clickontheinstallerfiletostarttheinstallationprocess.



PyCharm Community Edition Setup

Choose Start Menu Folder

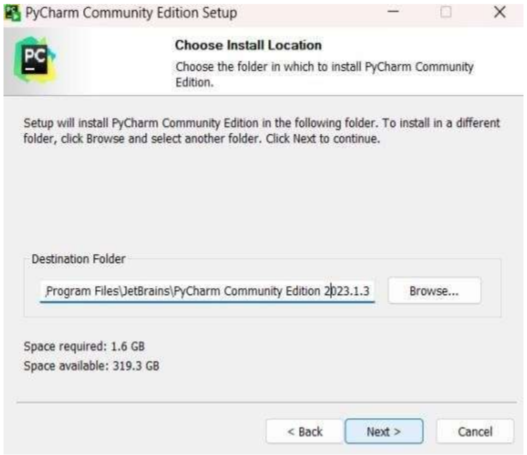
Choose a Start Menu folder for the PyCharm Community Edition shortcuts.

Select the Start Menu folder in which you would like to create the program's shortcuts. You can also enter a name to create a new folder.

JetBrains

Accessibility
Accessories
Administrative Tools
Bloodshed Dev-C++
Chrome Apps
Dell
Discord Inc
Java Development Kit
Lavasoft
Maintenance
Microsoft Office Tools
MySQL

Step4: Choosetheinstallationlocation(youcanusuallyleavethedefaultlocationasis).



PyCharm Community Edition Setup

Choose Install Location

Choose the folder in which to install PyCharm Community Edition.

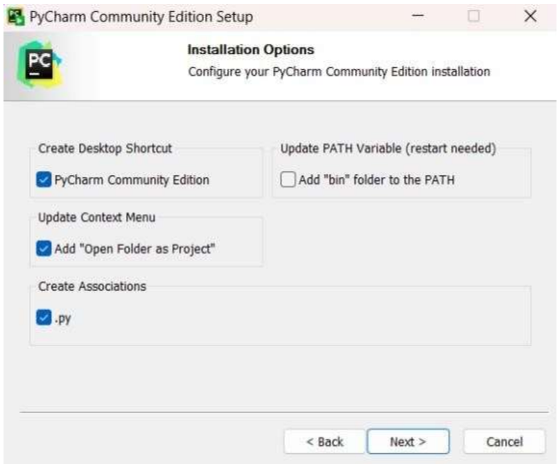
Setup will install PyCharm Community Edition in the following folder. To install in a different folder, click Browse and select another folder. Click Next to continue.

Destination Folder

Program Files\JetBrains\PyCharm Community Edition 2023.1.3

Space required: 1.6 GB
Space available: 319.3 GB

Step5: ChooseInstallationoptions



PyCharm Community Edition Setup

Installation Options

Configure your PyCharm Community Edition installation

Create Desktop Shortcut

☑ PyCharm Community Edition

Update PATH Variable (restart needed)

☐ Add "bin" folder to the PATH

Update Context Menu

☑ Add "Open Folder as Project"

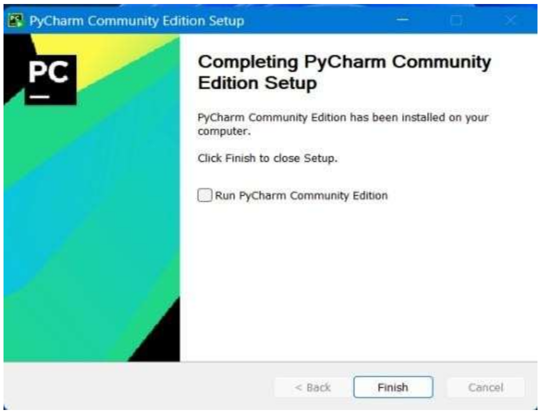
Create Associations

☑ .py

Step6: Clickonthe"Install"buttontobegintheinstallation. Wait

for the installation to complete.

Step 7: After the installation, choose whether to run PyCharm immediately or exit and launch itlater from the Start menu.



PyCharm Community Edition Setup

Completing PyCharm Community Edition Setup

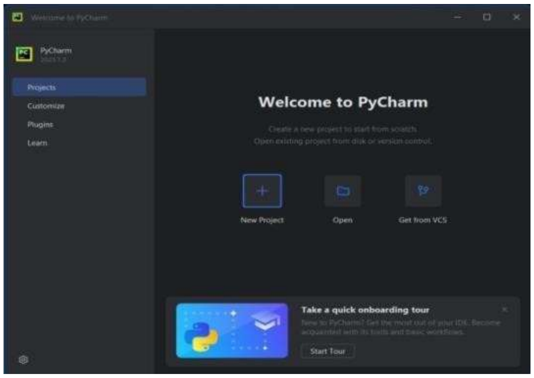
PyCharm Community Edition has been installed on your computer.

Click Finish to close Setup.

☐ Run PyCharm Community Edition

Step8: Oncetheinstallationiscomplete,gotosearchmenuandopenPyCharm.

Nowbyclickingon“NewProject”itwillcreateafolderwhereyou code.



Welcome to PyCharm

Welcome to PyCharm

Create a new project to start from scratch.
Open existing project from disk or version control.

Take a quick onboarding tour

New to PyCharm? Get the most out of your IDE. Become acquainted with its tools and basic workflows.

Practical-2

Aim:-**1)**Createalistnamed“Subjects”byinserting10subjectsintoitthroughanyloopandcreatealist“ElectiveSubjects” with5subjectsthroughdirectinitialization.Extendlist“Subject”byanotherlist“ElectiveSubjects”.Append3duplicate subjectsinto“Subject”list.Findtheindexoffirstoccurrenceofthatduplicatevalueandthenremovealltheoccurrences ofthatspecificsubjectthroughloop.Definefunctionremoverange(i1,i2)toremoverangeofelementfromi1toi2 through del keyword and return the resultant list. Pop 5th element after reversing and sorting your list. Count total elementsinyourlistandfinallyclearthelist.Whichoftheaboveoperationscanbeperformeddirectly?Whichofthe aboveoperationscannotbeperformeddirectlyonTupleandwhy?Updateandremovespecificitemfromthetuplebyconvertingitintolist.

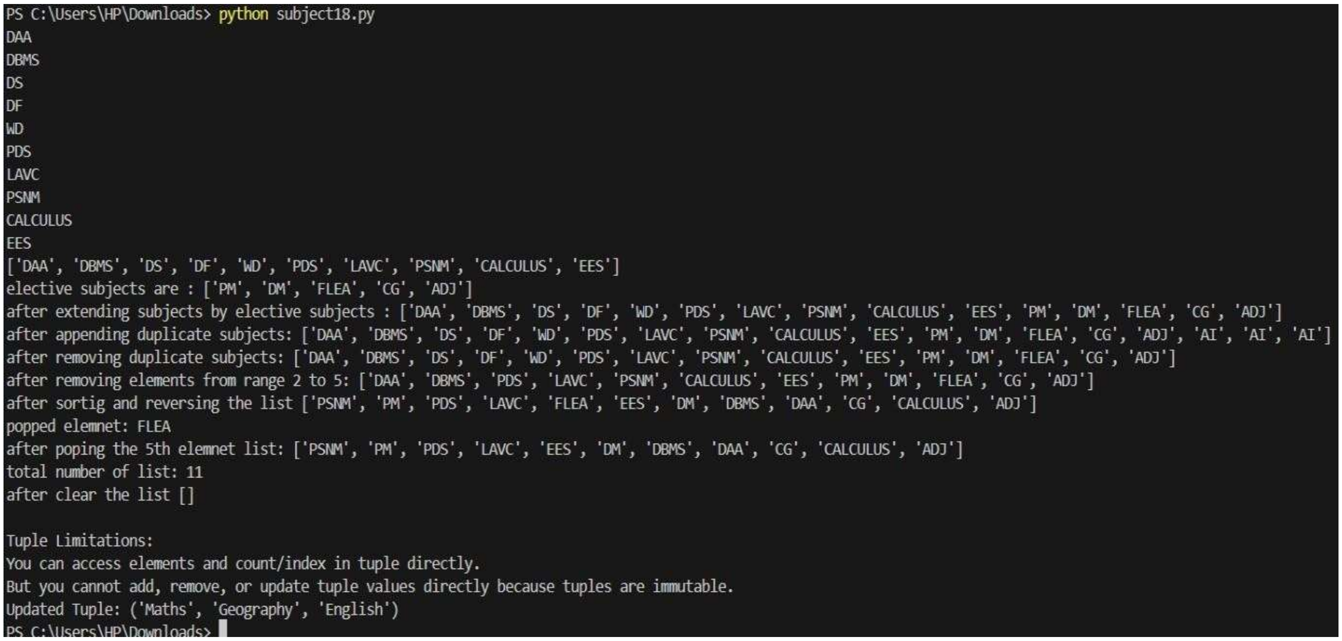
Createadictionarynamed“StudentsData”with5studentsandid_no,nameandmarksasthekeyvalues.Providethe separatelistofallthekeysandvalues.Adddetailsofonemorestudent.Retrievevaluecorrespondingtospecifickey throughgetmethod.Defineafunctionupdatedetail(k)byloopingoverkeystosearchforspecifickey‘k’whosedetails tobeupdatedandthenupdateitwithnewdetailsandreturnupdateddictionary.Ifspecificdetailisnotavailableinlist printappropriatemessage.Convertdictionary’skeysintoalistbyloopingthroughkeysandappendingittotheotherlist. Convertdictionaryvaluesintolistthroughlistconstructor.Countanddisplaytotalnumberofstudentsinthedictionary. Removeallthedetailsfromthedictionary.Defineadictionarynamed“exam_data_array”with4keys,namely‘name’, ‘score’,‘attempts’and‘qualify’.Valuesforeachofthese 4keys willbean1Darraywith5elements.bycreatinga dictionarynamed“exam_data_list”with5listandeachliststoresall4key-valuepairsforsinglestudent.

→code:-

```
subjects=[]
for i in range(10):
   subjects.append(input())
print(subjects)
elective_subjects=["PM","DM","FLEA","CG","ADJ"]
print("elective subjects are :",elective_subjects)
subjects.extend(elective_subjects)
print("afterextendingsubjectsbyelectivesubjects:",subjects)
subjects.append("AI")
subjects.append("AI")
subjects.append("AI")
dup_subjects="AI"
print("afterappendingduplicatesubjects:",subjects)
first_index=subjects.index(dup_subjects)
while dup_subjects in subjects:
   subjects.remove(dup_subjects)
print("afterremovingduplicatesubjects:",subjects)
def remove_range(i1,i2):
   delsubjects[i1:i2]
   return subjects
subjects=remove_range(2,5)
print("afterremovingelementsfromrange2to5:",subjects)
subjects.sort()
subjects.reverse()
```

```
print("aftersortigandreversingthelist",subjects)
popped_ele=subjects.pop(4)
print("poppedelemnet:",popped_ele)
print("afterpopingthe5thelemnetlist:",subjects)
print("total number of list:",len(subjects))
subjects.clear()
print("afterclearthelist",subjects)
print("\nTuple Limitations:")
print("Youcanaccesselementsandcount/indexintupledirectly.")
print("Butyoucannotadd,remove,orupdatetuplevaluesdirectlybecausetuplesare immutable.") #
Update tuple (convert to list and back)
my_tuple=("Maths","Science","History","English")
temp_list = list(my_tuple)
temp_list[2] ="Geography" # updating
temp_list.remove("Science")#removing
my_tuple = tuple(temp_list)
print("Updated Tuple:", my_tuple)
```

solution:-



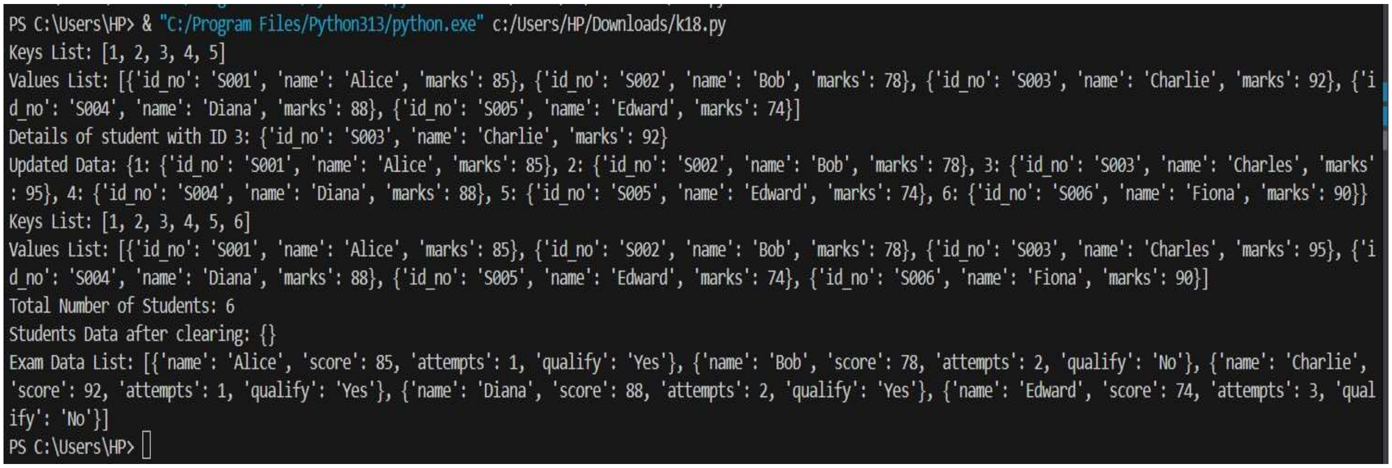
```
PS C:\Users\HP\Downloads> python subject18.py
DAA
DBMS
DS
DF
WD
PDS
LAVC
PSNM
CALCULUS
EES
['DAA', 'DBMS', 'DS', 'DF', 'WD', 'PDS', 'LAVC', 'PSNM', 'CALCULUS', 'EES']
elective subjects are : ['PM', 'DM', 'FLEA', 'CG', 'ADJ']
after extending subjects by elective subjects : ['DAA', 'DBMS', 'DS', 'DF', 'WD', 'PDS', 'LAVC', 'PSNM', 'CALCULUS', 'EES', 'PM', 'DM', 'FLEA', 'CG', 'ADJ']
after appending duplicate subjects: ['DAA', 'DBMS', 'DS', 'DF', 'WD', 'PDS', 'LAVC', 'PSNM', 'CALCULUS', 'EES', 'PM', 'DM', 'FLEA', 'CG', 'ADJ', 'AI', 'AI', 'AI']
after removing duplicate subjects: ['DAA', 'DBMS', 'DS', 'DF', 'WD', 'PDS', 'LAVC', 'PSNM', 'CALCULUS', 'EES', 'PM', 'DM', 'FLEA', 'CG', 'ADJ']
after removing elements from range 2 to 5: ['DAA', 'DBMS', 'PDS', 'LAVC', 'PSNM', 'CALCULUS', 'EES', 'PM', 'DM', 'FLEA', 'CG', 'ADJ']
after sortig and reversing the list ['PSNM', 'PM', 'PDS', 'LAVC', 'FLEA', 'EES', 'DM', 'DBMS', 'DAA', 'CG', 'CALCULUS', 'ADJ']
popped elemnet: FLEA
after poping the 5th elemnet list: ['PSNM', 'PM', 'PDS', 'LAVC', 'EES', 'DM', 'DBMS', 'DAA', 'CG', 'CALCULUS', 'ADJ']
total number of list: 11
after clear the list []

Tuple Limitations:
You can access elements and count/index in tuple directly.
But you cannot add, remove, or update tuple values directly because tuples are immutable.
Updated Tuple: ('Maths', 'Geography', 'English')
PS C:\Users\HP\Downloads>
```

Aim:-2) Create a dictionary named “Students Data” with 5 students and id_no, name and marks as the key values. Provide the separate list of all the keys and values. Add details of one more student. Retrieve value corresponding to specific key through get method. Define a function update detail(k) by looping over keys to search for specific key ‘k’ whose details to be updated and then update it with new details and return updated dictionary. If specific detail is not available in list print appropriate message. Convert dictionary’s keys into a list by looping through keys and appending it to the other list. Convert dictionary values into list through list constructor. Count and display total number of students in the dictionary. Remove all the details from the dictionary. Define a dictionary named “exam_data_array” with 4 keys, namely ‘name’, ‘score’, ‘attempts’ and ‘qualify’. Values for each of these 4 keys will be an 1Darray with 5 elements. by creating a dictionary named “exam_data_list” with 5 list and each list stores all 4 key-value pairs for single student.

→code:-

```
Students_Data = {
    1: {'id_no': 'S001', 'name': 'Alice', 'marks': 85},
    2: {'id_no': 'S002', 'name': 'Bob', 'marks': 78},
    3: {'id_no': 'S003', 'name': 'Charlie', 'marks': 92},
    4: {'id_no': 'S004', 'name': 'Diana', 'marks': 88},
    5: {'id_no': 'S005', 'name': 'Edward', 'marks': 74}
}
keys_list = list(Students_Data.keys())
values_list = list(Students_Data.values())
print("Keys List:", keys_list)
print("Values List:", values_list)
Students_Data[6] = {'id_no': 'S006', 'name': 'Fiona', 'marks': 90}
student_id = 3
student_details = Students_Data.get(student_id, "Student not found")
print(f"Details of student with ID {student_id}:", student_details)
def update_detail(k, new_details):
    if k in Students_Data:
        Students_Data[k].update(new_details)
        return Students_Data
    else:
        print(f"Student with ID {k} not found.")
        return Students_Data
new_details = {'name': 'Charles', 'marks': 95}
updated_data  =  update_detail(3,  new_details)
print("Updated Data:", updated_data)
keys_list = [key for key in Students_Data.keys()]
values_list = list(Students_Data.values())
print("Keys List:", keys_list)
print("Values List:", values_list)
total_students = len(Students_Data)
print("Total Number of Students:", total_students)
Students_Data.clear()
print("Students Data after clearing:", Students_Data)
exam_data_array = {
    'name': ['Alice', 'Bob', 'Charlie', 'Diana', 'Edward'],
    'score': [85, 78, 92, 88, 74],
    'attempts': [1, 2, 1, 2, 3],
    'qualify': ['Yes', 'No', 'Yes', 'Yes', 'No']
}
exam_data_list = [
    {
        'name': exam_data_array['name'][i],
        'score': exam_data_array['score'][i],
        'attempts': exam_data_array['attempts'][i],
        'qualify': exam_data_array['qualify'][i]
    }
    for i in range(len(exam_data_array['name']))
]
print("Exam Data List:", exam_data_list)
```

solution:-



```
PS C:\Users\HP> & "C:/Program Files/Python313/python.exe" c:/Users/HP/Downloads/k18.py
Keys List: [1, 2, 3, 4, 5]
Values List: [{'id_no': 'S001', 'name': 'Alice', 'marks': 85}, {'id_no': 'S002', 'name': 'Bob', 'marks': 78}, {'id_no': 'S003', 'name': 'Charlie', 'marks': 92}, {'i
d_no': 'S004', 'name': 'Diana', 'marks': 88}, {'id_no': 'S005', 'name': 'Edward', 'marks': 74}]
Details of student with ID 3: {'id_no': 'S003', 'name': 'Charlie', 'marks': 92}
Updated Data: {1: {'id_no': 'S001', 'name': 'Alice', 'marks': 85}, 2: {'id_no': 'S002', 'name': 'Bob', 'marks': 78}, 3: {'id_no': 'S003', 'name': 'Charles', 'marks'
: 95}, 4: {'id_no': 'S004', 'name': 'Diana', 'marks': 88}, 5: {'id_no': 'S005', 'name': 'Edward', 'marks': 74}, 6: {'id_no': 'S006', 'name': 'Fiona', 'marks': 90}}
Keys List: [1, 2, 3, 4, 5, 6]
Values List: [{'id_no': 'S001', 'name': 'Alice', 'marks': 85}, {'id_no': 'S002', 'name': 'Bob', 'marks': 78}, {'id_no': 'S003', 'name': 'Charles', 'marks': 95}, {'i
d_no': 'S004', 'name': 'Diana', 'marks': 88}, {'id_no': 'S005', 'name': 'Edward', 'marks': 74}, {'id_no': 'S006', 'name': 'Fiona', 'marks': 90}]
Total Number of Students: 6
Students Data after clearing: {}
Exam Data List: [{'name': 'Alice', 'score': 85, 'attempts': 1, 'qualify': 'Yes'}, {'name': 'Bob', 'score': 78, 'attempts': 2, 'qualify': 'No'}, {'name': 'Charlie',
'score': 92, 'attempts': 1, 'qualify': 'Yes'}, {'name': 'Diana', 'score': 88, 'attempts': 2, 'qualify': 'Yes'}, {'name': 'Edward', 'score': 74, 'attempts': 3, 'qual
ify': 'No'}]
PS C:\Users\HP>
```

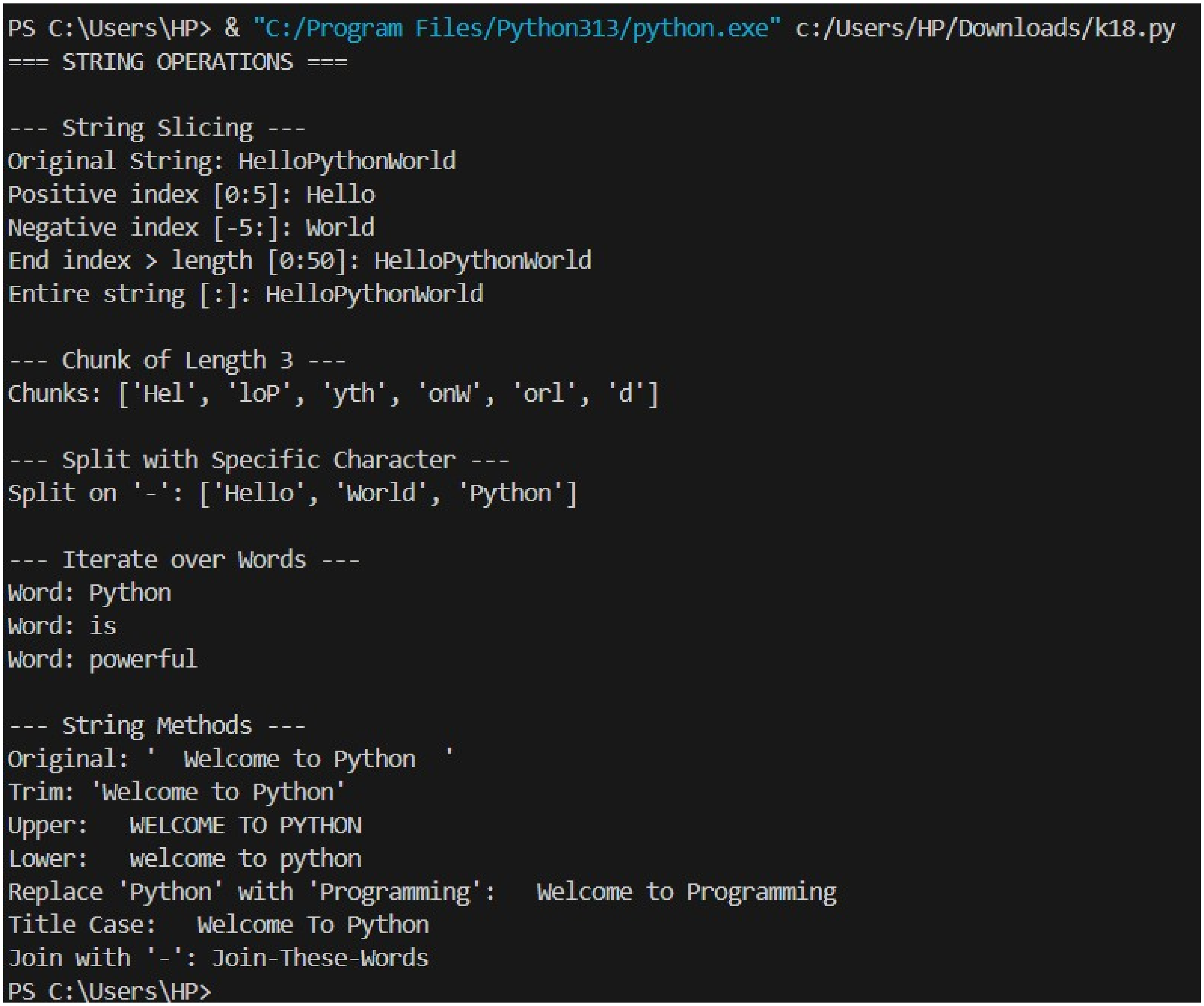
Practical-3

Aim:-1) Do the slicing of a given String to generate various substring by passing different index (like positive index, negative index, end index > string length, entire string), split this string into chunks of length 3 using list comprehension, split the string with specific character, iterate over the words of string. Apply trim, toupper, tolower, replace string and character, title, join and other operations on String.

→code:-

```
print("=== STRING OPERATIONS ===")
sample = "HelloPythonWorld"
print("\n--- String Slicing ---")
print("Original String:", sample)
print("Positive index [0:5]:", sample[0:5])
print("Negative index [-5:]:", sample[-5:])
print("End index > length [0:50]:", sample[0:50])
print("Entire string [:]:", sample[:])
print("\n--- Chunk of Length 3 ---")
chunks = [sample[i:i+3] for i in range(0, len(sample), 3)]
print("Chunks:", chunks)
print("\n--- Split with Specific Character ---")
split_string = "Hello-World-Python"
print("Split on '-':", split_string.split('-'))
print("\n--- Iterate over Words ---")
sentence = "Python is powerful"
for word in sentence.split():
    print("Word:", word)
print("\n--- String Methods ---")
str1 = "  Welcome to Python  "
print("Original:", repr(str1))
print("Trim:", repr(str1.strip()))
print("Upper:", str1.upper())
print("Lower:", str1.lower())
print("Replace 'Python' with 'Programming':", str1.replace("Python", "Programming"))
print("Title Case:", str1.title())
print("Join with '-':", "-".join(["Join", "These", "Words"]))
```

solution:-



```
PS C:\Users\HP> & "C:/Program Files/Python313/python.exe" c:/Users/HP/Downloads/k18.py
=== STRING OPERATIONS ===

--- String Slicing ---
Original String: HelloPythonWorld
Positive index [0:5]: Hello
Negative index [-5:]: World
End index > length [0:50]: HelloPythonWorld
Entire string [:]: HelloPythonWorld

--- Chunk of Length 3 ---
Chunks: ['Hel', 'loP', 'yth', 'onW', 'orl', 'd']

--- Split with Specific Character ---
Split on '-': ['Hello', 'World', 'Python']

--- Iterate over Words ---
Word: Python
Word: is
Word: powerful

--- String Methods ---
Original: '  Welcome to Python  '
Trim: 'Welcome to Python'
Upper:   WELCOME TO PYTHON
Lower:   welcome to python
Replace 'Python' with 'Programming':   Welcome to Programming
Title Case:   Welcome To Python
Join with '-': Join-These-Words
PS C:\Users\HP>
```

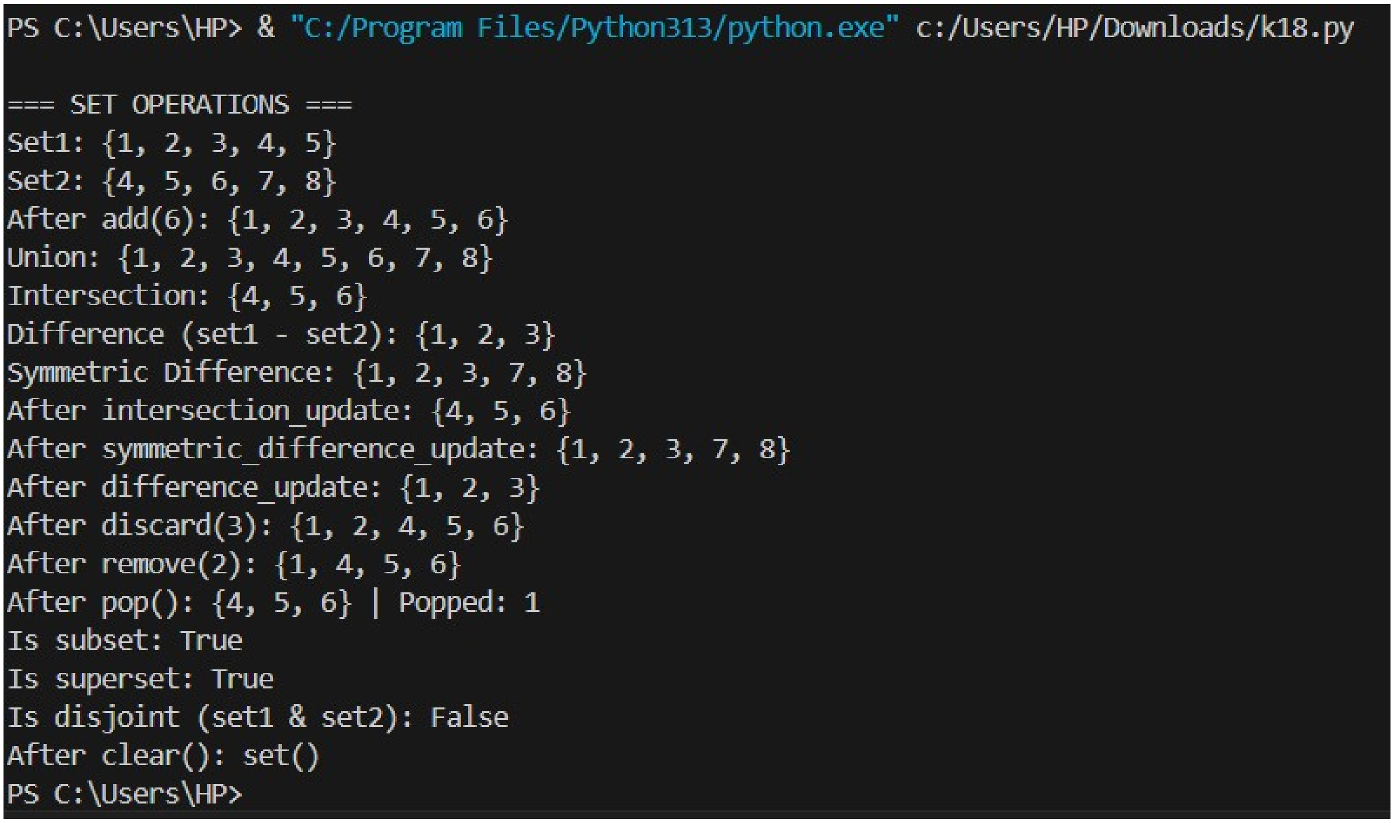
Aim:-2) Perform add, union, intersection, difference, symmetric_difference, union, intersection_update, symmetric_difference_update, difference_update, discard, issubset, issuperset, isdisjoint, remove, pop and clear operations on Set. Import array module in python and perform all operations available in the module.

Code:-

```
print("\n=== SET OPERATIONS ===")
set1 = {1, 2, 3, 4, 5}
set2 = {4, 5, 6, 7, 8}
print("Set1:", set1)
print("Set2:", set2)
```

```
# Add
set1.add(6)
print("After add(6):", set1)
# Union
print("Union:", set1.union(set2))
# Intersection
print("Intersection:", set1.intersection(set2))
# Difference
print("Difference (set1 - set2):", set1.difference(set2))
# Symmetric Difference
print("Symmetric Difference:", set1.symmetric_difference(set2))
# intersection_update
set1_temp = set1.copy()
set1_temp.intersection_update(set2)
print("After intersection_update:", set1_temp)
# symmetric_difference_update
set1_temp = set1.copy()
set1_temp.symmetric_difference_update(set2)
print("After symmetric_difference_update:", set1_temp)
# difference_update
set1_temp = set1.copy()
set1_temp.difference_update(set2)
print("After difference_update:", set1_temp)
# discard
set1.discard(3)
print("After discard(3):", set1)
# remove (raises error if not present)
set1.remove(2)
print("After remove(2):", set1)
# pop (removes arbitrary element)
popped = set1.pop()
print("After pop():", set1, "| Popped:", popped)
# issubset
print("Is subset:", {4, 5}.issubset(set2))
# issuperset
print("Is superset:", set2.issuperset({4, 5}))
# isdisjoint
print("Is disjoint (set1 & set2):", set1.isdisjoint(set2))
# clear
set1.clear()
print("After clear():", set1)
```

solution:-



```
PS C:\Users\HP> & "C:/Program Files/Python313/python.exe" c:/Users/HP/Downloads/k18.py

=== SET OPERATIONS ===
Set1: {1, 2, 3, 4, 5}
Set2: {4, 5, 6, 7, 8}
After add(6): {1, 2, 3, 4, 5, 6}
Union: {1, 2, 3, 4, 5, 6, 7, 8}
Intersection: {4, 5, 6}
Difference (set1 - set2): {1, 2, 3}
Symmetric Difference: {1, 2, 3, 7, 8}
After intersection_update: {4, 5, 6}
After symmetric_difference_update: {1, 2, 3, 7, 8}
After difference_update: {1, 2, 3}
After discard(3): {1, 2, 4, 5, 6}
After remove(2): {1, 4, 5, 6}
After pop(): {4, 5, 6} | Popped: 1
Is subset: True
Is superset: True
Is disjoint (set1 & set2): False
After clear(): set()
PS C:\Users\HP>
```

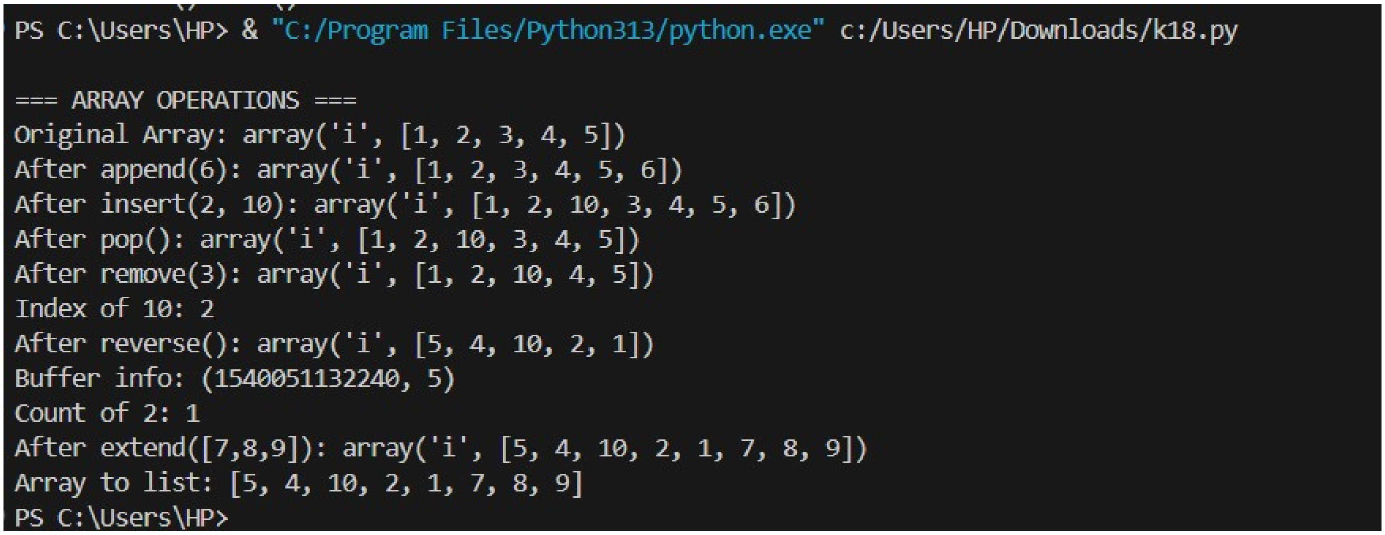
Aim:-3) Import array module in python and perform all operations available in the module.

Code:-

```
# --- ARRAY OPERATIONS ---
print("\n=== ARRAY OPERATIONS ===")
import array
# Creating an array of integers
arr = array.array('i', [1, 2, 3, 4, 5])
print("Original Array:", arr)
# Append
arr.append(6)
print("After append(6):", arr)
# Insert
arr.insert(2,  10)
print("After insert(2, 10):", arr)
# Pop
arr.pop()
print("After pop():", arr)
# Remove
arr.remove(3)
print("After remove(3):", arr)
# Index
```

```
print("Index of 10:", arr.index(10))
# Reverse
arr.reverse()
print("After reverse():", arr)
# Buffer info
print("Buffer info:", arr.buffer_info())
# Count
print("Count of 2:", arr.count(2))
# Extend
arr.extend([7, 8, 9])
print("After extend([7,8,9]):", arr)
# Convert to list
print("Array to list:", arr.tolist())
```

Solution:-



```
PS C:\Users\HP> & "C:/Program Files/Python313/python.exe" c:/Users/HP/Downloads/k18.py

=== ARRAY OPERATIONS ===
Original Array: array('i', [1, 2, 3, 4, 5])
After append(6): array('i', [1, 2, 3, 4, 5, 6])
After insert(2, 10): array('i', [1, 2, 10, 3, 4, 5, 6])
After pop(): array('i', [1, 2, 10, 3, 4, 5])
After remove(3): array('i', [1, 2, 10, 4, 5])
Index of 10: 2
After reverse(): array('i', [5, 4, 10, 2, 1])
Buffer info: (1540051132240, 5)
Count of 2: 1
After extend([7,8,9]): array('i', [5, 4, 10, 2, 1, 7, 8, 9])
Array to list: [5, 4, 10, 2, 1, 7, 8, 9]
PS C:\Users\HP>
```

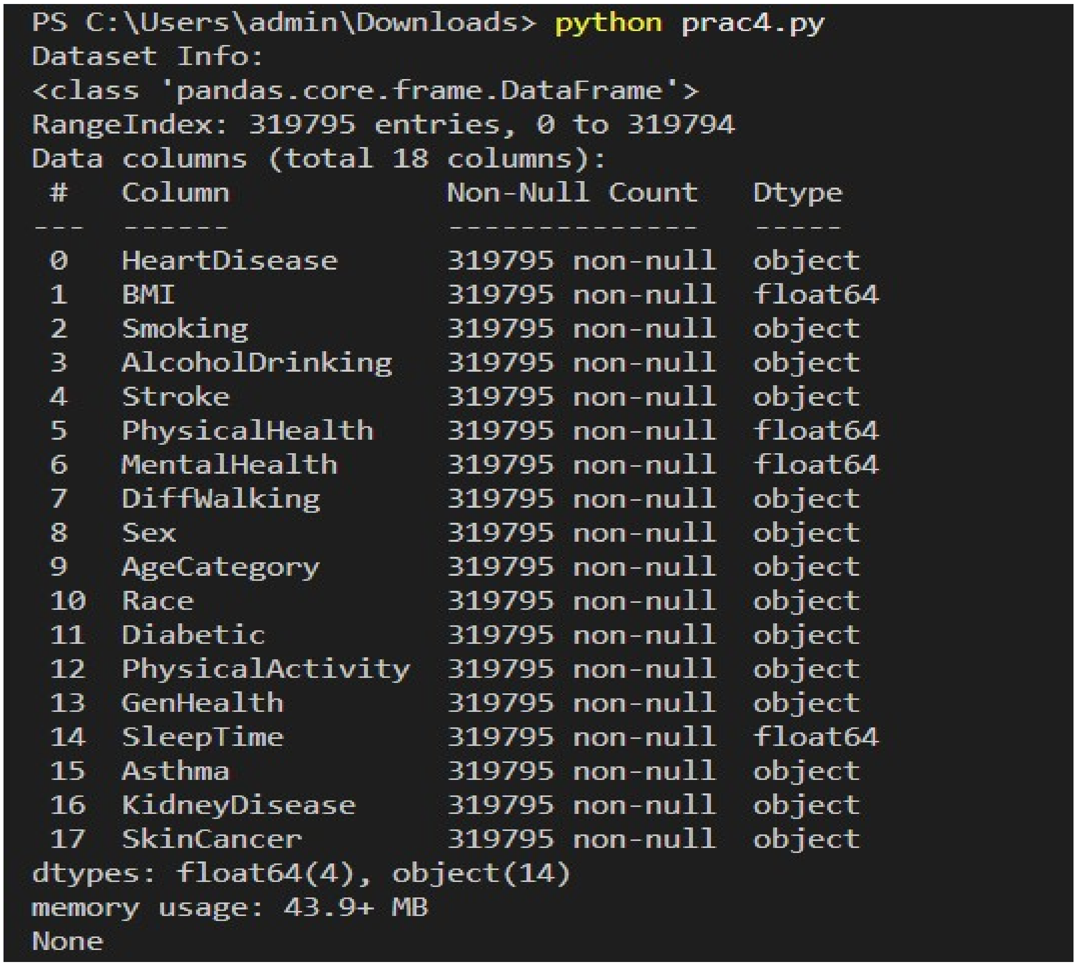
Practical-4

Aim:-Download “heart_2020_cleaned.csv” dataset from “https://www.kaggle.com/datasets/kamilpytlak/personal-key-indicators-of-heart-disease “ and perform all the descriptive statistics on above dataset using statistics module of python and scipy.stats package (Measures of central tendency, measure of dispersion/variation, measure of location, measure of shape and symmetry).

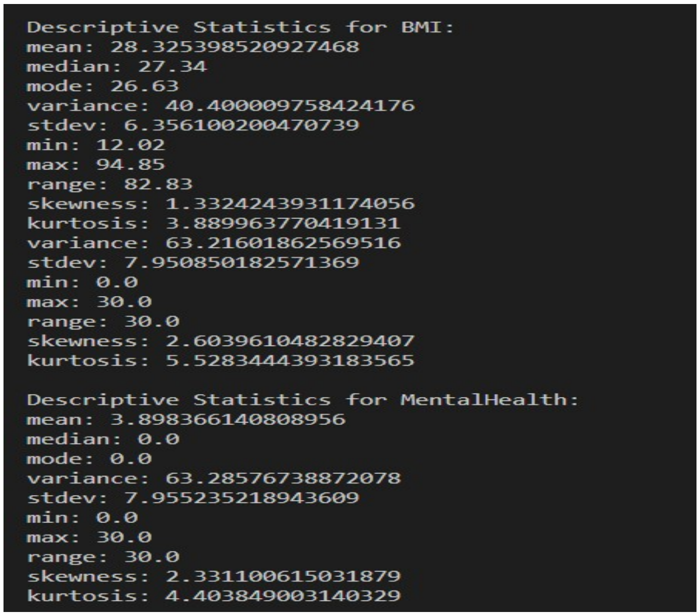
Code:-

```
import pandas as pd
import statistics
import scipy.stats as stats
# Load the dataset
heart_data = pd.read_csv('C:/Users/YourUsername/Documents/heart_2020_cleaned.csv')
# Display basic info about the dataset
print("Dataset Info:")
print(heart_data.info())
# List of numerical columns
numerical_columns = heart_data.select_dtypes(include='number').columns
# Measures of central tendency, dispersion, location, and shape/symmetry
descriptive_stats = {}
for col in numerical_columns:
    data = heart_data[col].dropna()
    descriptive_stats[col] = {
        'mean': statistics.mean(data),
        'median': statistics.median(data),
        'mode': statistics.mode(data),
        'variance': statistics.variance(data),
        'stdev': statistics.stdev(data),
        'min': min(data),
        'max': max(data),
        'range': max(data) - min(data),
        'skewness': stats.skew(data),
        'kurtosis': stats.kurtosis(data)
    }
# Display the descriptive statistics
for col, stats in descriptive_stats.items():
    print(f"\nDescriptive Statistics for {col}:")
    for stat, value in stats.items():
        print(f"{stat}:  {value}")
```

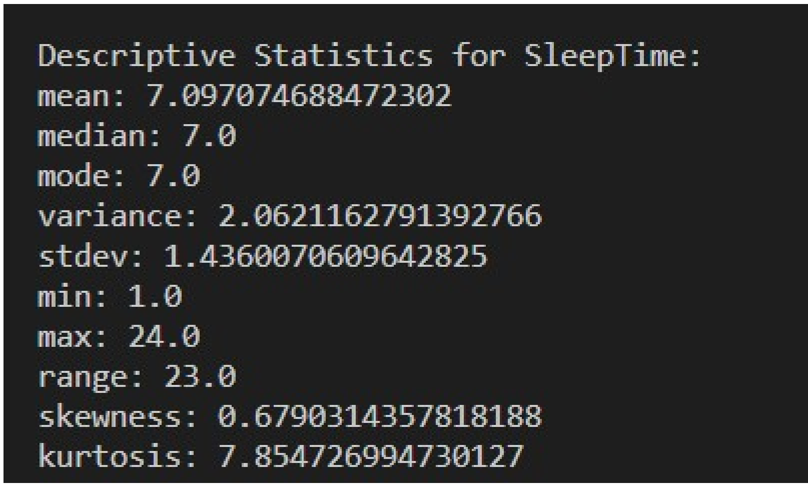
Solution:-



```
PS C:\Users\admin\Downloads> python prac4.py
Dataset Info:
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 319795 entries, 0 to 319794
Data columns (total 18 columns):
 #   Column            Non-Null Count   Dtype
---  ------            --------------   -----
 0   HeartDisease      319795 non-null  object
 1   BMI               319795 non-null  float64
 2   Smoking           319795 non-null  object
 3   AlcoholDrinking   319795 non-null  object
 4   Stroke            319795 non-null  object
 5   PhysicalHealth    319795 non-null  float64
 6   MentalHealth      319795 non-null  float64
 7   DiffWalking       319795 non-null  object
 8   Sex               319795 non-null  object
 9   AgeCategory       319795 non-null  object
 10  Race              319795 non-null  object
 11  Diabetic          319795 non-null  object
 12  PhysicalActivity  319795 non-null  object
 13  GenHealth         319795 non-null  object
 14  SleepTime         319795 non-null  float64
 15  Asthma            319795 non-null  object
 16  KidneyDisease     319795 non-null  object
 17  SkinCancer        319795 non-null  object
dtypes: float64(4), object(14)
memory usage: 43.9+ MB
None
```



```
Descriptive Statistics for BMI:
mean: 28.325398520927468
median: 27.34
mode: 26.63
variance: 40.400009758424176
stdev: 6.356100200470739
min: 12.02
max: 94.85
range: 82.83
skewness: 1.3324243931174056
kurtosis: 3.889963770419131
variance: 63.21601862569516
stdev: 7.950850182571369
min: 0.0
max: 30.0
range: 30.0
skewness: 2.6039610482829407
kurtosis: 5.5283444393183565

Descriptive Statistics for MentalHealth:
mean: 3.898366140808956
median: 0.0
mode: 0.0
variance: 63.28576738872078
stdev: 7.955235218943609
min: 0.0
max: 30.0
range: 30.0
skewness: 2.331100615031879
kurtosis: 4.403849003140329
```



```
Descriptive Statistics for SleepTime:
mean: 7.097074688472302
median: 7.0
mode: 7.0
variance: 2.0621162791392766
stdev: 1.4360070609642825
min: 1.0
max: 24.0
range: 23.0
skewness: 0.6790314357818188
kurtosis: 7.854726994730127
```

Practical-5

Aim:-1) Write following program on Pandas DataFrame:

- Create an array “rank” with 5 element(rank1,rank2,…,rank5). Create and display a DataFrame “exam” from a specified dictionary “exam_data_array” with “rank” as label. Also display a summary of basic information and its data. Perform following operations on DataFrame “exam” :
- Select the rows where the score is between 15 and 20 (inclusive).
- Sort the data first by “score” in ascending order , then by “name” in descending order.
- Replace the 'yes' and 'no' values from column “qualify” with True and False.
- Display specified columns(columns: 2 and 4) and rows(row: 1,3 and 5).
- Select the rows where number of attempts in the examination is less than 2 and score greater than 15.
- Change the name 'James' to 'Suresh' in “name” column of the data frame.
- Calculate the sum of the examination attempts by the students
- Append one row.
- Insert a new column “exam_name” and then Delete the ”exam_name” column.
- Convert a NumPy array, dictionary and first column of a DataFrame to a series.

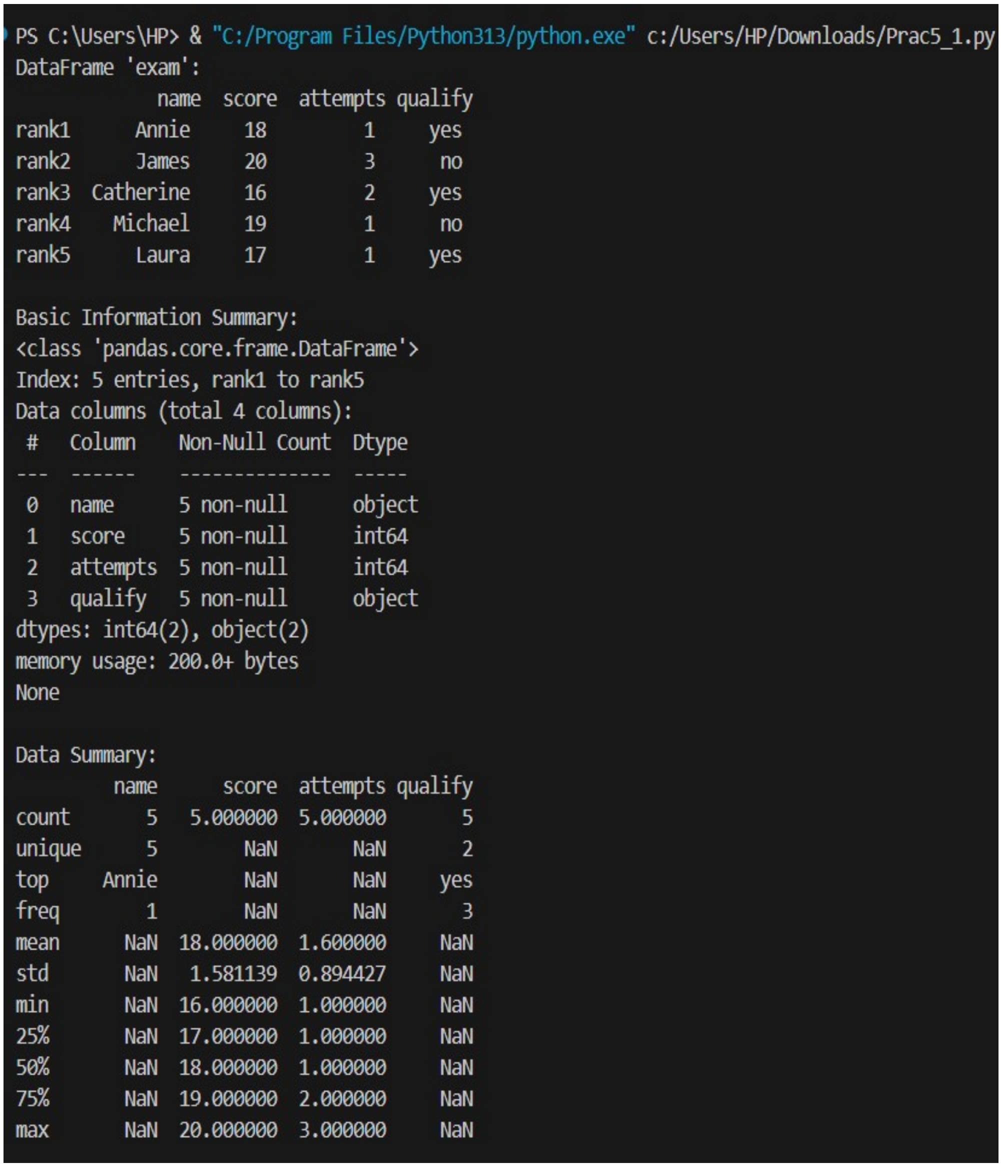
Code:-

```
import pandas as pd
import numpy as np
# Step 1: Create an array “rank” with 5 elements
rank = ['rank1', 'rank2', 'rank3', 'rank4', 'rank5']
# Step 2: Create and display a DataFrame “exam” from a specified dictionary “exam_data_array” with “rank” as label
exam_data_array = {
  'name': ['Annie', 'James', 'Catherine', 'Michael', 'Laura'],
  'score': [18, 20, 16, 19, 17],
  'attempts': [1, 3, 2, 1, 1],
  'qualify': ['yes', 'no', 'yes', 'no', 'yes']
}
exam = pd.DataFrame(exam_data_array, index=rank)
# Display the DataFrame
print("DataFrame 'exam':\n", exam)
# Display a summary of basic information and its data
print("\nBasic Information Summary:")
print(exam.info())
print("\nData Summary:")
print(exam.describe(include='all'))
```

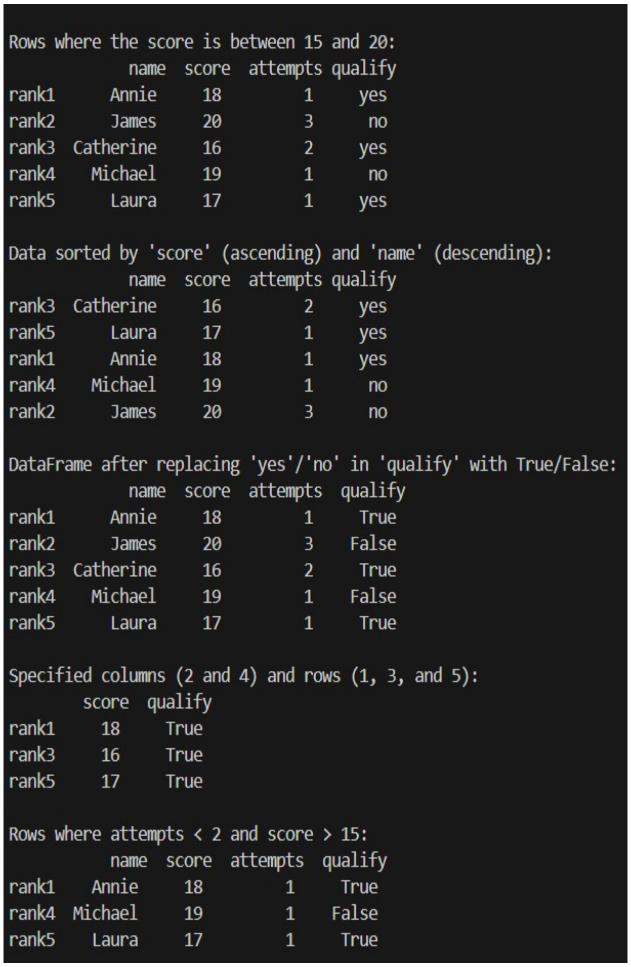
```
# Step 3: Select the rows where the score is between 15 and 20 (inclusive)
filtered_exam = exam[(exam['score'] >= 15) & (exam['score'] <= 20)]
print("\nRows where the score is between 15 and 20:\n", filtered_exam)
# Step 4: Sort the data first by “score” in ascending order, then by “name” in descending order
sorted_exam = exam.sort_values(by=['score', 'name'], ascending=[True, False])
print("\nData sorted by 'score' (ascending) and 'name' (descending):\n", sorted_exam)
# Step 5: Replace the 'yes' and 'no' values from the "qualify" column with True and False
exam['qualify'] = exam['qualify'].map({'yes': True, 'no': False})
print("\nDataFrame after replacing 'yes'/'no' in 'qualify' with True/False:\n", exam)
# Step 6: Display specified columns (columns: 2 and 4) and rows (row: 1, 3, and 5)
selected_data = exam.iloc[[0, 2, 4], [1, 3]]
print("\nSpecified columns (2 and 4) and rows (1, 3, and 5):\n", selected_data)
# Step 7: Select the rows where number of attempts in the examination is less than 2 and score greater than 15
filtered_attempts = exam[(exam['attempts'] < 2) & (exam['score'] > 15)]
print("\nRows where attempts < 2 and score >15:\n", filtered_attempts)
# Step 8: Change the name 'James' to 'Suresh' in the “name” column of the DataFrame
exam.loc[exam['name'] == 'James', 'name'] = 'Suresh'
print("\nDataFrame after changing 'James' to 'Suresh':\n", exam)
# Step 9: Calculate the sum of the examination attempts by the students
total_attempts = exam['attempts'].sum()
print("\nSum of examination attempts by the students:", total_attempts)
# Step 10: Append one row to the DataFrame
new_row = pd.DataFrame({'name': ['Kevin'], 'score': [15], 'attempts': [1], 'qualify': [True]}, index=['rank6'])
exam = exam.append(new_row)
print("\nDataFrame after appending one row:\n", exam)
# Step 11: Insert a new column “exam_name” and then delete the ”exam_name” column
exam['exam_name'] = 'Final Exam'
print("\nDataFrame after inserting 'exam_name' column:\n", exam)
exam.drop('exam_name', axis=1, inplace=True)
print("\nDataFrame after deleting 'exam_name' column:\n", exam)
# Step 12: Convert a NumPy array, dictionary, and first column of a DataFrame to a series
# Converting a NumPy array to a series
numpy_array = np.array([1, 2, 3, 4, 5])
numpy_series = pd.Series(numpy_array)
print("\nNumPy array converted to Series:\n", numpy_series)
```

```
    # Converting a dictionary to a series
    dictionary = {'a': 10, 'b': 20, 'c': 30}
    dictionary_series = pd.Series(dictionary)
    print("\nDictionary converted to Series:\n", dictionary_series)
# Converting the first column of the DataFrame to a series
    name_series = exam['name']
print("\nFirst column ('name') of DataFrame converted to Series:\n", name_series)
```

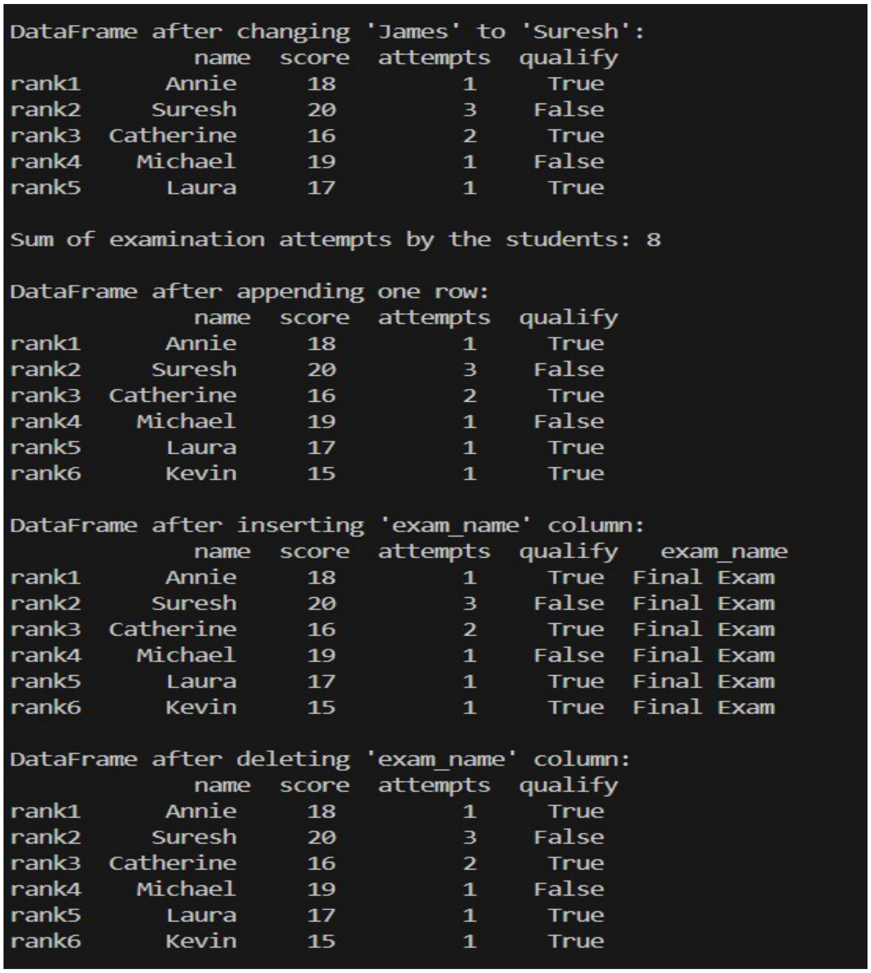
Solution:-



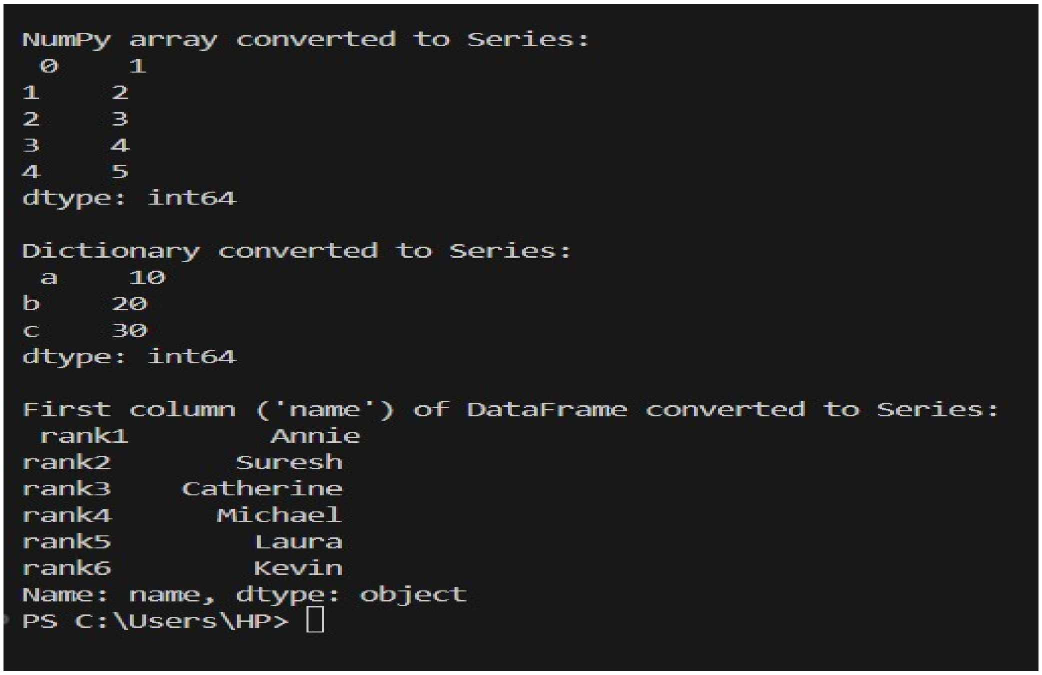
```
PS C:\Users\HP> & "C:/Program Files/Python313/python.exe" c:/Users/HP/Downloads/Prac5_1.py
DataFrame 'exam':
             name  score  attempts qualify
rank1       Annie     18         1     yes
rank2       James     20         3      no
rank3   Catherine     16         2     yes
rank4     Michael     19         1      no
rank5       Laura     17         1     yes

Basic Information Summary:
<class 'pandas.core.frame.DataFrame'>
Index: 5 entries, rank1 to rank5
Data columns (total 4 columns):
 #   Column    Non-Null Count  Dtype
---  ------    --------------  -----
 0   name      5 non-null      object
 1   score     5 non-null      int64
 2   attempts  5 non-null      int64
 3   qualify   5 non-null      object
dtypes: int64(2), object(2)
memory usage: 200.0+ bytes
None

Data Summary:
         name      score  attempts qualify
count       5   5.000000  5.000000       5
unique      5        NaN       NaN       2
top     Annie        NaN       NaN     yes
freq        1        NaN       NaN       3
mean      NaN  18.000000  1.600000     NaN
std       NaN   1.581139  0.894427     NaN
min       NaN  16.000000  1.000000     NaN
25%       NaN  17.000000  1.000000     NaN
50%       NaN  18.000000  1.000000     NaN
75%       NaN  19.000000  2.000000     NaN
max       NaN  20.000000  3.000000     NaN
```



```
Rows where the score is between 15 and 20:
            name  score  attempts qualify
rank1      Annie     18         1     yes
rank2      James     20         3      no
rank3  Catherine     16         2     yes
rank4    Michael     19         1      no
rank5      Laura     17         1     yes

Data sorted by 'score' (ascending) and 'name' (descending):
            name  score  attempts qualify
rank3  Catherine     16         2     yes
rank5      Laura     17         1     yes
rank1      Annie     18         1     yes
rank4    Michael     19         1      no
rank2      James     20         3      no

DataFrame after replacing 'yes'/'no' in 'qualify' with True/False:
            name  score  attempts  qualify
rank1      Annie     18         1     True
rank2      James     20         3    False
rank3  Catherine     16         2     True
rank4    Michael     19         1    False
rank5      Laura     17         1     True

Specified columns (2 and 4) and rows (1, 3, and 5):
       score  qualify
rank1     18     True
rank3     16     True
rank5     17     True

Rows where attempts < 2 and score > 15:
          name  score  attempts  qualify
rank1    Annie     18         1     True
rank4  Michael     19         1    False
rank5    Laura     17         1     True
```



```
DataFrame after changing 'James' to 'Suresh':
            name  score  attempts  qualify
rank1      Annie     18         1     True
rank2     Suresh     20         3    False
rank3  Catherine     16         2     True
rank4    Michael     19         1    False
rank5      Laura     17         1     True

Sum of examination attempts by the students: 8

DataFrame after appending one row:
            name  score  attempts  qualify
rank1      Annie     18         1     True
rank2     Suresh     20         3    False
rank3  Catherine     16         2     True
rank4    Michael     19         1    False
rank5      Laura     17         1     True
rank6      Kevin     15         1     True

DataFrame after inserting 'exam_name' column:
            name  score  attempts  qualify   exam_name
rank1      Annie     18         1     True  Final Exam
rank2     Suresh     20         3    False  Final Exam
rank3  Catherine     16         2     True  Final Exam
rank4    Michael     19         1    False  Final Exam
rank5      Laura     17         1     True  Final Exam
rank6      Kevin     15         1     True  Final Exam

DataFrame after deleting 'exam_name' column:
            name  score  attempts  qualify
rank1      Annie     18         1     True
rank2     Suresh     20         3    False
rank3  Catherine     16         2     True
rank4    Michael     19         1    False
rank5      Laura     17         1     True
rank6      Kevin     15         1     True
```



```
NumPy array converted to Series:
 0    1
1    2
2    3
3    4
4    5
dtype: int64

Dictionary converted to Series:
 a    10
b    20
c    30
dtype: int64

First column ('name') of DataFrame converted to Series:
 rank1        Annie
rank2       Suresh
rank3    Catherine
rank4      Michael
rank5        Laura
rank6        Kevin
Name: name, dtype: object
PS C:\Users\HP> 
```

Aim:-2) Write following program on NumPy Array:

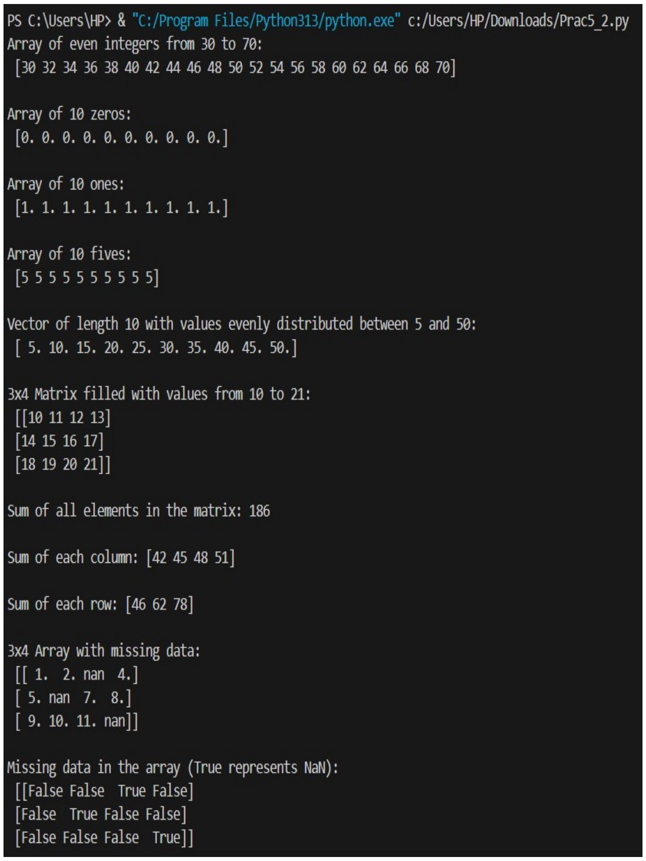
- Create an array of all the even integers from 30 to 70.
- Create an array of 10 zeros, other with 10 ones, and one more with10 fives.
- Create a vector of length 10 with values evenly distributed between 5 and 50.
- Create a 3x4 matrix filled with values from 10 to 21 and compute sum of all elements, sum of each column and sum of each row of a given array.
- Create a 3x4 array and find the missing data in the array.
- Calculate round, floor, ceiling, truncated and round (to the given number of decimals) of the input, element-wise of an array.
- Find the maximum and minimum value, median , Weighted average, mean, standard deviation, variance, covariance matrix, of a given flattened array, minimum and maximum value along the second axis. Create a structured array from given student name, height, class and their data types. Now sort by class, then height if class are equal.

Code:-

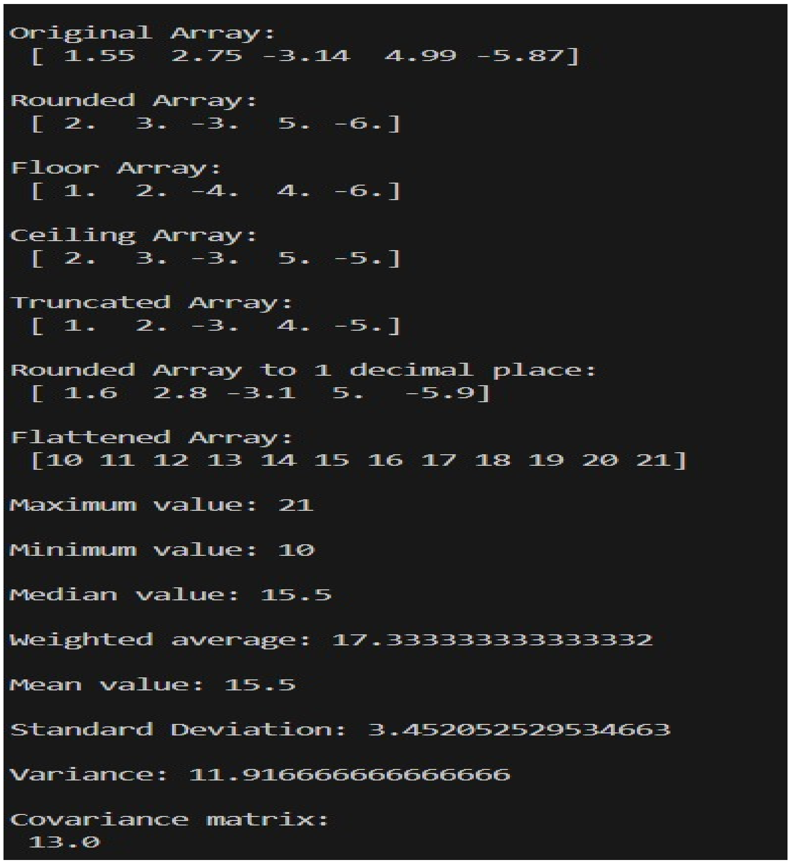
```
import numpy as np
# Step 1: Create an array of all the even integers from 30 to 70
even_integers = np.arange(30, 71, 2)
print("Array of even integers from 30 to 70:\n", even_integers)
# Step 2: Create an array of 10 zeros, another with 10 ones, and one more with 10 fives
zeros_array = np.zeros(10)
ones_array = np.ones(10)
fives_array = np.full(10, 5)
print("\nArray of 10 zeros:\n", zeros_array)
print("\nArray of 10 ones:\n", ones_array)
print("\nArray of 10 fives:\n", fives_array)
# Step 3: Create a vector of length 10 with values evenly distributed between 5 and 50
evenly_distributed = np.linspace(5, 50, 10)
print("\nVector of length 10 with values evenly distributed between 5 and 50:\n", evenly_distributed)
# Step 4: Create a 3x4 matrix filled with values from 10 to 21 and compute sums
matrix_3x4 = np.arange(10, 22).reshape(3, 4)
sum_all_elements = np.sum(matrix_3x4)
sum_each_column = np.sum(matrix_3x4, axis=0)
sum_each_row = np.sum(matrix_3x4, axis=1)
print("\n3x4 Matrix filled with values from 10 to 21:\n", matrix_3x4)
print("\nSum of all elements in the matrix:", sum_all_elements)
print("\nSum of each column:", sum_each_column)
print("\nSum of each row:", sum_each_row)
# Step 5: Create a 3x4 array and find the missing data in the array
array_with_nan = np.array([[1, 2, np.nan, 4], [5, np.nan, 7, 8], [9, 10, 11, np.nan]])
missing_data = np.isnan(array_with_nan)
```

```
print("\n3x4 Array with missing data:\n", array_with_nan)
print("\nMissing data in the array (True represents NaN):\n", missing_data)
# Step 6: Calculate round, floor, ceiling, truncated and round (to the given number of decimals) element-wise of an array
input_array = np.array([1.55, 2.75, -3.14, 4.99, -5.87])
rounded_array = np.round(input_array)
floor_array = np.floor(input_array)
ceiling_array = np.ceil(input_array)
truncated_array = np.trunc(input_array)
rounded_to_decimals = np.round(input_array, 1)
print("\nOriginal Array:\n", input_array)
print("\nRounded Array:\n", rounded_array)
print("\nFloor Array:\n", floor_array)
print("\nCeiling Array:\n", ceiling_array)
print("\nTruncated Array:\n", truncated_array)
print("\nRounded Array to 1 decimal place:\n", rounded_to_decimals)
# Step 7: Statistical calculations on a given flattened array
flattened_array = matrix_3x4.flatten()
max_value = np.max(flattened_array)
min_value = np.min(flattened_array)
median_value = np.median(flattened_array)
weighted_avg = np.average(flattened_array, weights=np.arange(1, len(flattened_array) + 1))
mean_value = np.mean(flattened_array)
std_deviation = np.std(flattened_array)
variance_value = np.var(flattened_array)
covariance_matrix = np.cov(flattened_array)
min_second_axis = np.min(matrix_3x4, axis=1)
max_second_axis = np.max(matrix_3x4, axis=1)
print("\nFlattened Array:\n", flattened_array)
print("\nMaximum value:", max_value)
print("\nMinimum value:", min_value)
print("\nMedian value:", median_value)
print("\nWeighted average:", weighted_avg)
print("\nMean value:", mean_value)
print("\nStandard Deviation:", std_deviation)
print("\nVariance:", variance_value)
print("\nCovariance matrix:\n", covariance_matrix)
print("\nMinimum value along the second axis:", min_second_axis)
print("\nMaximum value along the second axis:", max_second_axis)
# Step 8: Create a structured array from given student name, height, class, and their data types
student_data = np.array([('John', 5.9, 10), ('Alice', 5.5, 12), ('Bob', 6.1, 10), ('Mary', 5.7, 11)],
                dtype=[('name', 'U10'), ('height', 'f4'), ('class', 'i4')])
# Sort by class, then height if class are equal
sorted_students = np.sort(student_data, order=['class', 'height'])
print("\nStructured Array sorted by 'class' and then 'height':\n", sorted_students)
```

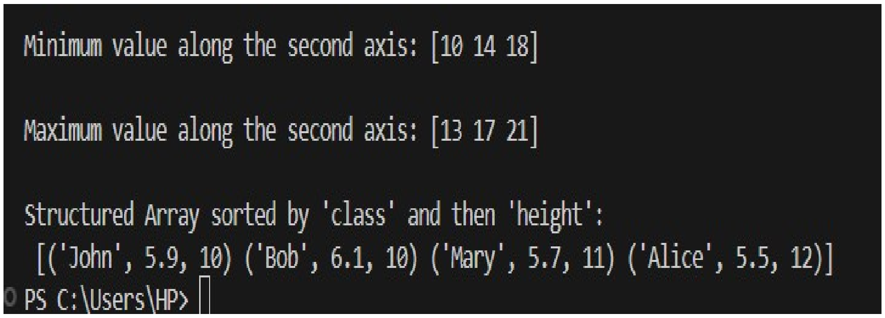
Solution:-



```
PS C:\Users\HP> & "C:/Program Files/Python313/python.exe" c:/Users/HP/Downloads/Prac5_2.py
Array of even integers from 30 to 70:
 [30 32 34 36 38 40 42 44 46 48 50 52 54 56 58 60 62 64 66 68 70]

Array of 10 zeros:
 [0. 0. 0. 0. 0. 0. 0. 0. 0. 0.]

Array of 10 ones:
 [1. 1. 1. 1. 1. 1. 1. 1. 1. 1.]

Array of 10 fives:
 [5 5 5 5 5 5 5 5 5 5]

Vector of length 10 with values evenly distributed between 5 and 50:
 [ 5. 10. 15. 20. 25. 30. 35. 40. 45. 50.]

3x4 Matrix filled with values from 10 to 21:
 [[10 11 12 13]
 [14 15 16 17]
 [18 19 20 21]]

Sum of all elements in the matrix: 186

Sum of each column: [42 45 48 51]

Sum of each row: [46 62 78]

3x4 Array with missing data:
 [[ 1.  2. nan  4.]
 [ 5. nan  7.  8.]
 [ 9. 10. 11. nan]]

Missing data in the array (True represents NaN):
 [[False False  True False]
 [False  True False False]
 [False False False  True]]
```



```
Original Array:
 [ 1.55  2.75 -3.14  4.99 -5.87]

Rounded Array:
 [ 2.  3. -3.  5. -6.]

Floor Array:
 [ 1.  2. -4.  4. -6.]

Ceiling Array:
 [ 2.  3. -3.  5. -5.]

Truncated Array:
 [ 1.  2. -3.  4. -5.]

Rounded Array to 1 decimal place:
 [ 1.6  2.8 -3.1  5.  -5.9]

Flattened Array:
 [10 11 12 13 14 15 16 17 18 19 20 21]

Maximum value: 21

Minimum value: 10

Median value: 15.5

Weighted average: 17.333333333333332

Mean value: 15.5

Standard Deviation: 3.452052529534663

Variance: 11.916666666666666

Covariance matrix:
 13.0
```



```
Minimum value along the second axis: [10 14 18]

Maximum value along the second axis: [13 17 21]

Structured Array sorted by 'class' and then 'height':
 [('John', 5.9, 10) ('Bob', 6.1, 10) ('Mary', 5.7, 11) ('Alice', 5.5, 12)]
PS C:\Users\HP> 
```

Practical-6

Aim:-1) Write following python programs on Beautiful Soup Perform following operations on a HTML document.

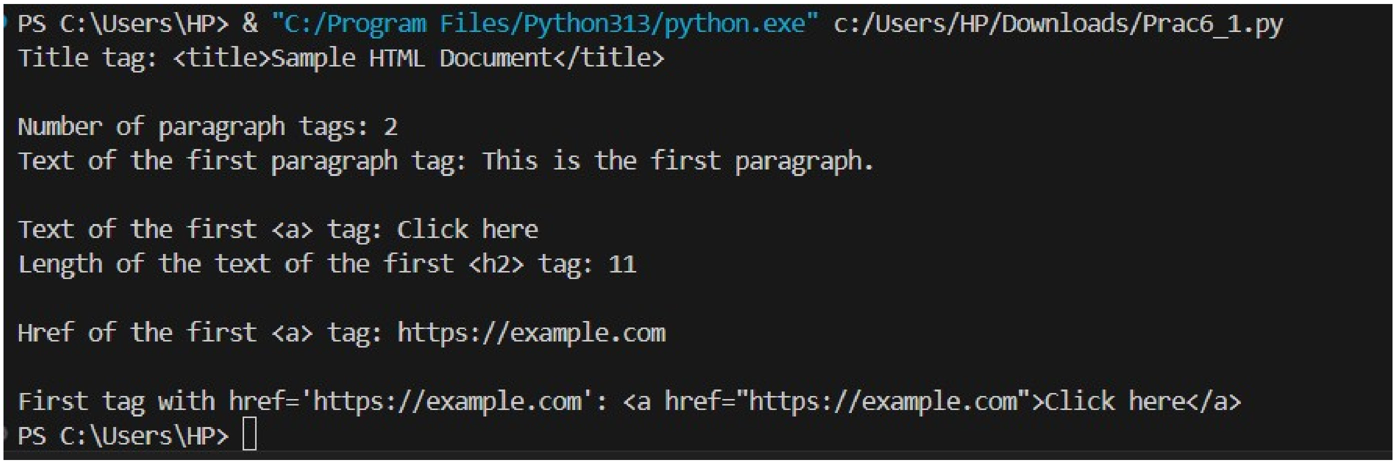
- Find the title tag from a given html document.
- Count and retrieve all the paragraph tags and extract the text in the first paragraph tag.
- Find the text of the first tag and length of the text of the first tag.
- Find the href of the first tag.
- Find the first tag with a given attribute value in an html document.

Code:-

```
from bs4 import BeautifulSoup
# Example HTML document
html_doc = """
<!DOCTYPE html>
<html>
<head>
  <title>Sample HTML Document</title>
</head>
<body>
  <h1>Main Heading</h1>
  <p>This is the first paragraph.</p>
  <p>This is the second paragraph.</p>
  <a href="https://example.com">Click here</a>
  <h2>Sub Heading</h2>
</body>
</html>
"""
# Parse the HTML document with BeautifulSoup
soup = BeautifulSoup(html_doc, 'html.parser')
# 1. Find the title tag from a given HTML document
title_tag = soup.title
print("Title tag:", title_tag)
# 2. Count and retrieve all the paragraph tags and extract the text in the first paragraph tag
paragraph_tags = soup.find_all('p')
print("\nNumber of paragraph tags:", len(paragraph_tags))
print("Text of the first paragraph tag:", paragraph_tags[0].get_text())
```

```
# 3. Find the text of the first <a> tag and length of the text of the first <h2> tag
first_a_tag_text = soup.find('a').get_text()
first_h2_tag_text = soup.find('h2').get_text()
print("\nText of the first <a> tag:", first_a_tag_text)
print("Length of the text of the first <h2> tag:", len(first_h2_tag_text))
# 4. Find the href of the first <a> tag
first_a_tag_href = soup.find('a')['href']
print("\nHref of the first <a> tag:", first_a_tag_href)
# 5. Find the first tag with a given attribute value in an HTML document
# Example: Find the first tag with href="https://example.com"
first_tag_with_attribute = soup.find(attrs={"href": "https://example.com"})
print("\nFirst tag with href='https://example.com':", first_tag_with_attribute)
```

Solution:-



```
PS C:\Users\HP> & "C:/Program Files/Python313/python.exe" c:/Users/HP/Downloads/Prac6_1.py
Title tag: <title>Sample HTML Document</title>

Number of paragraph tags: 2
Text of the first paragraph tag: This is the first paragraph.

Text of the first <a> tag: Click here
Length of the text of the first <h2> tag: 11

Href of the first <a> tag: https://example.com

First tag with href='https://example.com': <a href="https://example.com">Click here</a>
PS C:\Users\HP> 
```

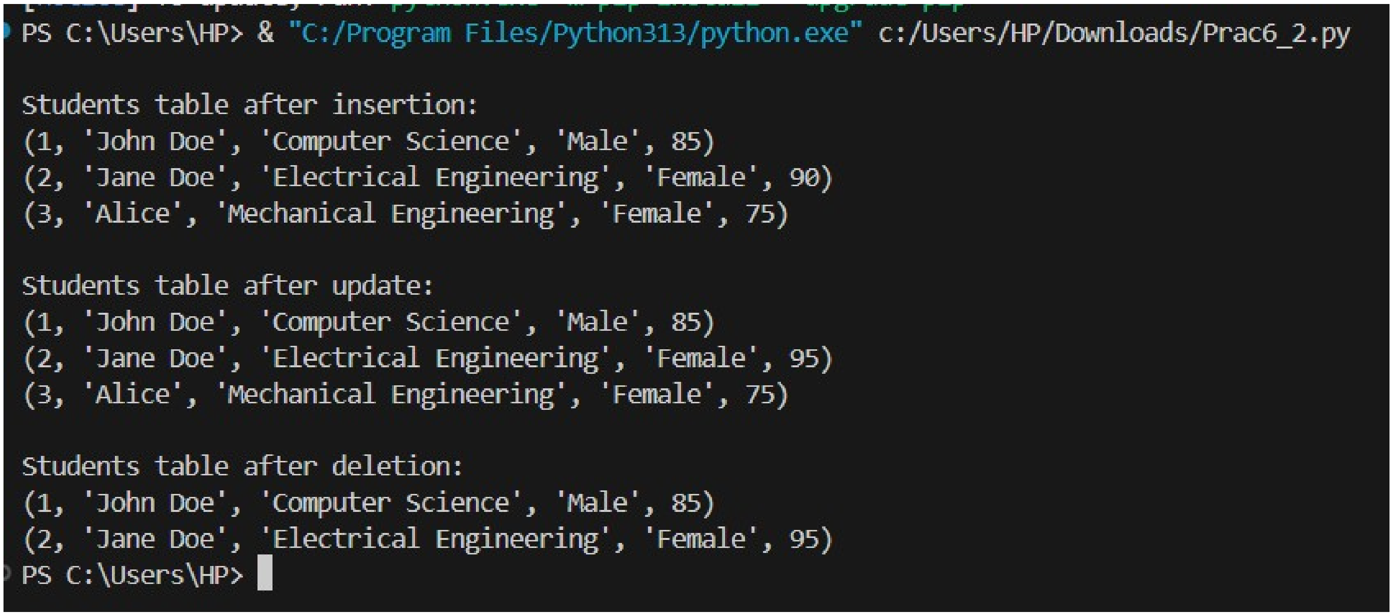
Aim:-2) Write a python program for MySQL Database connectivity(import sqlite3 module) Establish the connection with Education database named “Education” in SQLite , create a table named Student(with id_no, name, department, gander, total_marks) in Education database. Perform insert, update,select and delete operation on Student table.

Code:-

```
import sqlite3
# Step 1: Establish connection with the SQLite database
conn = sqlite3.connect('Education.db')
# Step 2: Create a cursor object to interact with the database
cursor = conn.cursor()
# Step 3: Create a table named "Student" in the "Education" database
cursor.execute('''CREATE TABLE IF NOT EXISTS Student (
                id_no INTEGER PRIMARY KEY,
                name TEXT NOT NULL,
                department TEXT,
                gender TEXT,
                total_marks INTEGER)''')
# Step 4: Insert records into the "Student" table
cursor.execute("INSERT INTO Student (id_no, name, department, gender, total_marks) VALUES (1, 'John
Doe', 'Computer Science', 'Male', 85)")
cursor.execute("INSERT INTO Student (id_no, name, department, gender, total_marks) VALUES (2, 'Jane
Doe', 'Electrical Engineering', 'Female', 90)")
cursor.execute("INSERT INTO Student (id_no, name, department, gender, total_marks) VALUES (3,
'Alice', 'Mechanical Engineering', 'Female', 75)")
conn.commit()
# Step 5: Select and display all records from the "Student" table
cursor.execute("SELECT * FROM Student")
students = cursor.fetchall()
print("\nStudents table after insertion:")
for student in students:
   print(student)
# Step 6: Update a record in the "Student" table
cursor.execute("UPDATE Student SET total_marks = 95 WHERE id_no = 2")
conn.commit()
# Step 7: Select and display the updated records
cursor.execute("SELECT * FROM Student")
updated_students = cursor.fetchall()
print("\nStudents table after update:")
for student in updated_students:
   print(student)
# Step 8: Delete a record from the "Student" table
cursor.execute("DELETE FROM Student WHERE id_no = 3")
conn.commit()
```

```
# Step 9: Select and display the records after deletion
cursor.execute("SELECT * FROM Student")
remaining_students = cursor.fetchall()
print("\nStudents table after deletion:")
for student in remaining_students:
    print(student)
# Step 10: Close the connection to the database
conn.close()
```

Solution:-



```
PS C:\Users\HP> & "C:/Program Files/Python313/python.exe" c:/Users/HP/Downloads/Prac6_2.py

Students table after insertion:
(1, 'John Doe', 'Computer Science', 'Male', 85)
(2, 'Jane Doe', 'Electrical Engineering', 'Female', 90)
(3, 'Alice', 'Mechanical Engineering', 'Female', 75)

Students table after update:
(1, 'John Doe', 'Computer Science', 'Male', 85)
(2, 'Jane Doe', 'Electrical Engineering', 'Female', 95)
(3, 'Alice', 'Mechanical Engineering', 'Female', 75)

Students table after deletion:
(1, 'John Doe', 'Computer Science', 'Male', 85)
(2, 'Jane Doe', 'Electrical Engineering', 'Female', 95)
PS C:\Users\HP>
```

Practical-7

Aim:- Write a python program to download appropriate dataset and explore random variable, Probability mass function, Probability density function, Cumulative distribution function, Discrete probability distribution and continuous probability distribution using scipy.stats , rv_discrete class and rv_continuousclass .

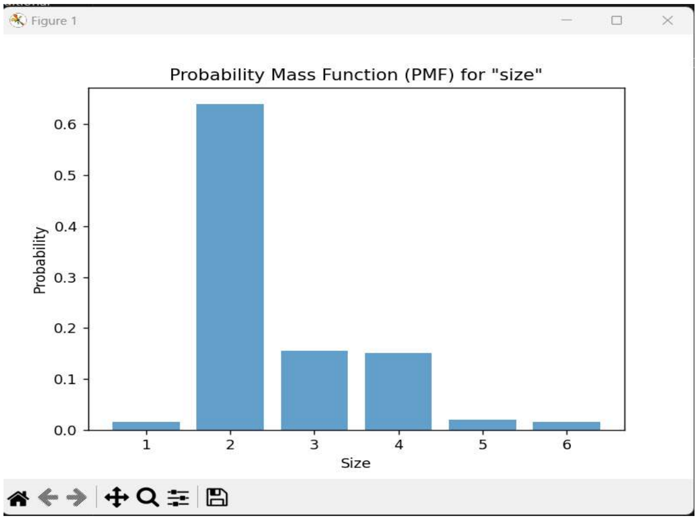
Code:-

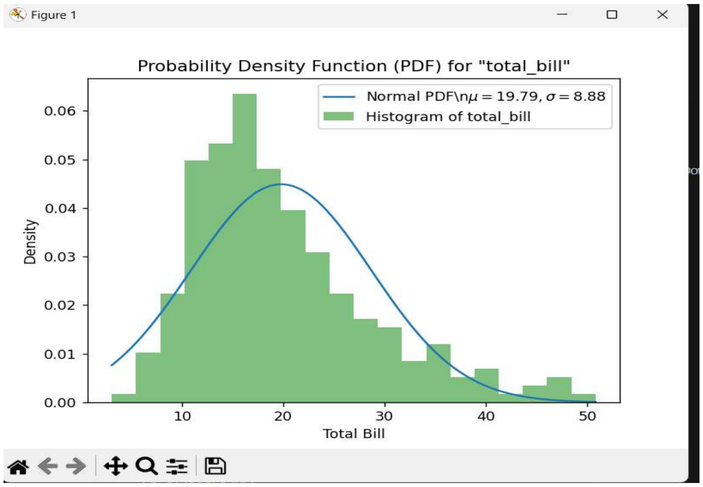
```
#install below lib first
#pip install numpy pandas scipy matplotlib seaborn
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
import seaborn as sns
from scipy import stats
# Step 1: Download a Dataset
# Let's use the "tips" dataset from seaborn, which is a built-in dataset.
data = sns.load_dataset('tips')
# Display the first few rows of the dataset
print("First few rows of the tips dataset:")
print(data.head())
# Step 2: Explore a Random Variable
# We'll explore the "total_bill" as a continuous random variable and "size" as a discrete random variable
total_bill = data['total_bill']
size = data['size']
# Step 3: Explore Probability Mass Function (PMF) for Discrete Distribution (using rv_discrete)
# Create a probability mass function for the 'size' variable
values, counts = np.unique(size, return_counts=True)
pmf = counts / len(size)
rv_discrete = stats.rv_discrete(name='size', values=(values, pmf))
# Plot the PMF
plt.bar(values, pmf, alpha=0.7)
plt.title('Probability Mass Function (PMF) for "size"')
plt.xlabel('Size')
plt.ylabel('Probability')
plt.show()
```

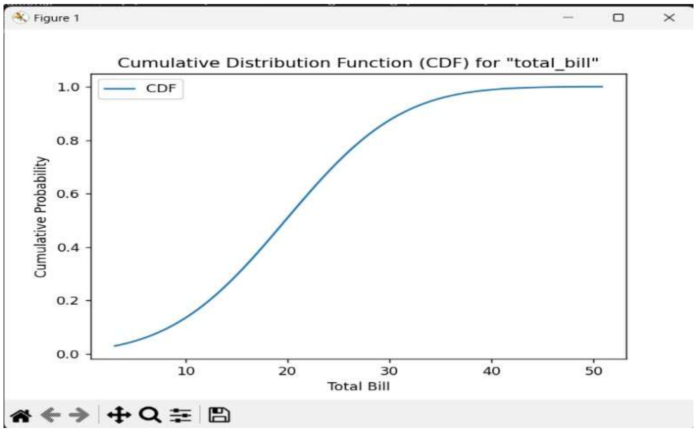
```
# Step 4: Explore Probability Density Function (PDF) for Continuous Distribution (using rv_continuous)
# Fit a normal distribution to the "total_bill" data
mu, std = stats.norm.fit(total_bill)
# Create a PDF using the fitted normal distribution
rv_continuous = stats.norm(loc=mu, scale=std)
# Plot the PDF
x = np.linspace(min(total_bill), max(total_bill), 100)
pdf = rv_continuous.pdf(x)
plt.plot(x, pdf, label=rf'Normal PDF\n$\mu={mu:.2f}, \sigma={std:.2f}$')
plt.hist(total_bill, density=True, bins=20, alpha=0.5, color='g', label='Histogram of total_bill')
plt.title('Probability Density Function (PDF) for "total_bill"')
plt.xlabel('Total Bill')
plt.ylabel('Density')
plt.legend()
plt.show()
# Step 5: Explore Cumulative Distribution Function (CDF) for Continuous Distribution
cdf = rv_continuous.cdf(x)
plt.plot(x, cdf, label='CDF')
plt.title('Cumulative Distribution Function (CDF) for "total_bill"')
plt.xlabel('Total Bill')
plt.ylabel('Cumulative Probability')
plt.legend()
plt.show()
# Step 6: Discrete Probability Distribution
# We have already explored the PMF, which is the discrete probability distribution for "size".
# Step 7: Continuous Probability Distribution
# The PDF of "total_bill" is an example of a continuous probability distribution.
# Additional Exploration: Descriptive Statistics
mean_bill = np.mean(total_bill)
median_bill = np.median(total_bill)
std_bill = np.std(total_bill)
var_bill = np.var(total_bill)
print(f"Mean of total_bill: {mean_bill:.2f}")
print(f"Median of total_bill: {median_bill:.2f}")
print(f"Standard Deviation of total_bill: {std_bill:.2f}")
print(f"Variance of total_bill: {var_bill:.2f}")
```

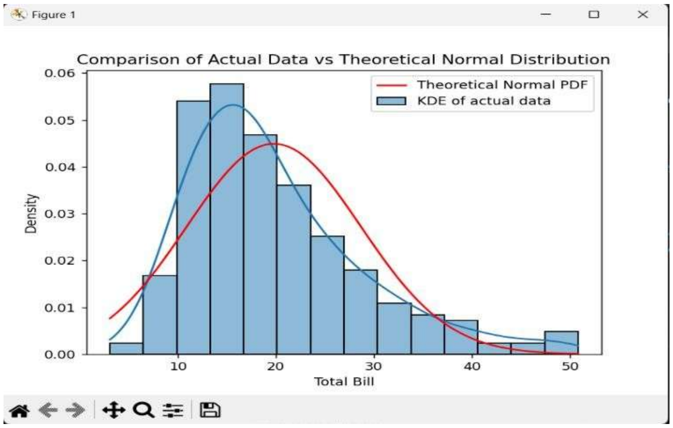
```
# Step 8: Comparison of Actual vs Theoretical Distribution
sns.histplot(total_bill, kde=True, stat="density", label='KDE of actual data')
plt.plot(x, pdf, label='Theoretical Normal PDF', color='red')
plt.title('Comparison of Actual Data vs Theoretical Normal Distribution')
plt.xlabel('Total Bill')
plt.ylabel('Density')
plt.legend()
plt.show()
```

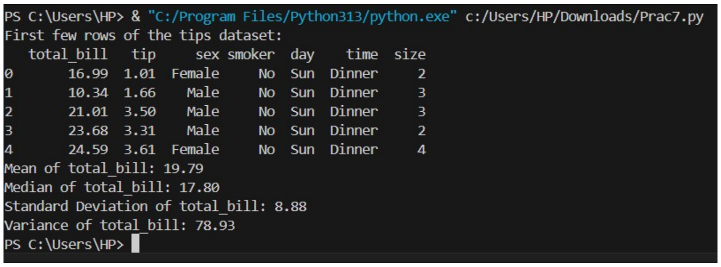
Solution:-











```
PS C:\Users\HP> & "C:/Program Files/Python313/python.exe" c:/Users/HP/Downloads/Prac7.py
First few rows of the tips dataset:
   total_bill   tip     sex smoker  day    time  size
0       16.99  1.01  Female     No  Sun  Dinner     2
1       10.34  1.66    Male     No  Sun  Dinner     3
2       21.01  3.50    Male     No  Sun  Dinner     3
3       23.68  3.31    Male     No  Sun  Dinner     2
4       24.59  3.61  Female     No  Sun  Dinner     4
Mean of total_bill: 19.79
Median of total_bill: 17.80
Standard Deviation of total_bill: 8.88
Variance of total_bill: 78.93
PS C:\Users\HP> 
```

Practical-8

Aim:- Write a python program to compute and explore normal distribution, central limit theorem, point estimate, interval estimation and hypothesis testing.

Code:-

```
#pip install numpy scipy matplotlib seaborn
import numpy as np
import matplotlib.pyplot as plt
import seaborn as sns
from scipy import stats
# Step 1: Explore Normal Distribution
# Generate a normal distribution with a mean of 0 and standard deviation of 1
mu, sigma = 0, 1
data = np.random.normal(mu, sigma, 1000)
# Plot the normal distribution
sns.histplot(data, kde=True, stat="density")
x = np.linspace(mu - 4*sigma, mu + 4*sigma, 100)
pdf = stats.norm.pdf(x, mu, sigma)
plt.plot(x, pdf, label=f'Normal PDF\n$\mu={mu}, \sigma={sigma}$', color='red')
plt.title('Normal Distribution')
plt.xlabel('Value')
plt.ylabel('Density')
plt.legend()
plt.show()
# Step 2: Explore Central Limit Theorem (CLT)
# Generate samples from a uniform distribution
uniform_data = np.random.uniform(0, 1, 1000)
# Draw samples of increasing size and calculate their means
means = []
sample_sizes = [5, 10, 30, 50, 100]
for size in sample_sizes:
  sample_means = [np.mean(np.random.choice(uniform_data, size=size)) for _ in range(1000)]
  means.append(sample_means)
```

```
    # Plot histograms of sample means for different sample sizes
    for i, size in enumerate(sample_sizes):
        sns.histplot(means[i], kde=True, stat="density")
        plt.title(f'Central Limit Theorem - Sample Size {size}')
        plt.xlabel('Sample Mean')
        plt.ylabel('Density')
        plt.show()
    # Step 3: Point Estimation
    # Point estimate for the population mean using sample mean
    sample = np.random.normal(mu, sigma, 50)
    sample_mean = np.mean(sample)
    print(f"Point Estimate (Sample Mean): {sample_mean:.2f}")
    # Step 4: Interval Estimation (Confidence Interval)
    # Calculate the 95% confidence interval for the sample mean
    confidence_level = 0.95
    ci = stats.norm.interval(confidence_level, loc=sample_mean, scale=sigma/np.sqrt(len(sample)))
    print(f"95% Confidence Interval for the Mean: {ci}")
    # Step 5: Hypothesis Testing
    # Perform a one-sample t-test
    # Null hypothesis: The sample mean is equal to 0 (mu = 0)
    t_statistic, p_value = stats.ttest_1samp(sample, popmean=0)
    print(f"t-statistic: {t_statistic:.2f}, p-value: {p_value:.4f}")
    # Determine if we can reject the null hypothesis
    alpha = 0.05
    if p_value < alpha:
        print("Reject the null hypothesis: The sample mean is significantly different from 0.")
    else:
print("Fail to reject the null hypothesis: The sample mean is not significantly different from 0.")
```

Solution:-

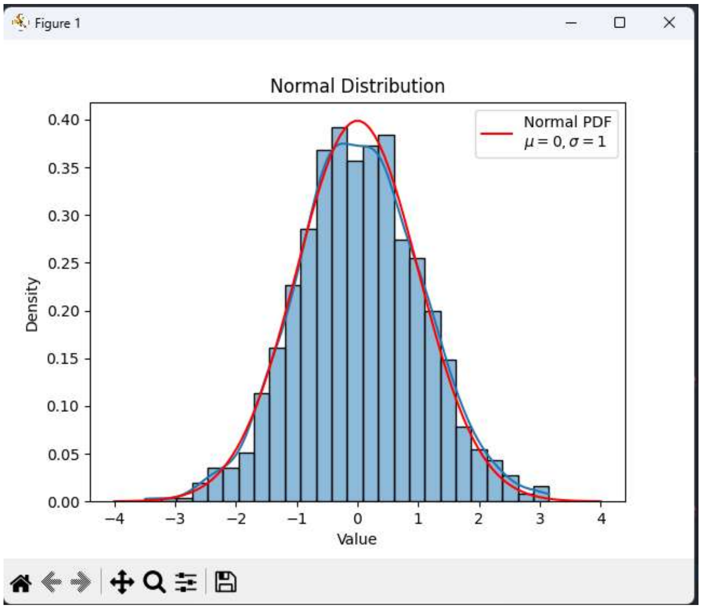


Figure 1
Normal Distribution
Normal PDF
$\mu = 0, \sigma = 1$
Density
0.00
0.05
0.10
0.15
0.20
0.25
0.30
0.35
0.40
Value
−4
−3
−2
−1
0
1
2
3
4

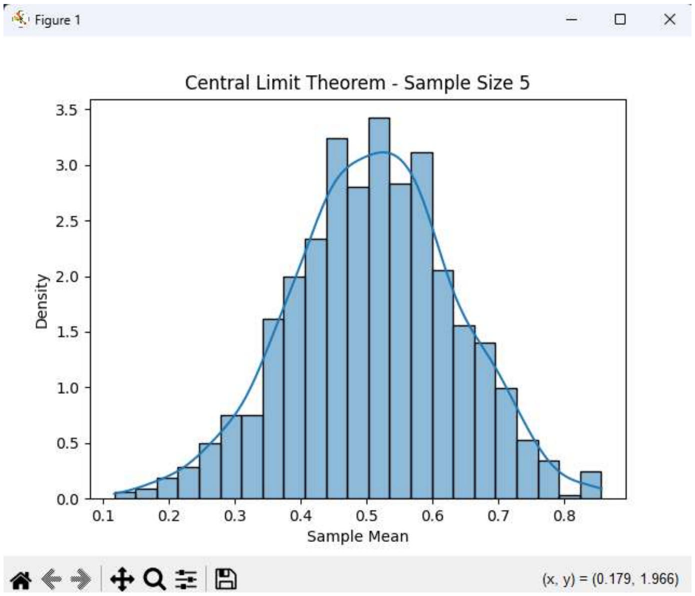


Figure 1
Central Limit Theorem - Sample Size 5
Density
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
Sample Mean
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
(x, y) = (0.179, 1.966)

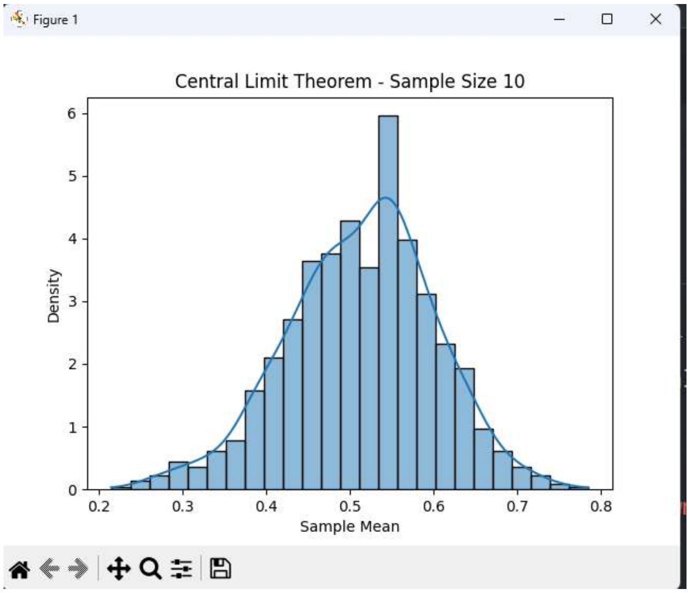


Figure 1
Central Limit Theorem - Sample Size 10
Density
0
1
2
3
4
5
6
Sample Mean
0.2
0.3
0.4
0.5
0.6
0.7
0.8

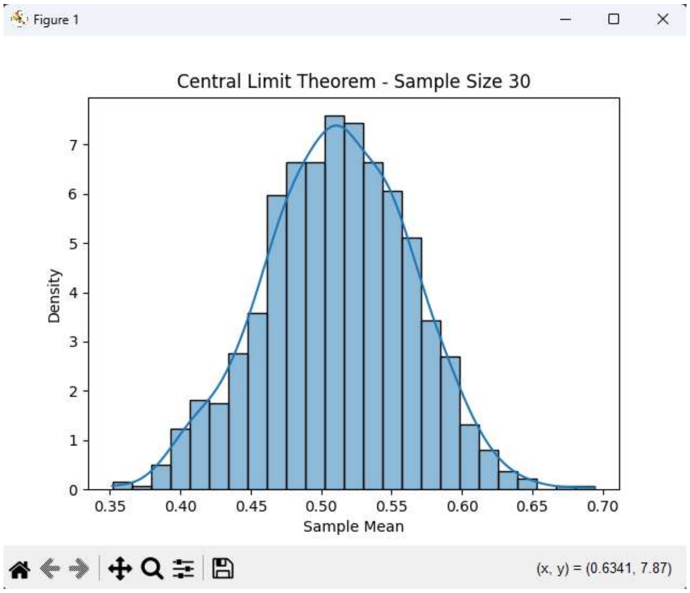
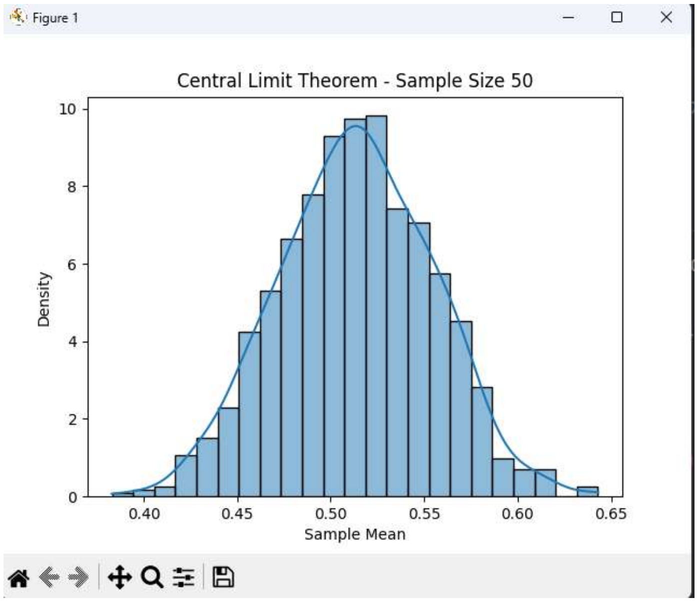
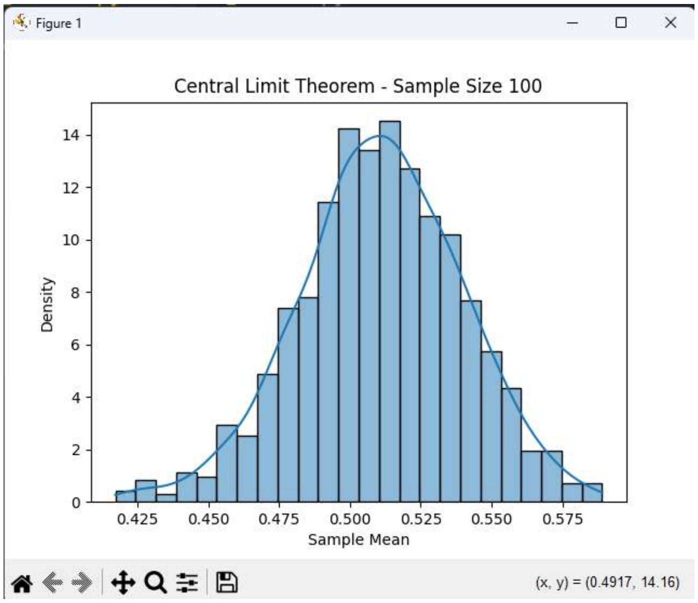
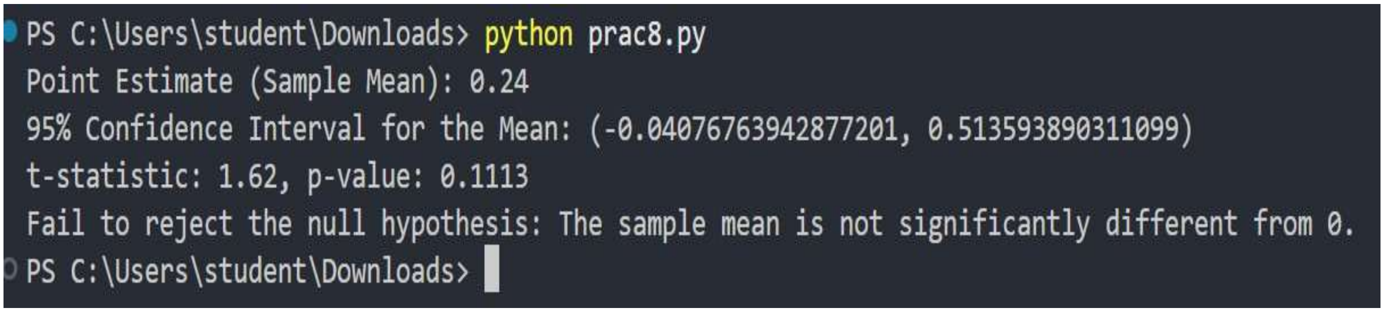


Figure 1
Central Limit Theorem - Sample Size 30
Density
0
1
2
3
4
5
6
7
Sample Mean
0.35
0.40
0.45
0.50
0.55
0.60
0.65
0.70
(x, y) = (0.6341, 7.87)







```
PS C:\Users\student\Downloads> python prac8.py
Point Estimate (Sample Mean): 0.24
95% Confidence Interval for the Mean: (-0.04076763942877201, 0.513593890311099)
t-statistic: 1.62, p-value: 0.1113
Fail to reject the null hypothesis: The sample mean is not significantly different from 0.
PS C:\Users\student\Downloads>
```

Practical-9

Aim:-

- Identify the column(s) of a given DataFrame which have at least one missing value, count the number of missing values in each column and drop the raws and columns with missing values. Check for the null values. Also remove the duplicate values from the DataFrame. Handle outliers in the Data Frame.
- Access subset of data through indexing(Select data using labels(column headings)), Slicing(Extract range based subset, subset of rows, subset of columns, select a subset of rows and columns from our DataFrame using iloc method).
- Perform other data processing on a given dataset.

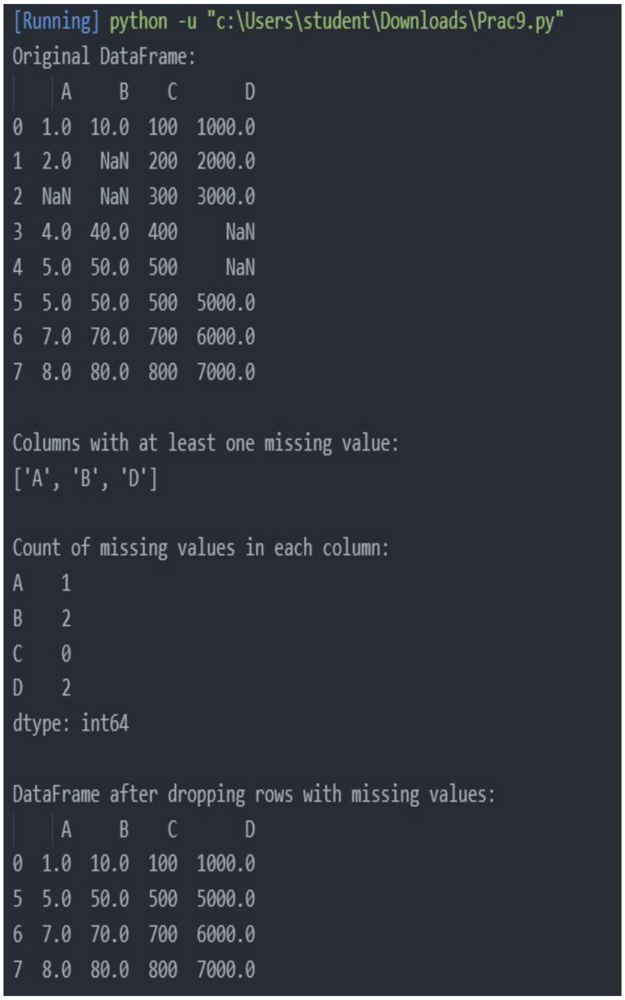
Code:-

```
#pip install pandas numpy
import pandas as pd
import numpy as np
# Step 1: Create a sample DataFrame with some missing values and duplicates
data = {
   'A': [1, 2, np.nan, 4, 5, 5, 7, 8],
   'B': [10, np.nan, np.nan, 40, 50, 50, 70, 80],
   'C': [100, 200, 300, 400, 500, 500, 700, 800],
   'D': [1000, 2000, 3000, np.nan, np.nan, 5000, 6000, 7000]
}
df = pd.DataFrame(data)
print("Original DataFrame:")
print(df)
# Step 2: Identify columns with at least one missing value
columns_with_nan = df.columns[df.isnull().any()].tolist()
print("\nColumns with at least one missing value:")
print(columns_with_nan)
# Step 3: Count the number of missing values in each column
missing_values_count = df.isnull().sum()
print("\nCount of missing values in each column:")
print(missing_values_count)
```

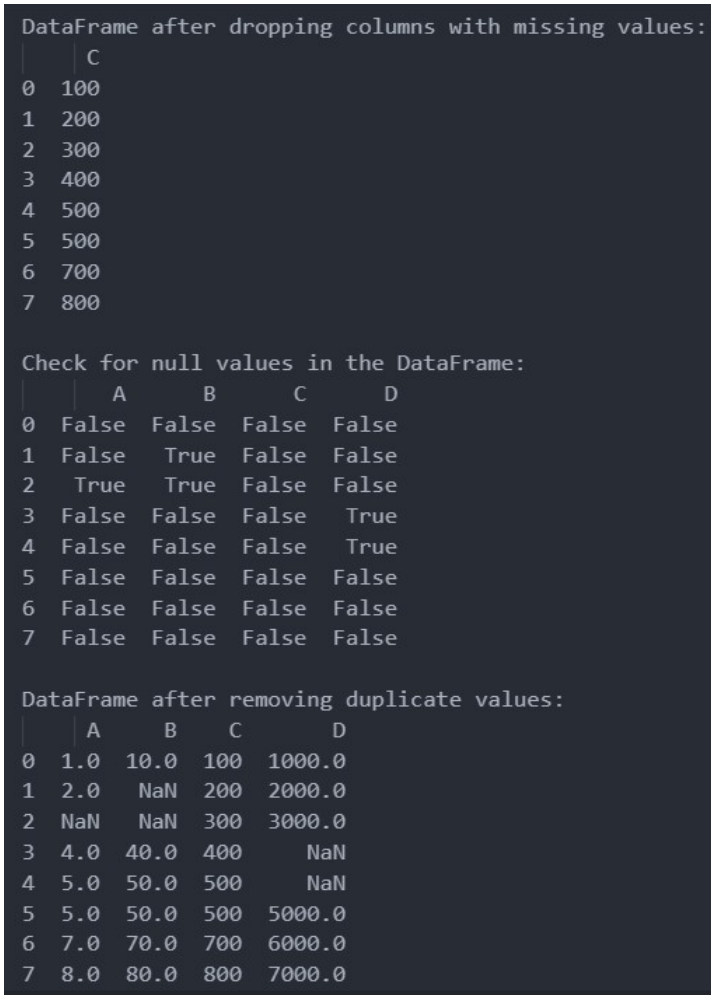
```
# Step 4: Drop rows and columns with missing values
df_dropped = df.dropna(axis=0)  # Drop rows with any missing value
df_dropped_columns = df.dropna(axis=1)  # Drop columns with any missing value
print("\nDataFrame after dropping rows with missing values:")
print(df_dropped)
print("\nDataFrame after dropping columns with missing values:")
print(df_dropped_columns)
# Step 5: Check for null values in the DataFrame
print("\nCheck for null values in the DataFrame:")
print(df.isnull())
# Step 6: Remove duplicate values
df_no_duplicates = df.drop_duplicates()
print("\nDataFrame after removing duplicate values:")
print(df_no_duplicates)
# Step 7: Handle outliers in the DataFrame
# For this example, we'll handle outliers by capping them within 1.5 * IQR range
def cap_outliers(series):
    Q1 = series.quantile(0.25)
    Q3 = series.quantile(0.75)
    IQR = Q3 - Q1
    lower_bound = Q1 - 1.5 * IQR
    upper_bound = Q3 + 1.5 * IQR
    return np.where(series < lower_bound, lower_bound, np.where(series > upper_bound, upper_bound,
series))
df_capped = df.apply(cap_outliers)
print("\nDataFrame after capping outliers:")
print(df_capped)
# Step 8: Accessing subset of data through indexing
# Selecting specific columns
subset_columns = df[['A', 'B']]
print("\nSubset of DataFrame with columns A and B:")
print(subset_columns)
# Slicing - Extract a range-based subset (subset of rows)
subset_rows = df[2:5]
print("\nSubset of DataFrame with rows 2 to 4:")
print(subset_rows)
```

```
# Subset of rows and columns using iloc method
subset_iloc = df.iloc[2:5, [0, 2]]
print("\nSubset of DataFrame with rows 2 to 4 and columns 0 and 2:")
print(subset_iloc)
# Perform other data processing on a given dataset
# Example: Calculating the mean of each column
mean_values = df.mean()
print("\nMean of each column:")
print(mean_values)
# Example: Normalizing the data using Min-Max scaling
df_normalized = (df - df.min()) / (df.max() - df.min())
print("\nNormalized DataFrame:")
print(df_normalized)
```

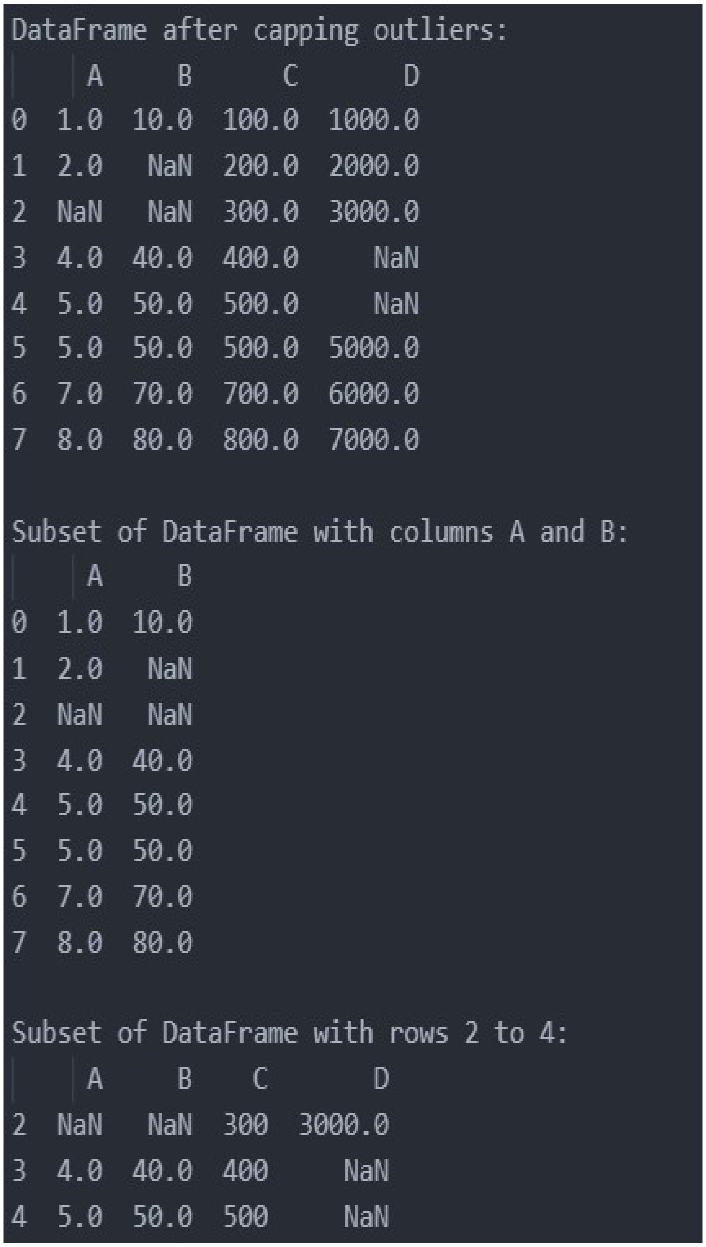
Solution:-



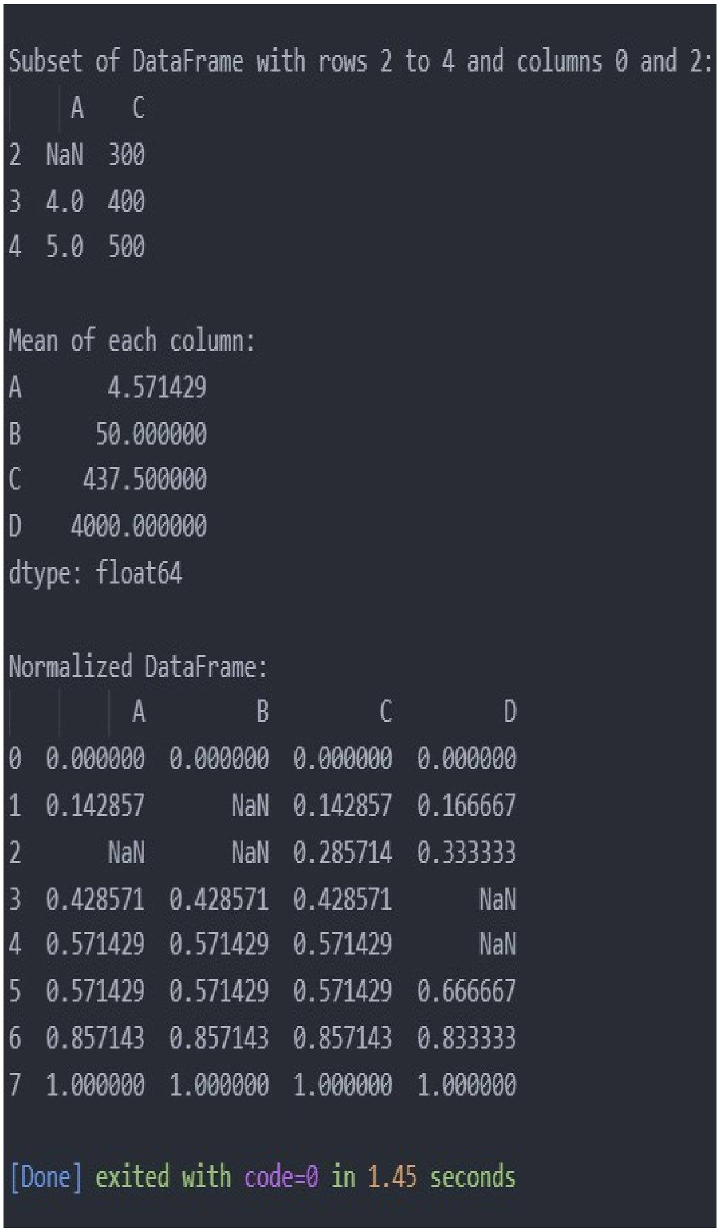
```
[Running] python -u "c:\Users\student\Downloads\Prac9.py"
Original DataFrame:
     A     B    C       D
0  1.0  10.0  100  1000.0
1  2.0   NaN  200  2000.0
2  NaN   NaN  300  3000.0
3  4.0  40.0  400     NaN
4  5.0  50.0  500     NaN
5  5.0  50.0  500  5000.0
6  7.0  70.0  700  6000.0
7  8.0  80.0  800  7000.0

Columns with at least one missing value:
['A', 'B', 'D']

Count of missing values in each column:
A    1
B    2
C    0
D    2
dtype: int64

DataFrame after dropping rows with missing values:
     A     B    C       D
0  1.0  10.0  100  1000.0
5  5.0  50.0  500  5000.0
6  7.0  70.0  700  6000.0
7  8.0  80.0  800  7000.0
```



```
DataFrame after dropping columns with missing values:
     C
0  100
1  200
2  300
3  400
4  500
5  500
6  700
7  800

Check for null values in the DataFrame:
       A      B      C      D
0  False  False  False  False
1  False   True  False  False
2   True   True  False  False
3  False  False  False   True
4  False  False  False   True
5  False  False  False  False
6  False  False  False  False
7  False  False  False  False

DataFrame after removing duplicate values:
     A     B    C       D
0  1.0  10.0  100  1000.0
1  2.0   NaN  200  2000.0
2  NaN   NaN  300  3000.0
3  4.0  40.0  400     NaN
4  5.0  50.0  500     NaN
5  5.0  50.0  500  5000.0
6  7.0  70.0  700  6000.0
7  8.0  80.0  800  7000.0
```



```
DataFrame after capping outliers:
     A     B      C       D
0  1.0  10.0  100.0  1000.0
1  2.0   NaN  200.0  2000.0
2  NaN   NaN  300.0  3000.0
3  4.0  40.0  400.0     NaN
4  5.0  50.0  500.0     NaN
5  5.0  50.0  500.0  5000.0
6  7.0  70.0  700.0  6000.0
7  8.0  80.0  800.0  7000.0

Subset of DataFrame with columns A and B:
     A     B
0  1.0  10.0
1  2.0   NaN
2  NaN   NaN
3  4.0  40.0
4  5.0  50.0
5  5.0  50.0
6  7.0  70.0
7  8.0  80.0

Subset of DataFrame with rows 2 to 4:
     A     B    C       D
2  NaN   NaN  300  3000.0
3  4.0  40.0  400     NaN
4  5.0  50.0  500     NaN
```



```
Subset of DataFrame with rows 2 to 4 and columns 0 and 2:
     A    C
2  NaN  300
3  4.0  400
4  5.0  500

Mean of each column:
A       4.571429
B      50.000000
C     437.500000
D    4000.000000
dtype: float64

Normalized DataFrame:
          A         B         C         D
0  0.000000  0.000000  0.000000  0.000000
1  0.142857       NaN  0.142857  0.166667
2       NaN       NaN  0.285714  0.333333
3  0.428571  0.428571  0.428571       NaN
4  0.571429  0.571429  0.571429       NaN
5  0.571429  0.571429  0.571429  0.666667
6  0.857143  0.857143  0.857143  0.833333
7  1.000000  1.000000  1.000000  1.000000

[Done] exited with code=0 in 1.45 seconds
```

Practical-10

Aim:- Write a python program to perform data visualization trough Matplotlib.

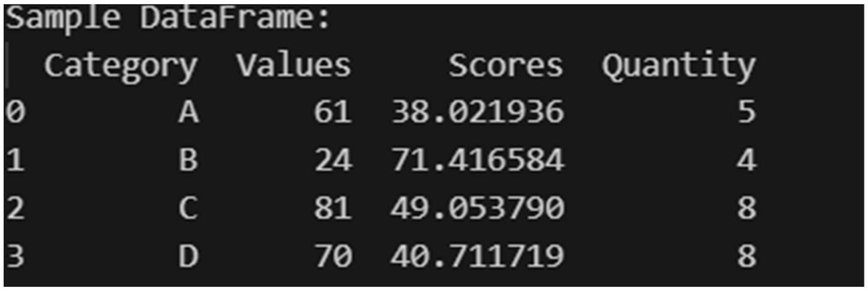
Code:-

```
#pip install matplotlib pandas numpy seaborn
import matplotlib.pyplot as plt
import pandas as pd
import numpy as np
import seaborn as sns
# Step 1: Create or load a sample dataset
# For this example, let's use a simple DataFrame with random data
np.random.seed(42) # For reproducibility
data = {
  'Category': ['A', 'B', 'C', 'D'],
  'Values': np.random.randint(10, 100, 4),
  'Scores': np.random.normal(50, 10, 4),
  'Quantity': np.random.randint(1, 10, 4)
}
df = pd.DataFrame(data)
print("Sample DataFrame:")
print(df)
# Step 2: Create a simple bar chart
plt.figure(figsize=(8, 6))
plt.bar(df['Category'], df['Values'], color='skyblue')
plt.title('Bar Chart of Values by Category')
plt.xlabel('Category')
plt.ylabel('Values')
plt.show()
# Step 3: Create a pie chart
plt.figure(figsize=(8, 6))
plt.pie(df['Values'], labels=df['Category'], autopct='%1.1f%%', startangle=140, colors=sns.color_palette("pastel"))
plt.title('Pie Chart of Values by Category')
plt.show()
```

```
# Step 4: Create a line chart
plt.figure(figsize=(8, 6))
plt.plot(df['Category'], df['Scores'], marker='o', color='green')
plt.title('Line Chart of Scores by Category')
plt.xlabel('Category')
plt.ylabel('Scores')
plt.show()
# Step 5: Create a scatter plot
plt.figure(figsize=(8, 6))
plt.scatter(df['Values'], df['Scores'], color='red')
plt.title('Scatter Plot of Scores vs. Values')
plt.xlabel('Values')
plt.ylabel('Scores')
plt.show()
# Step 6: Create a histogram
data = np.random.randn(1000) # Normally distributed data
plt.figure(figsize=(8, 6))
plt.hist(data, bins=30, color='purple', alpha=0.7)
plt.title('Histogram of Normally Distributed Data')
plt.xlabel('Value')
plt.ylabel('Frequency')
plt.show()
# Step 7: Create a box plot
plt.figure(figsize=(8, 6))
sns.boxplot(x='Category', y='Scores', data=df)
plt.title('Box Plot of Scores by Category')
plt.xlabel('Category')
plt.ylabel('Scores')
plt.show()
# Step 8: Create a heatmap
# Let's create a correlation matrix as an example
df_corr = df.corr()
plt.figure(figsize=(8, 6))
sns.heatmap(df_corr, annot=True, cmap='coolwarm', fmt=".2f")
plt.title('Heatmap of Correlation Matrix')
plt.show()
```

```
# Step 9: Create a pair plot
# Generating pair plots for more insights
sns.pairplot(df)
plt.suptitle('Pair Plot of the DataFrame', y=1.02)
plt.show()
# Step 10: Create a subplot (multiple plots in a single figure)
plt.figure(figsize=(12, 8))
# Subplot 1: Bar chart
plt.subplot(2, 2, 1)
plt.bar(df['Category'], df['Values'], color='blue')
plt.title('Bar Chart')
# Subplot 2: Line chart
plt.subplot(2, 2, 2)
plt.plot(df['Category'], df['Scores'], marker='o', color='orange')
plt.title('Line Chart')
# Subplot 3: Scatter plot
plt.subplot(2, 2, 3)
```

Solution:-



```
Sample DataFrame:
  Category  Values     Scores  Quantity
0        A      61  38.021936         5
1        B      24  71.416584         4
2        C      81  49.053790         8
3        D      70  40.711719         8
```

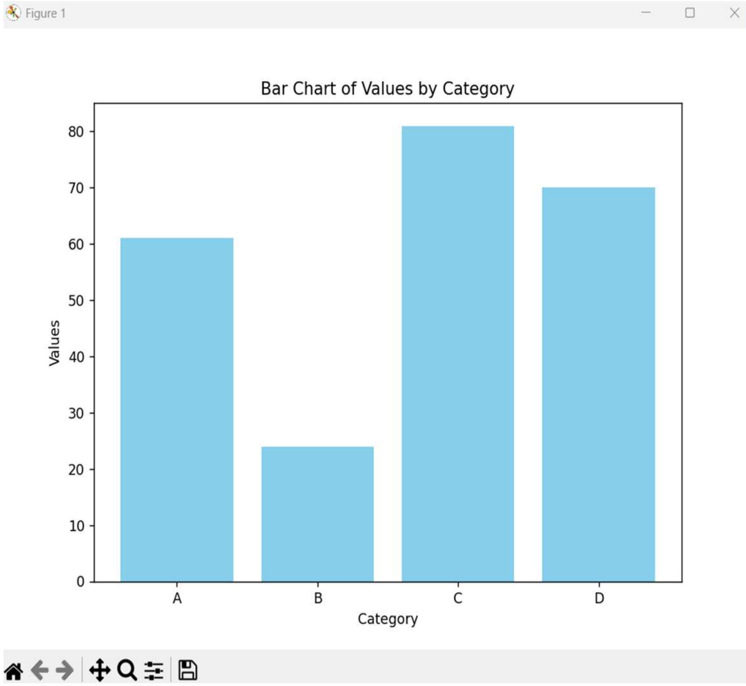


Figure 1
Bar Chart of Values by Category
Values
0
10
20
30
40
50
60
70
80
A
B
C
D
Category

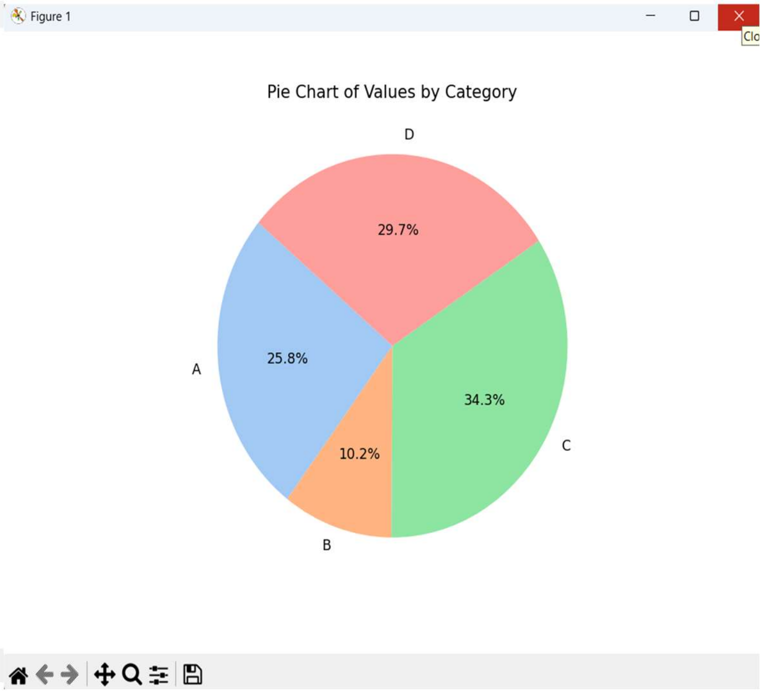


Figure 1
Clo
Pie Chart of Values by Category
D
29.7%
A
25.8%
34.3%
C
10.2%
B

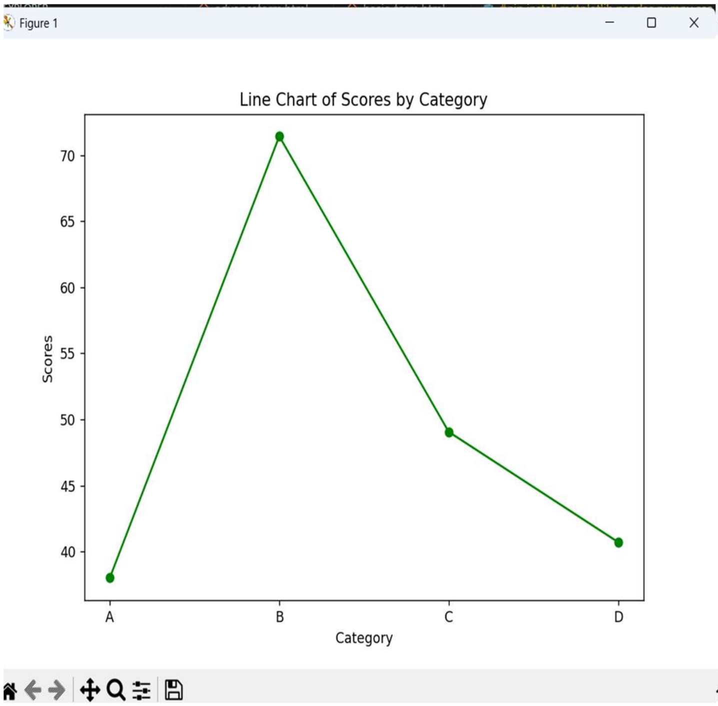


Figure 1
Line Chart of Scores by Category
Scores
40
45
50
55
60
65
70
A
B
C
D
Category

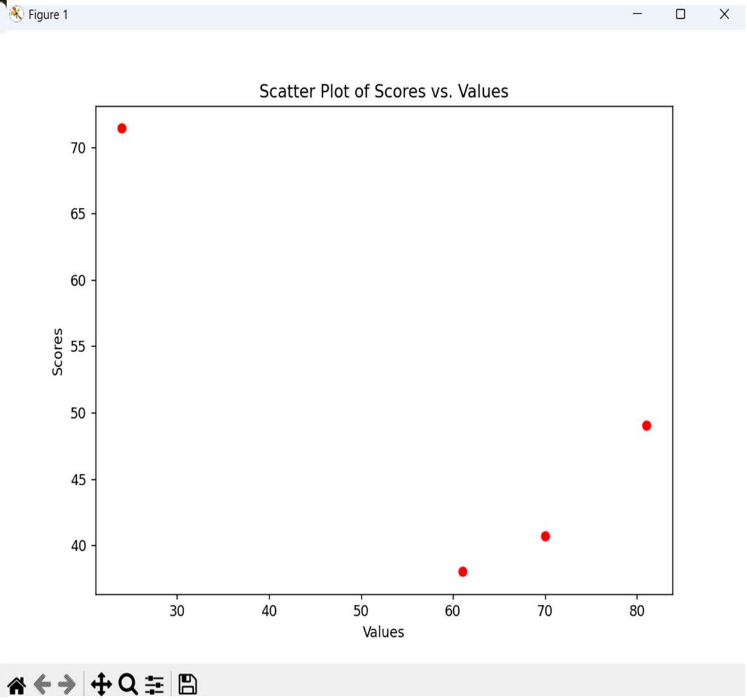


Figure 1
Scatter Plot of Scores vs. Values
Scores
40
45
50
55
60
65
70
30
40
50
60
70
80
Values

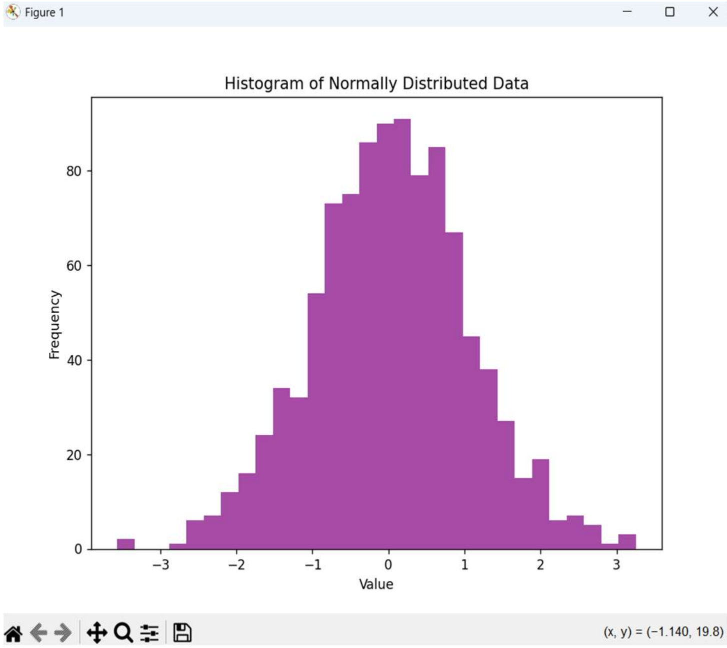


Figure 1
Histogram of Normally Distributed Data
Frequency
0
20
40
60
80
Value
−3
−2
−1
0
1
2
3
(x, y) = (−1.140, 19.8)

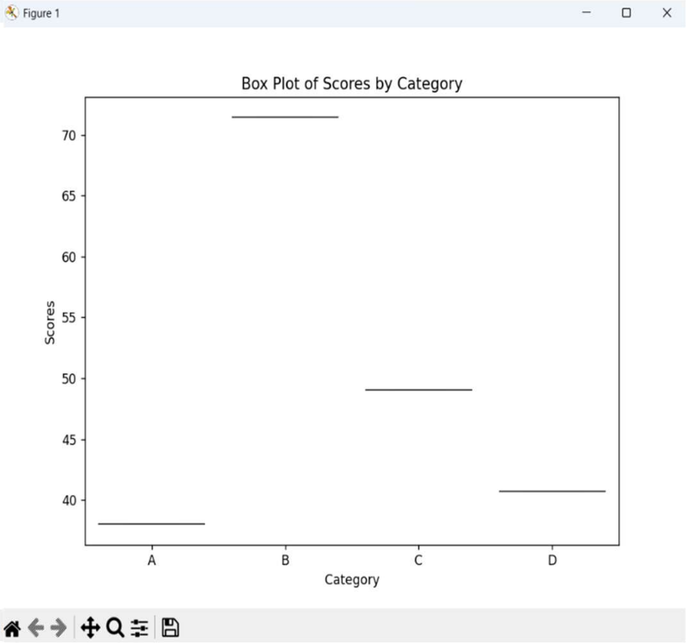


Figure 1
Box Plot of Scores by Category
Scores
40
45
50
55
60
65
70
Category
A
B
C
D

Practical-11

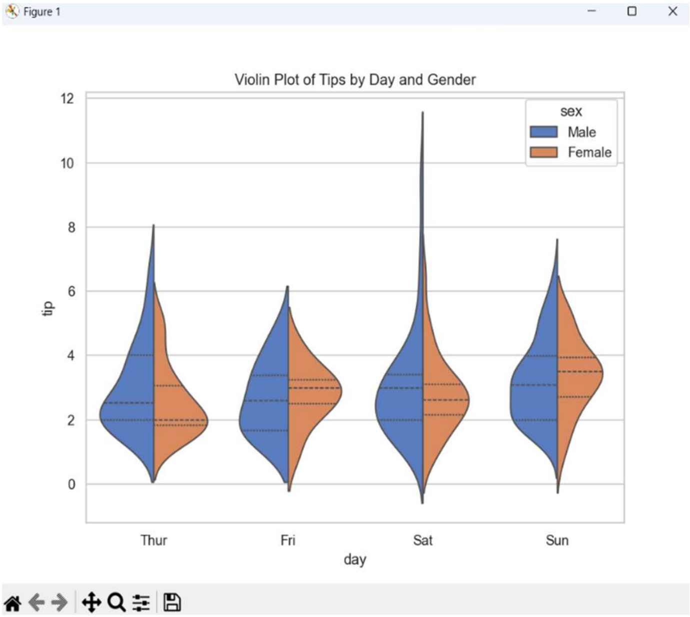
Aim: Write python program for advanced data visualization through Seaborn

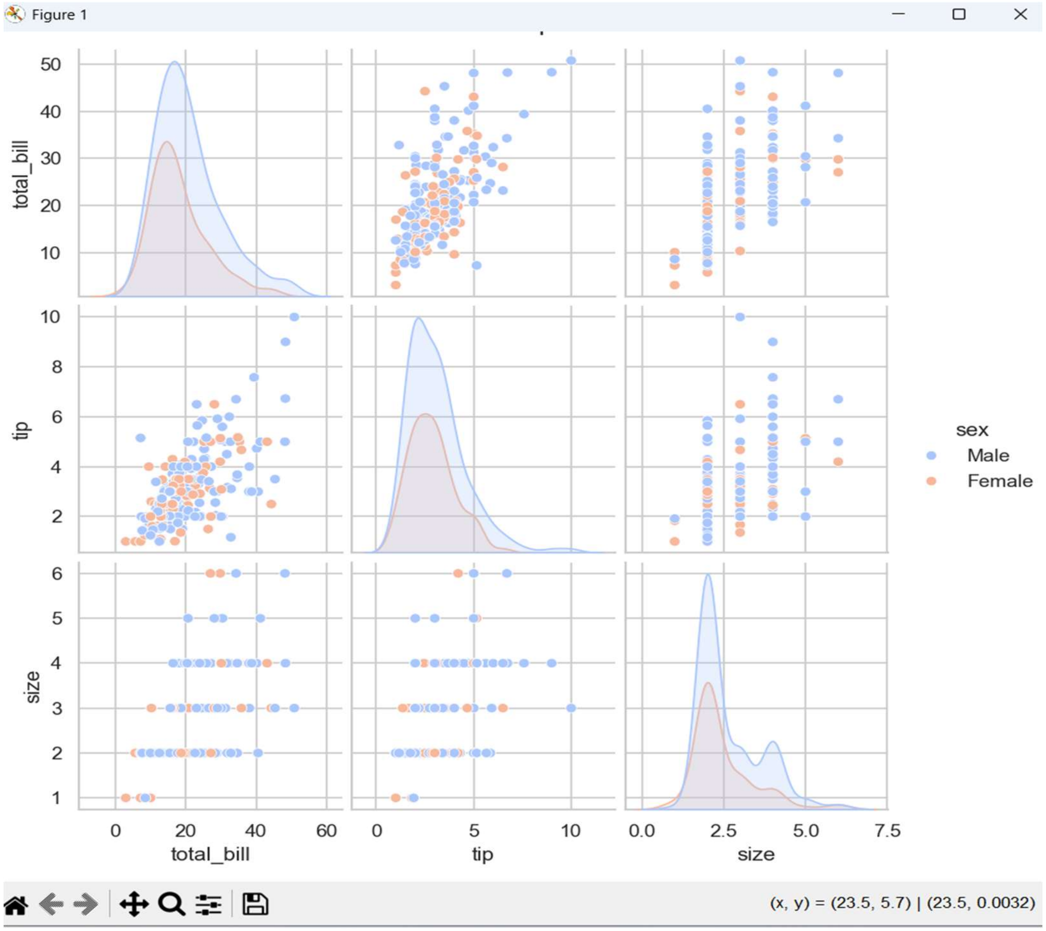
Code:

```
#pip install seaborn pandas matplotlib numpy
import seaborn as sns
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt

# Step 1: Load or create a sample dataset
# For demonstration, we'll use Seaborn's built-in datasets
# Load the 'tips' dataset, which contains data about restaurant bills and tips
tips = sns.load_dataset('tips')

# Step 2: Set Seaborn style for plots
sns.set(style='whitegrid')

# Step 3: Advanced Data Visualization
# 3.1. Violin Plot - Distribution of tips by day of the week and gender
plt.figure(figsize=(8, 6))
sns.violinplot(x='day', y='tip', hue='sex', data=tips, split=True, inner='quart', palette='muted')
plt.title('Violin Plot of Tips by Day and Gender')
plt.show()

# 3.2. Pair Plot - Pairwise relationships between variables in the dataset
sns.pairplot(tips, hue='sex', palette='coolwarm')
plt.suptitle('Pair Plot of Tips Dataset', y=1.02)
plt.show()

# 3.3. Heatmap - Correlation matrix with annotations
plt.figure(figsize=(10, 8))
corr_matrix = tips.corr()
sns.heatmap(corr_matrix, annot=True, cmap='coolwarm', linewidths=0.5)
plt.title('Heatmap of Correlation Matrix')
plt.show()

# 3.4. Box Plot - Distribution of total bill by day and time of day
plt.figure(figsize=(8, 6))
sns.boxplot(x='day', y='total_bill', hue='time', data=tips, palette='Set2')
plt.title('Box Plot of Total Bill by Day and Time of Day')
plt.show()

# 3.5. Swarm Plot - Tips by day of the week with jittered points
plt.figure(figsize=(8, 6))
sns.swarmplot(x='day', y='tip', data=tips, color='purple')
plt.title('Swarm Plot of Tips by Day')
plt.show()
```

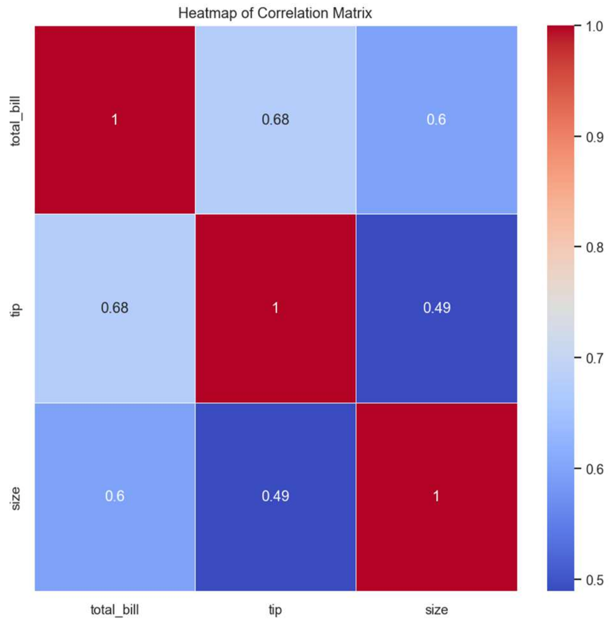
```
# 3.6. Facet Grid - Distribution of total bill across time of day and smoker status
g = sns.FacetGrid(tips, col='time', row='smoker', margin_titles=True)
g.map(sns.histplot, 'total_bill', bins=10, color='teal')
g.fig.suptitle('Facet Grid of Total Bill by Time and Smoker Status', y=1.03)
plt.show()

# 3.7. Joint Plot - Relationship between total bill and tip with regression line
sns.jointplot(x='total_bill', y='tip', data=tips, kind='reg', color='green')
plt.suptitle('Joint Plot of Total Bill vs Tip with Regression Line', y=1.02)
plt.show()

# 3.8. Count Plot - Count of observations in each categorical bin using bars
plt.figure(figsize=(8, 6))
sns.countplot(x='day', hue='smoker', data=tips, palette='coolwarm')
plt.title('Count Plot of Days by Smoker Status')
plt.show()

# 3.9. KDE Plot - Kernel density estimate of total bill for different time periods
plt.figure(figsize=(8, 6))
sns.kdeplot(data=tips, x='total_bill', hue='time', fill=True, palette='crest', alpha=0.5)
plt.title('KDE Plot of Total Bill by Time of Day')
plt.show()

# 3.10. Strip Plot - Tips by day of the week, with jitter
plt.figure(figsize=(8, 6))
sns.stripplot(x='day', y='tip', data=tips, jitter=True, hue='sex', palette='Set1', dodge=True)
plt.title('Strip Plot of Tips by Day with Jitter')
plt.show()
```

Solution:

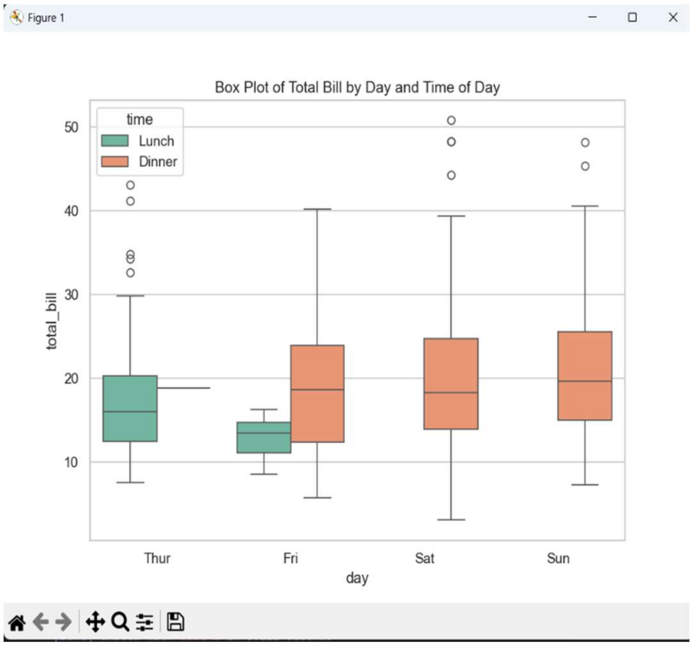




(x, y) = (23.5, 5.7) | (23.5, 0.0032)



	total_bill	tip	size
total_bill	1	0.68	0.6
tip	0.68	1	0.49
size	0.6	0.49	1



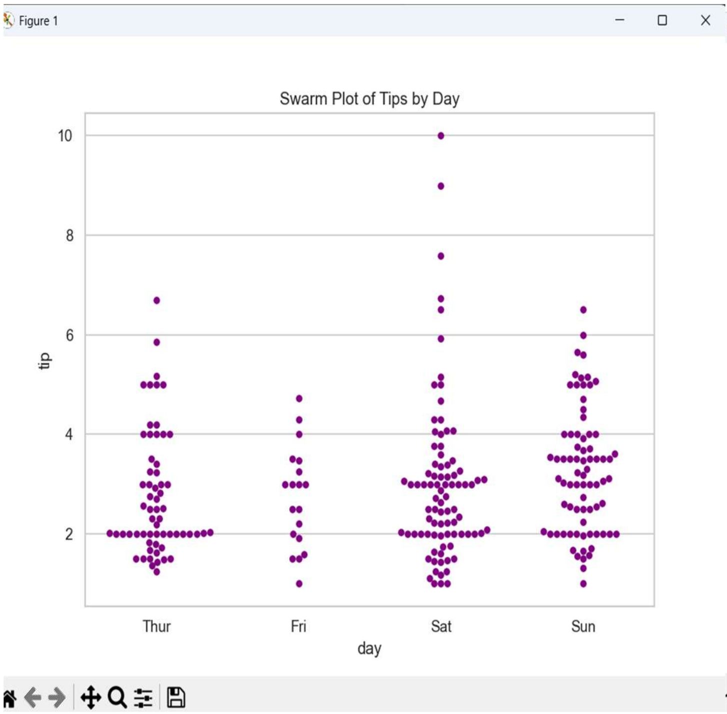


Figure 1
Swarm Plot of Tips by Day
tip
10
8
6
4
2
Thur
Fri
Sat
Sun
day

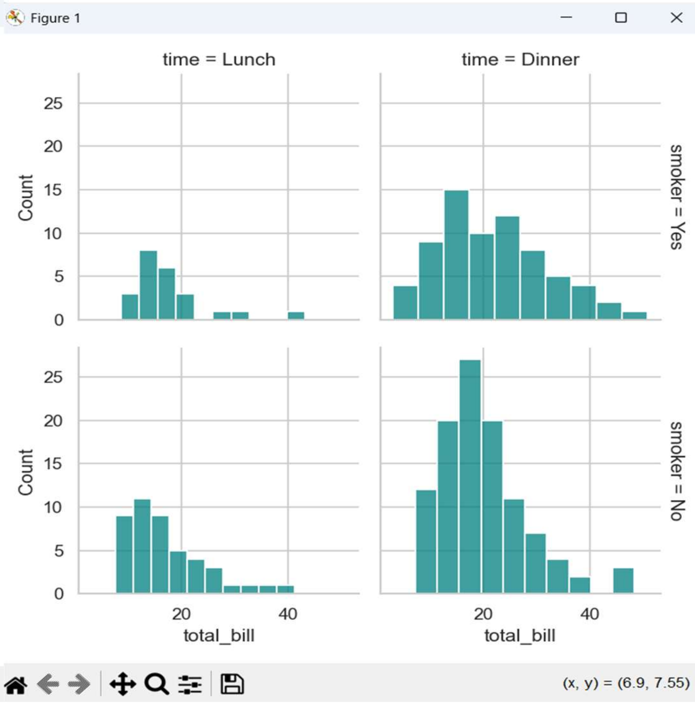


Figure 1
time = Lunch
time = Dinner
Count
25
20
15
10
5
0
smoker = Yes
smoker = No
20
40
total_bill
(x, y) = (6.9, 7.55)

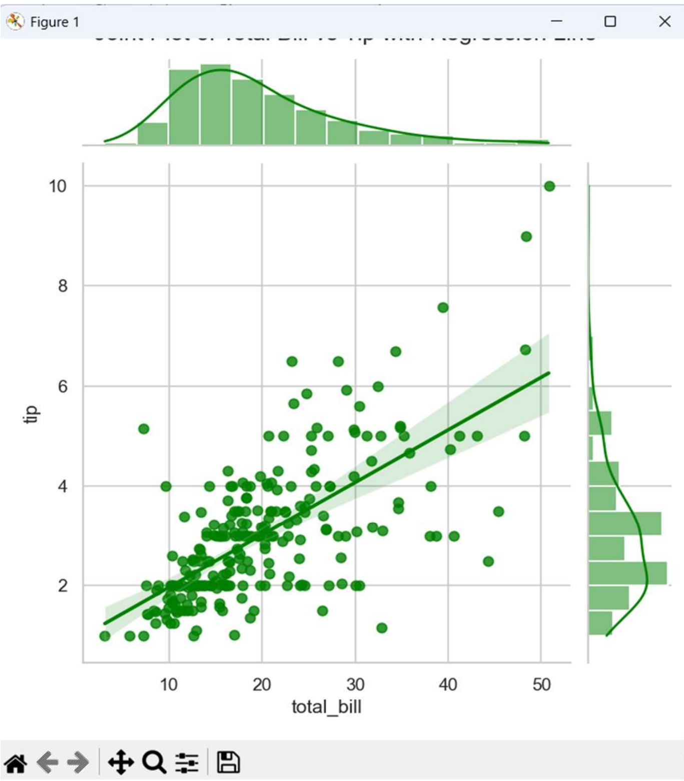


Figure 1
Joint Plot of Total Bill vs Tip with Regression Line
tip
10
8
6
4
2
10
20
30
40
50
total_bill

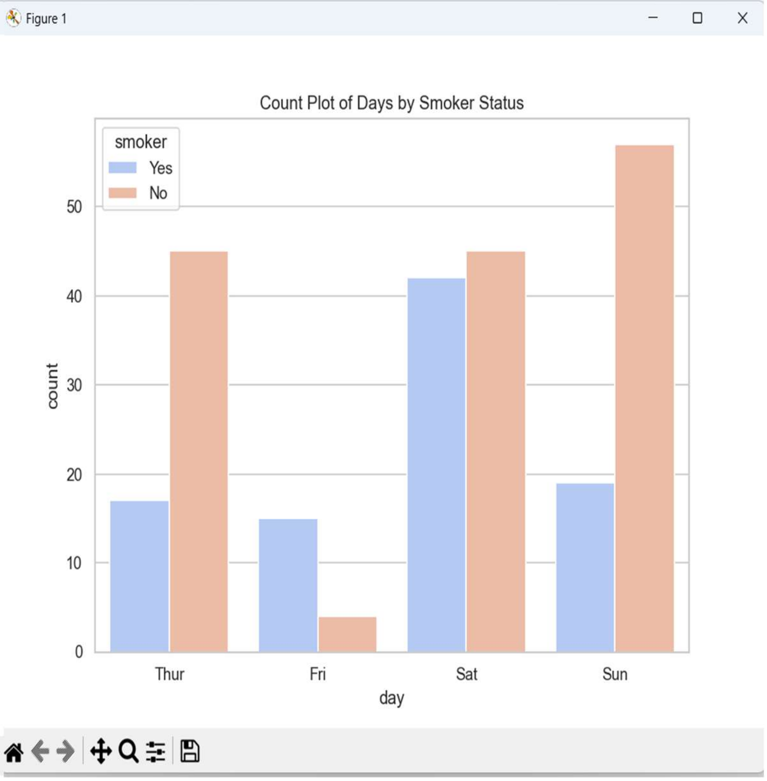


Figure 1
Count Plot of Days by Smoker Status
smoker
Yes
No
count
50
40
30
20
10
0
Thur
Fri
Sat
Sun
day

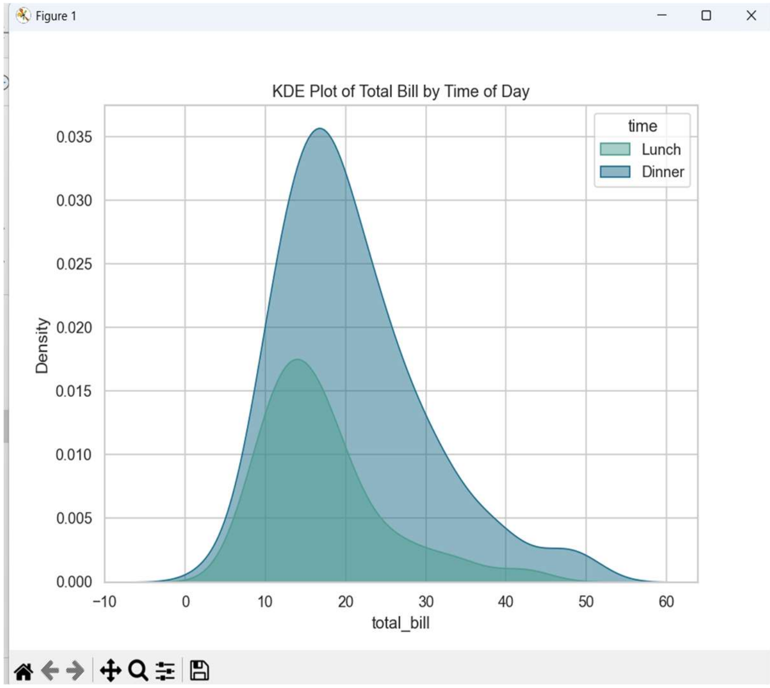


Figure 1
KDE Plot of Total Bill by Time of Day
time
Lunch
Dinner
Density
0.035
0.030
0.025
0.020
0.015
0.010
0.005
0.000
−10
0
10
20
30
40
50
60
total_bill

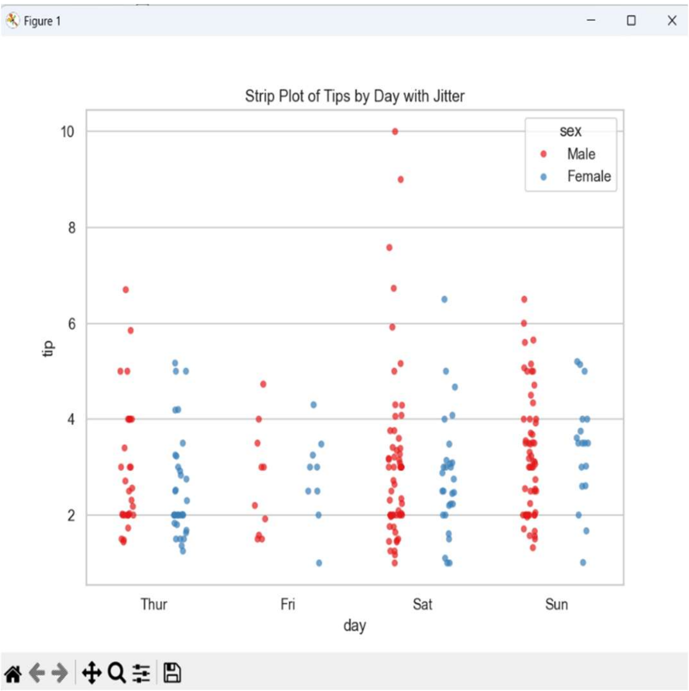


Figure 1
Strip Plot of Tips by Day with Jitter
sex
Male
Female
tip
10
8
6
4
2
Thur
Fri
Sat
Sun
day