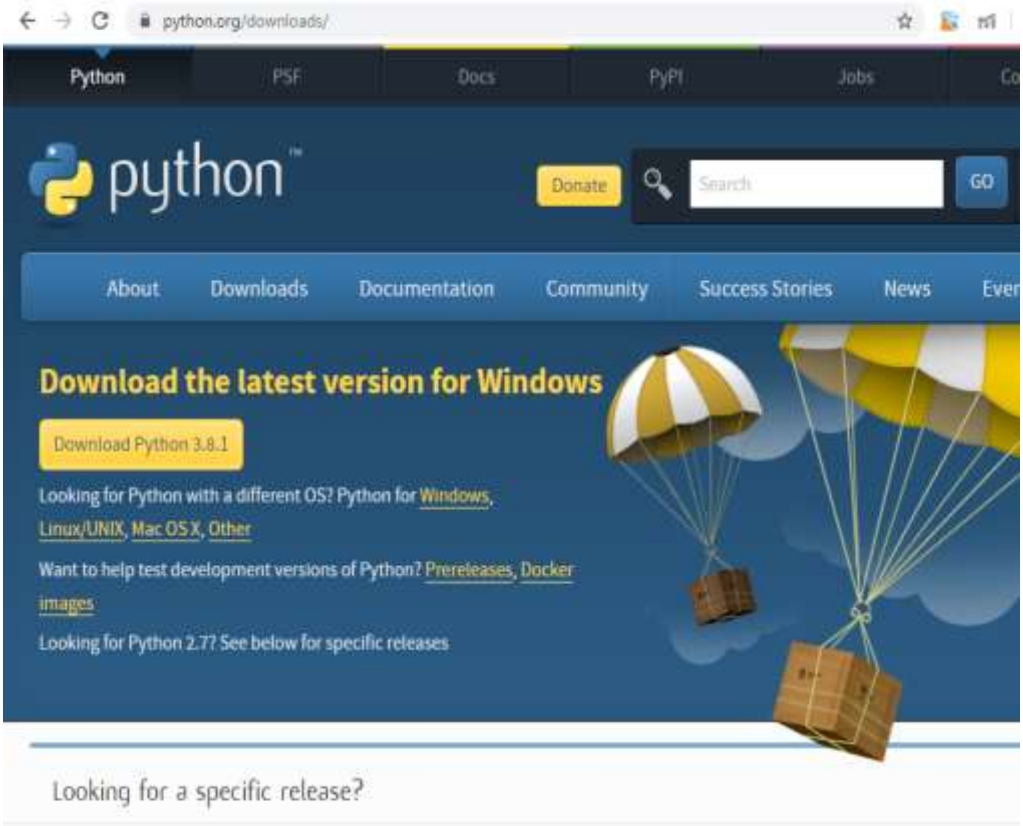
Practical 1

Aim: Develop Programs to understand the control structure of python.

(a) Write steps to install python and pycharm IDE for Windows Python Programming.

Steps of installing python:

Step 1) To download and install Python visit the official website of Python http://www.python.org/downloads/ and choose your version. We have chosen Python version 3.6.3



Download the latest version for Windows

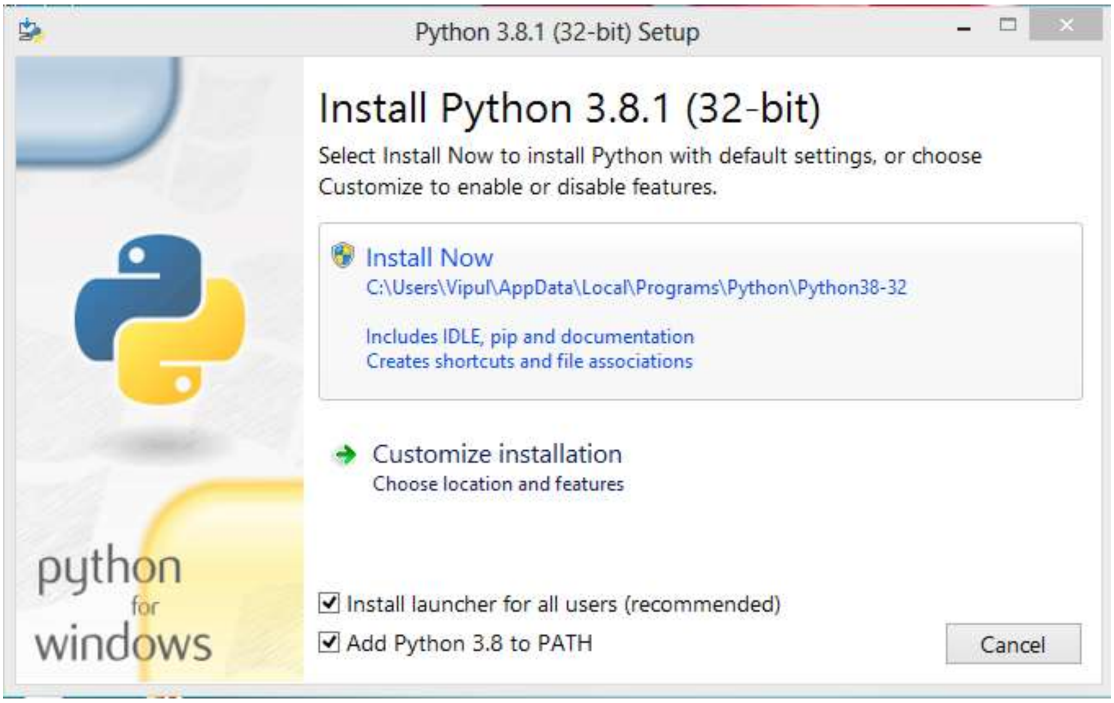
Looking for Python with a different OS? Python for Windows, Linux/UNIX, Mac OS X, Other

Want to help test development versions of Python? Prereleases, Docker images

Looking for Python 2.7? See below for specific releases

Looking for a specific release?

Step 2) Once the download is complete, run the exe for install Python. Now click on Install Now.



Python 3.8.1 (32-bit) Setup

Install Python 3.8.1 (32-bit)

Select Install Now to install Python with default settings, or choose Customize to enable or disable features.

Install Now
C:\Users\Vipul\AppData\Local\Programs\Python\Python38-32

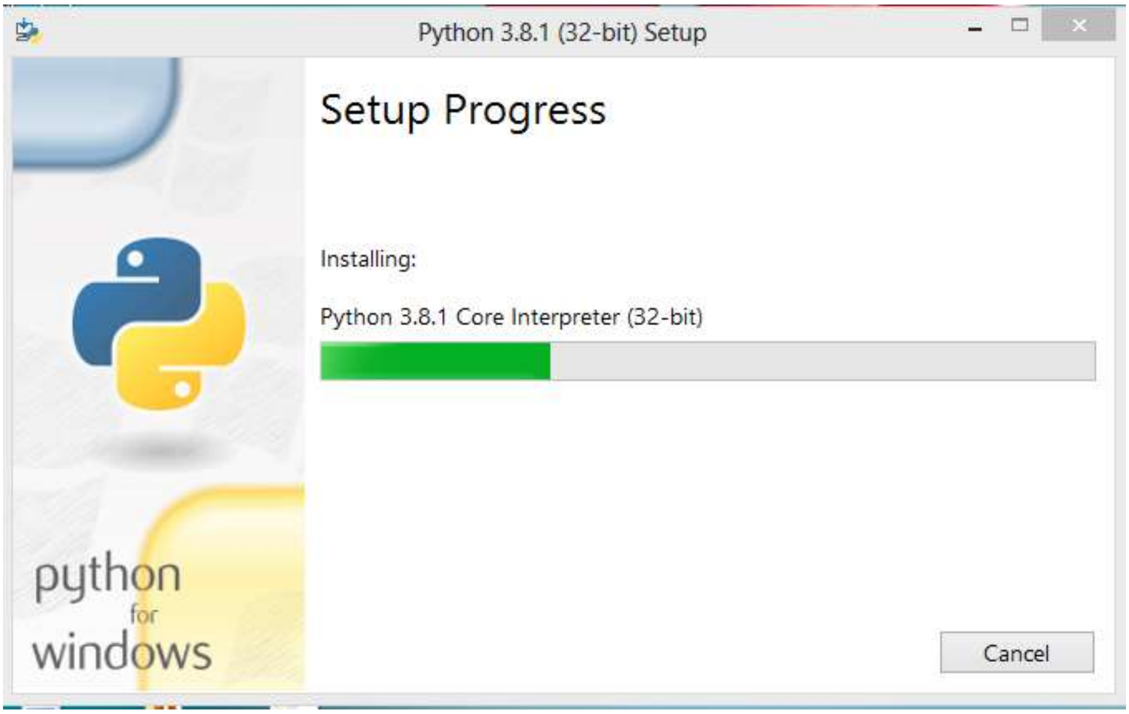
Includes IDLE, pip and documentation
Creates shortcuts and file associations

Customize installation
Choose location and features

☑ Install launcher for all users (recommended)

☑ Add Python 3.8 to PATH

Step 3) You can see Python is installing at this point.

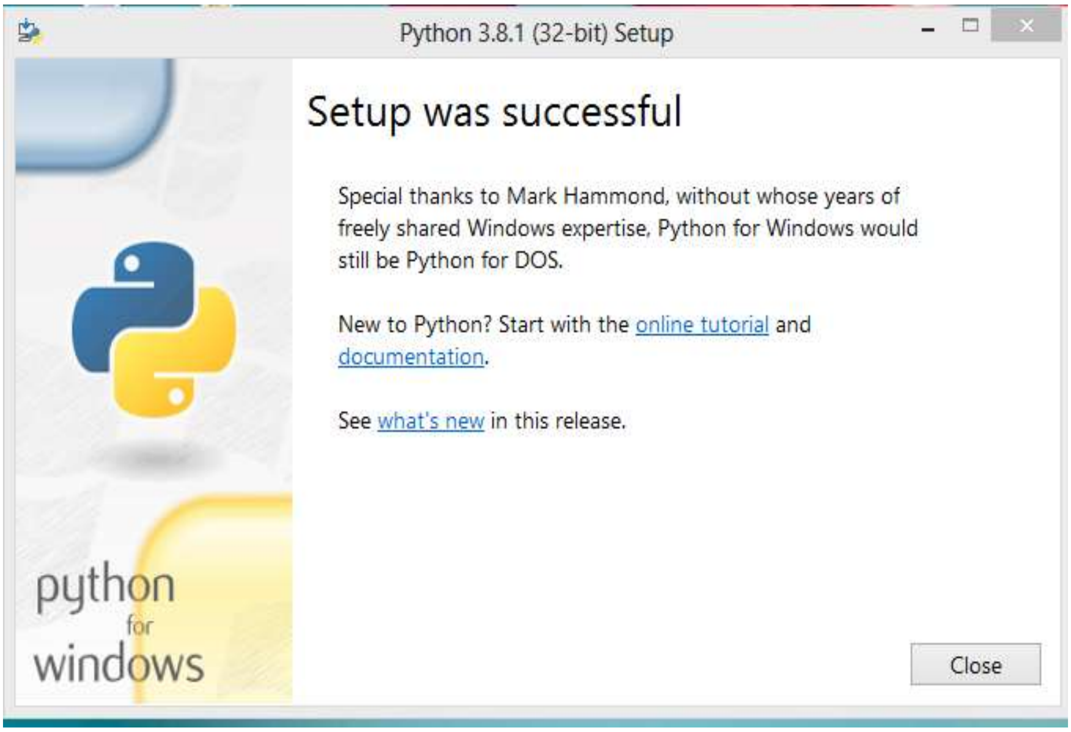


Setup Progress

Installing:

Python 3.8.1 Core Interpreter (32-bit)

Step 4) When it finishes, you can see a screen that says the Setup was successful. Now click on "Close".



Setup was successful

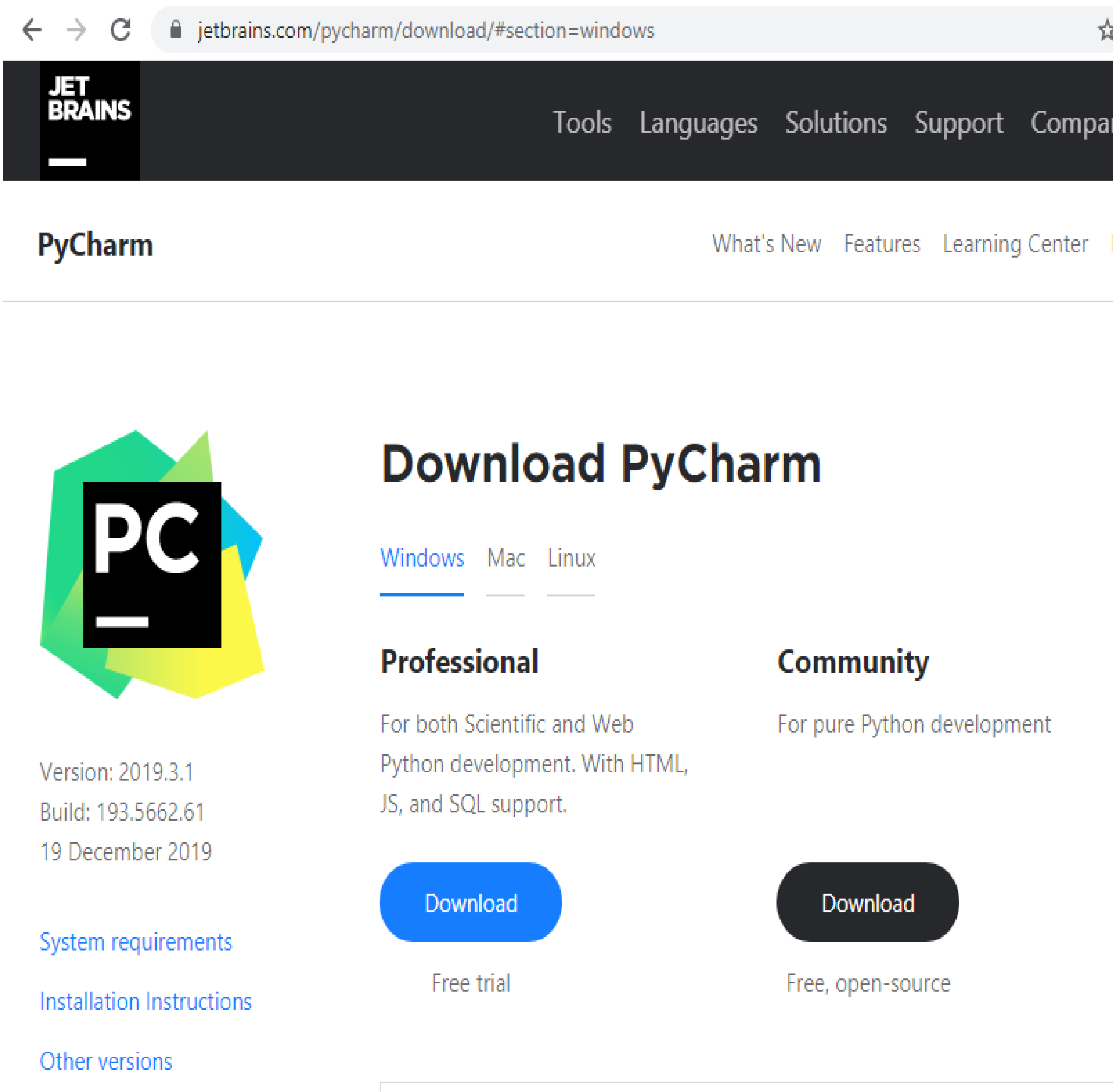
Special thanks to Mark Hammond, without whose years of freely shared Windows expertise, Python for Windows would still be Python for DOS.

New to Python? Start with the online tutorial and documentation.

See what's new in this release.

Steps of installing pycharm:

Step 1) To download PyCharm visit the website https://www.jetbrains.com/pycharm/download/ and Click the "DOWNLOAD" link under the Community Section.



Download PyCharm

Version: 2019.3.1
Build: 193.5662.61
19 December 2019

Professional

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

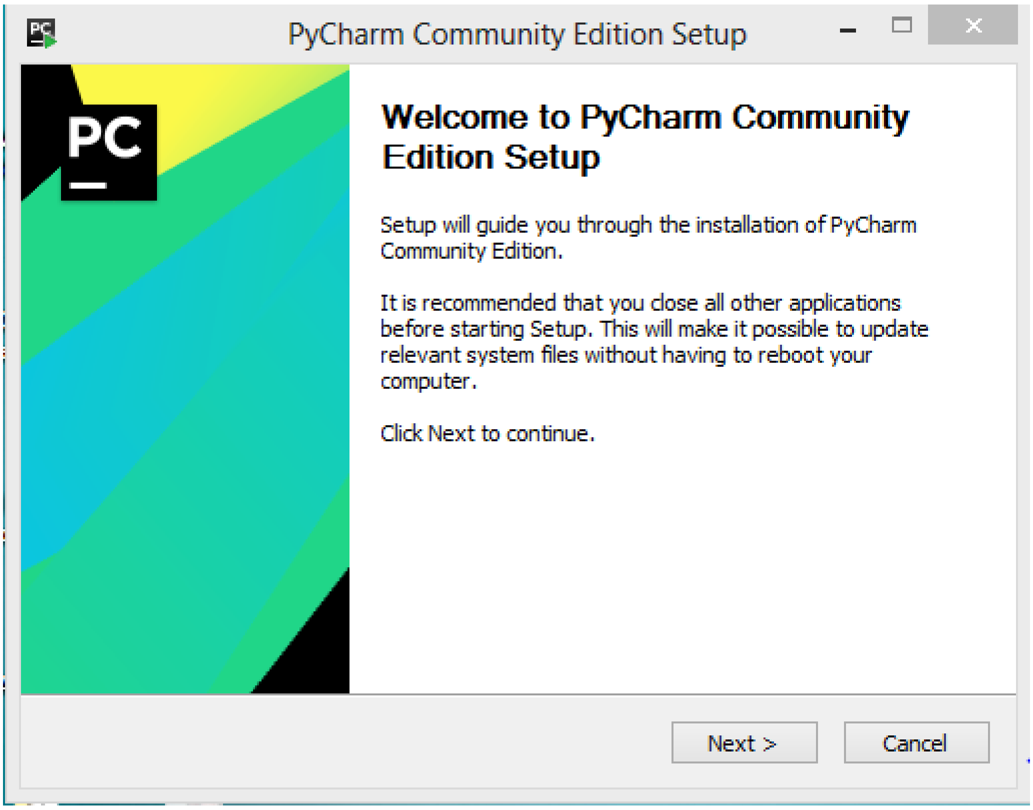
Free trial

Community

For pure Python development

Free, open-source

Step 2) Once the download is complete, run the exe for install PyCharm. The setup wizard should have started. Click “Next”.



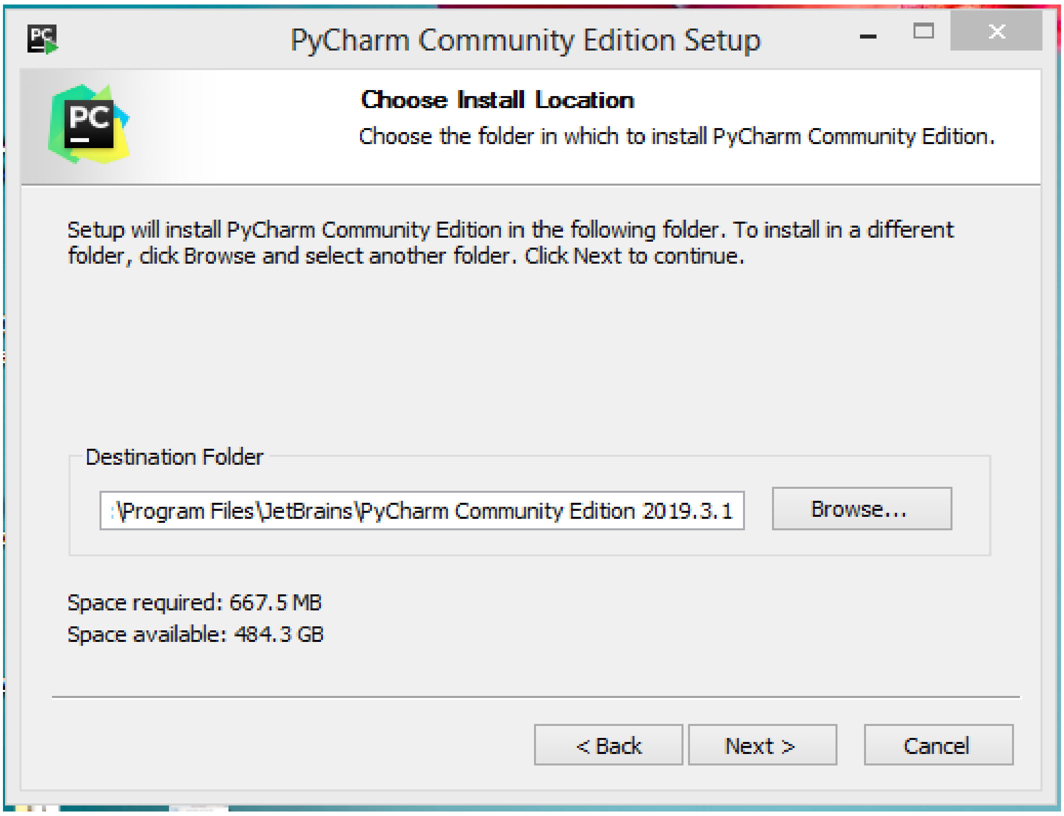
Welcome to PyCharm Community Edition Setup

Setup will guide you through the installation of PyCharm Community Edition.

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.

Step 3) On the next screen, Change the installation path if required. Click "Next".



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.

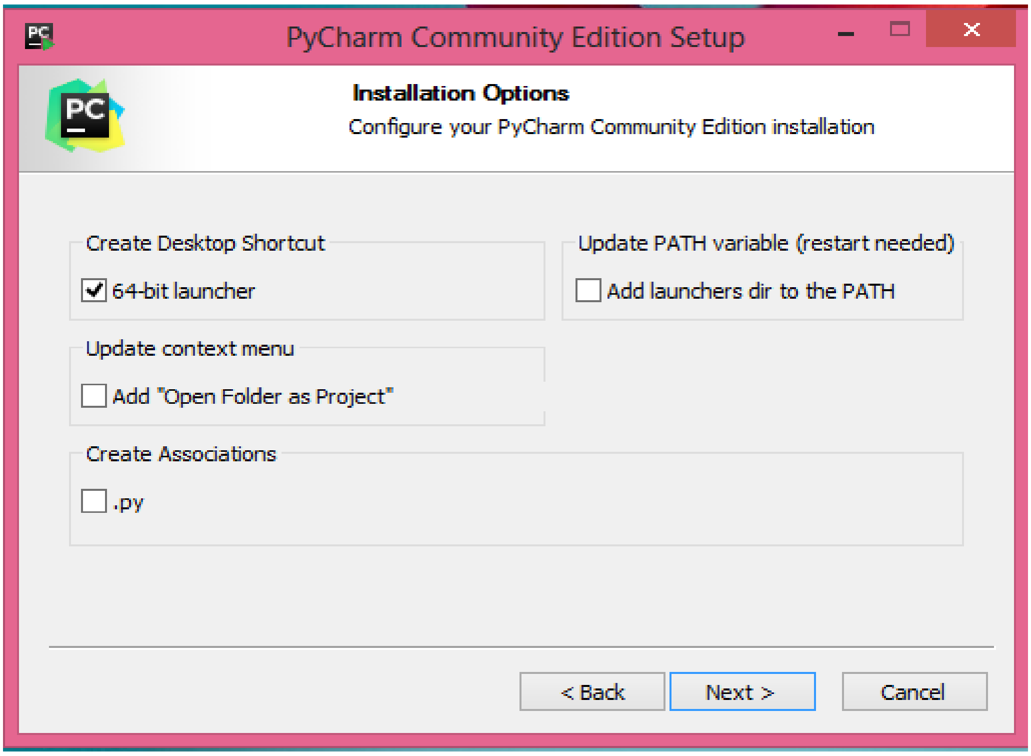
Destination Folder

:\Program Files\JetBrains\PyCharm Community Edition 2019.3.1

Space required: 667.5 MB

Space available: 484.3 GB

Step 4) On the next screen, you can create a desktop shortcut if you want and click on "Next".



Installation Options

Configure your PyCharm Community Edition installation

Create Desktop Shortcut

☑ 64-bit launcher

Update PATH variable (restart needed)

□ Add launchers dir to the PATH

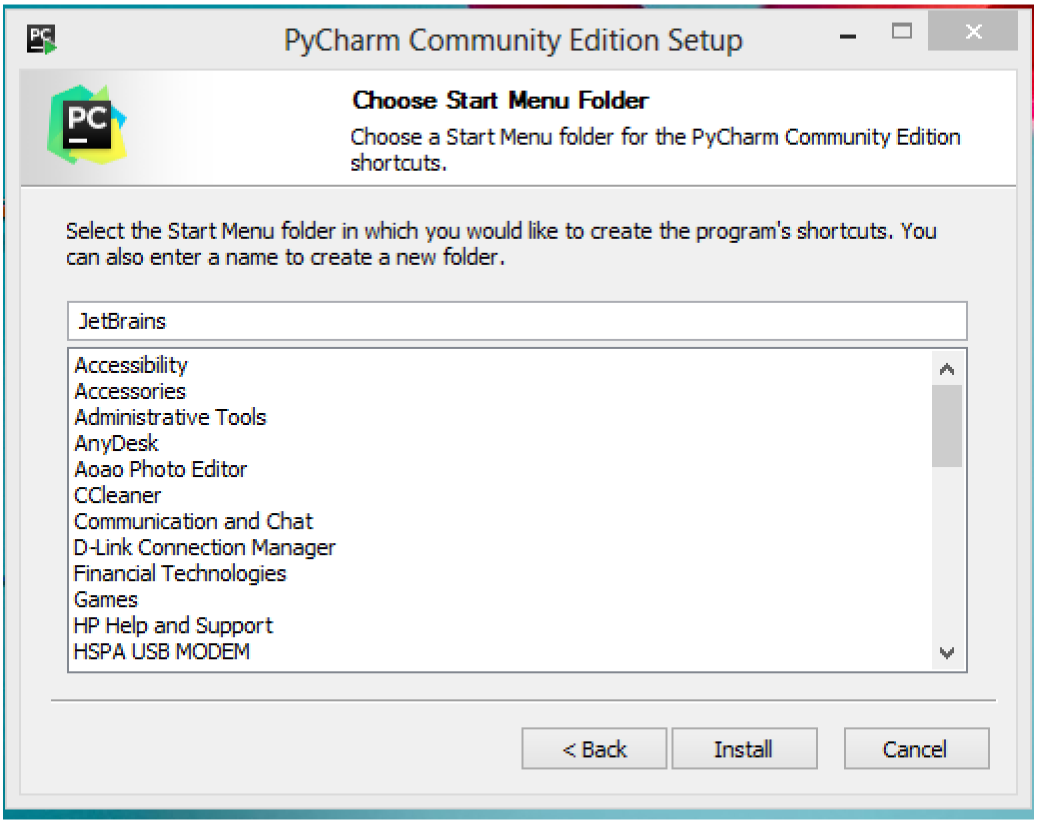
Update context menu

□ Add "Open Folder as Project"

Create Associations

□ .py

Step 5) Choose the start menu folder. Keep selected JetBrains and click on "Install".



Choose Start Menu Folder

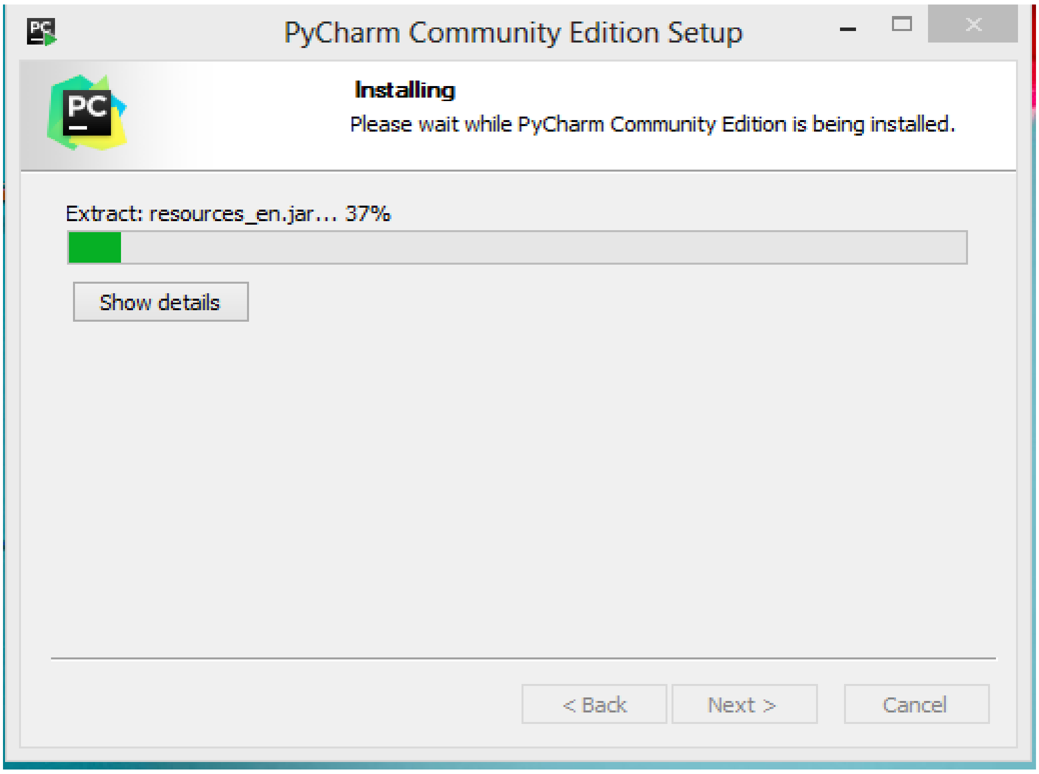
Choose a Start Menu folder for the PyCharm Community Edition shortcuts.

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
AnyDesk
Aoao Photo Editor
CCleaner
Communication and Chat
D-Link Connection Manager
Financial Technologies
Games
HP Help and Support
HSPA USB MODEM

Step 6) Wait for the installation to finish.

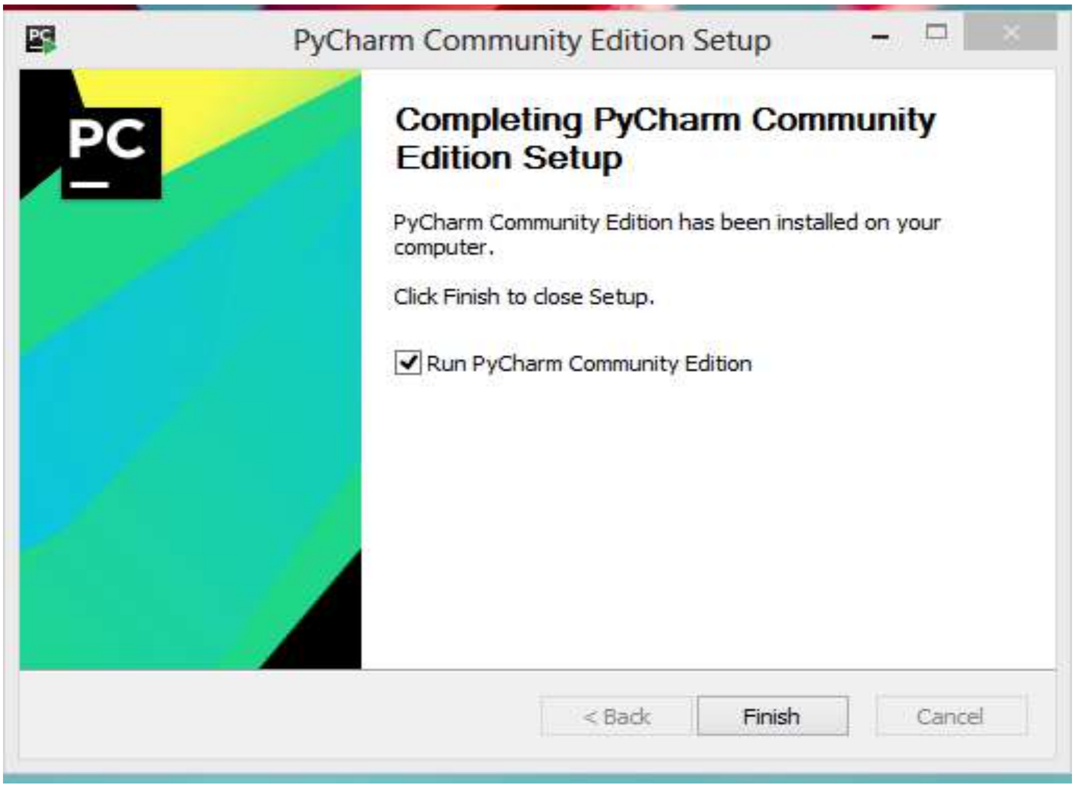


Installing

Please wait while PyCharm Community Edition is being installed.

Extract: resources_en.jar... 37%

Step 7) Once installation is finished, you should receive a message screen that PyCharm is installed. If you want to go ahead and run it, click the "Run PyCharm Community Edition" box first and click "Finish".


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

(b) Write a program to implement all arithmetic operators.

```
num1=eval(input("Enter value of num1: "))
num2=eval(input("Enter value of num2: "))
def add(a,b):
   return a+b
def sub(a,b):
   return a-b
def mul(a,b):
   return a*b
def div(a,b):
   return a/b
print("select operation")
print("1.Addition")
print("2.Subtraction")
print("3.Multiplication")
print("4.Division")
choice=eval(input("Enter the choice: "))
print(choice)
if choice==1:
    print("Addition is: ",add(num1,num2))
elif choice==2:
    print("Subtraction is: ",sub(num1,num2))
elif choice==3:
    print("Multiplication is: ",mul(num1,num2))
elif choice==4:
    print("Division is: ",div(num1,num2))
else:
    print("Invalid Input")
```

Output:

```
Enter value of num1: 20
Enter value of num2: 10
select operation
1.Addition
2.Subtraction
3.Multiplication
4.Division
Enter the choice: 1
1
Addition is:  30
Enter value of num1: 20
Enter value of num2: 10
select operation
1.Addition
2.Subtraction
3.Multiplication
4.Division
```

```
Enter the choice: 2
2
Subtraction is:  10
Enter value of num1: 20
Enter value of num2: 10
select operation
1.Addition
2.Subtraction
3.Multiplication
4.Division
Enter the choice: 3
3
Multiplication is:  200
Enter value of num1: 20
Enter value of num2: 10
select operation
1.Addition
2.Subtraction
3.Multiplication
4.Division
Enter the choice: 4
4
Division is:2.0
Enter value of num1: 20
Enter value of num2: 10
select operation
1.Addition
2.Subtraction
3.Multiplication
4.Division
Enter the choice: 5
5
Invalid Input
```

(c) Write a program to find the largest out of three numbers given by users.

```
num1=eval(input("Enter value of num1: "))
num2=eval(input("Enter value of num2: "))
num3=eval(input("Enter value of num3: "))

def max(a,b,c):
    if (a>b and a>c):
        return a
    elif (c>a and c>b):
        return c
    else:
        return b
print("Largest number is: ",max(num1,num2,num3))
```

Output:

```
Enter value of num1: 43
Enter value of num2: 23
Enter value of num3: 65
Largest number is:  65
```

(d) Display all prime numbers within range given by users.

```
lower=eval(input("Enter the lower Number:"))
higher=eval(input("Enter the higher Number:"))
l=1
for num in range(lower,higher+1):
   if(num>0):
      for i in range(2,num):
            if(num%i==0):
                l=1
                break
      if(l==1):
           l=0
      else:
          print("prime numbers are: ",num)
```

Output:

```
Enter the lower Number:1
Enter the higher Number:20
prime numbers are:  2
prime numbers are:  3
prime numbers are:  5
prime numbers are:  7
prime numbers are:  11
prime numbers are:  13
prime numbers are:  17
prime numbers are:  19
```

Practical 2

Aim: Develop programs to learn different types of structures(list, dictionary, tuples) in python.

(a) Create a list(list1) of ten elements. Separate the elements of list1 into two lists say(list2 and list3) , one for storing even and other for odd from list1.

```
list1=[ ]
n=int(input("enter the number of elements: "))
for i in range(1,n+1):
    b=int(input("enter element: "))
    list1.append(b)
list2=[ ]
list3=[ ]
for j in list1:
    if(j%2==0):
        list2.append(j)
    else:
        list3.append(j)
print("the even list: ",list2)
print("the odd list: ",list3)
```

Output:

```
enter the number of elements: 10

enter element: 23

enter element: 45

enter element: 68

enter element: 2

enter element: 6

enter element: 4

enter element: 31
enter element: 80

enter element: 57

enter element: 91

the even list:  [68, 2, 6, 4, 80]

the odd list:  [23, 45, 31, 57, 91]
```

(b) Create list1 and list2. Copy the content in list3.

```
list1=input("enter the content of list 1: \n")
list2=input("enter the content of list 2: \n")
list1=list1.split(' ')
list2=list2.split(' ')
list3=[ ]
list3.extend(list1)
list3.extend(list2)
print(list1)
print(list2)
print(list3)
```

Output:

```
enter the content of list 1:

A programming language is a formal language, which consist of a set of instructions that produce various kinds of output.

enter the content of list 2:

Programming languages are used to implement algorithms.

['A', 'programming', 'language', 'is', 'a', 'formal', 'language,', 'which', 'consist', 'of', 'a', 'set', 'of', 'instructions', 'that', 'produce', 'various', 'kinds', 'of', 'output.']

['Programming', 'languages', 'are', 'used', 'to', 'implement', 'algorithms.']
```

```
['A', 'programming', 'language', 'is', 'a', 'formal', 'language,', 'which', 'consist', 'of', 'a', 'set', 'of',
'instructions', 'that', 'produce', 'various', 'kinds', 'of', 'output.', 'Programming', 'languages', 'are',
'used', 'to', 'implement', 'algorithms.']
```

(c) Create two 3x3 matrix using list and store addition in the result matrix.

```
A=[ ]
n=int(input("Enter size for matrix: "))
print("Enter the elements : ")
for i in range(n):
    row=[ ]
    for j in range(n):
        row.append(int(input()))
    A.append(row)

print("matrix 1: \n")
for i in range(n):
   for j in range(n):
      print(A[i][j], end=" ")
   print()

B=[ ]
n=int(input("Enter size for matrix : "))
print("Enter the elements : ")
for i in range(n):
   row=[]
   for j in range(n):
      row.append(int(input()))
   B.append(row)



print("matrix 2: \n")
for i in range(n):
   for j in range(n):
      print(B[i][j], end=" ")
   print()
result = [[0,0,0], [0,0,0], [0,0,0]]
```

```
print("Resultant Matrix is : ")
for i in range(n):
    for j in range(len(A[0])):
       result[i][j] = A[i][j] + B[i][j]

for r in result:
   print(r)
```

Output:

```
Enter size for matrix: 3
Enter the elements :
1
3
5
7
9
2
4
6
8
matrix 1:

1 3 5
7 9 2
4 6 8
Enter size for matrix : 3
Enter the elements :
2
4
6
8
1
3
5
```

```
7
9
matrix 2:

2 4 6
8 1 3
5 7 9
Resultant Matrix is :
[3, 7, 11]
[15, 10, 5]
[9, 13, 17]
```

(d) Write a program to demonstrate class concepts along with constructor and destructor.

```
class abc:
    def __init__(self,name,year,private):
        self.name=name
        self.year=year
        self.__private=private
    def __del__(self):
        print("object with value %d is going out of scope" %self.year)
    def __repr__(self):
         return repr(self.name)
    def show(self):
        print(self.name)
        print(self.year)
        print(self.__private)
n1=abc("hello",123,16)
n1.show()
print("repr",repr(n1))
n2=abc("Object 2",456,12)
n2.show()
del n1
del n2
```

Output:

```
hello

123

16

repr 'hello'

Object 2

456
```

```
12

object with value 123 is going out of scope

object with value 456 is going out of scope
```

(e) Demonstrate use of dictionary and all its functions which can be operated on dictionary(i.e len(),itmes(),keys(),values() etc.....)

```
d1={"abc":98,"xyz":97,"pqr":95}
d2={}
print("Length of the dictionary: ",len(d1))
print(d1.keys())
print(d1.values())
print(d1.items())
del d1["pqr"]
print("After deleting: ",d1)
print("Copied dictionary: ",d1.copy())
print("Pop last elements: ",d1.popitem())
print("Get value by key: ",d1.get("abc"))
```

Output:

```
Length of the dictionary:  3

dict_keys(['abc', 'xyz', 'pqr'])

dict_values([98, 97, 95])

dict_items([('abc', 98), ('xyz', 97), ('pqr', 95)])

After deleting:  {'abc': 98, 'xyz': 97}

Copied dictionary:  {'abc': 98, 'xyz': 97}

Pop last elements:  ('xyz', 97)

Get value by key:  98
```

Practical 3

Aim: Develop program to learn concept of functions scooping, recursion and list mutability.

(a) Write a program to generate Fibonacci series using recursion.

```
ctr=0
def fibo(a,b,crt):
    c=a+b
    print(c)
    a=b
    b=c
    global ctr
    ctr=ctr+1
    if(ctr<10):
        fibo(a,b,ctr)
    else:
        return c
print(0)
print(1)
fibo(0,1,ctr)
```

Output:

```
0

1

1

2

3

5

8

13
```

```
21

34

55

89
```

(b) write a program to create a calculator(for each operator keep separate function)

Pract3_b1:

```
import math
def add(a,b):
    return a+b
def sub(a,b):
    return a-b
def mul(a,b):
    return a*b
def div(a,b):
    return a/b
def mod(a,b):
    return a%b
def rec(a):
    return (1/a)
def nigate(a):
    return (-a)
def sqrt(a):
    return (math.sqrt(a))
```

Pract3_b2:

```
import pract3_b1
a=int(input("Enter a: "))
b=int(input("Enter b: "))
print(pract3_b1.add(a, b))
print(pract3_b1.sub(a, b))
print(pract3_b1.mul(a, b))
print(pract3_b1.div(a, b))
print(pract3_b1.mod(a, b))
print(pract3_b1.rec(a))
print(pract3_b1.nigate(a))
print(pract3_b1.sqrt(a))
```

Output:

```
Enter a: 2
Enter b: 5
7
-3
10
0.4
2
0.5
-2
1.4142135623730951
```

Practical 4

Aim: Develop programs to understand working of exception handling

(a) Write a program to handle file opening(file not found) and divide by zero exception.

```
ifile=0
a=int(input("Enter number1: "))
b=int(input("Enter number2: "))
try:
    print(a/b)
except ZeroDivisionError:
        print("divid by 0")
else:
    while(ifile==0):
        try:
           i=input("Enter file name: ")
           file=open(i,"r")
        except FileNotFoundError:
             print("File could not be found")
        else:
             for line in file:
                 print(line)
                 ifile=1
        finally:
             if(ifile==1):
                  print("File operation completed successfully")
             else:
                 print("Enter correct file name")
```

Output:

```
Enter number1: 4

Enter number2: 2

2.0
```

```
Enter file name: file.txt

hello, how are you ??

good morning

File operation completed successfully
```

(b) Write a program to handle exception generated due to immutability of tuple element.

```
try:
    t=('j',19,5,'r')
    t[2]='k'
except ZeroDivisionError:
    print("divide by zero error")
except TypeError:
    print("Tuple is immutable")
else:
    print(t)
```

Output:

```
Tuple is immutable
```

Practical 5

Aim: Develop programs for data structure algorithms using python –searching, sorting and has tables.

(a) W.A.P to perform selection sort.

```
n=int(input("Enter the number of elements: "))
l=[]
for i in range(n):
    a=input("Enter the elements: ")
    l.append(a)
print("Before sorting: ",l)
def selsort(l):
    s=0
    while s!=len(l):
        for i in range(s,len(l)):
            if l[s]>l[i]:
                l[s],l[i]=l[i],l[s]
        s+=1
    return l
print("After sorting: ",selsort(l))
```

Output:

```
Enter the number of elements: 5

Enter the elements: 5

Enter the elements: 4

Enter the elements: 6

Enter the elements: 3

Enter the elements: 2

Before sorting:  ['5', '4', '6', '3', '2']

After sorting:  ['2', '3', '4', '5', '6']
```

(b) W.A.P to merge sort.

```
n=int(input("Enter the number of elements: "))
l=[]
for i in range(1,n+1):
    a=input("Enter the elements: ")
    l.append(a)
print("Before sorting: ",l)
def mergesort(l):
    if len(l)>1:
        mid=len(l)//2
        left=l[:mid]
        right=l[mid:]
        mergesort(left)
        mergesort(right)
        i=j=k=0
        while(i<len(left) and j<len(right)):
            if left[i]<right[j]:
                l[k]=left[i]
                i=i+1
            else:
                l[k]=right[j]
                j=j+1
            k=k+1
        while i<len(left):
            l[k]=left[i]
            i=i+1
            k=k+1
        while j<len(right):
            l[k]=right[j]
            j=j+1
            k=k+1
    return l
print("After sorting: ",mergesort(l））
```

Output:

```
Enter the number of elements: 5

Enter the elements: 6

Enter the elements: 8

Enter the elements: 4

Enter the elements: 2

Enter the elements: 5

Before sorting:  ['6', '8', '4', '2', '5']

After sorting:  ['2', '4', '5', '6', '8']
```

(c) W.A.P to do binary search on sorted elements.

```
import math
n = int(input("Enter the number of elements: "))
arr = []
for i in range(1, n + 1):
    a = int(input("Enter the elements: "))
    arr.append(a)
print("sorted elements: ", sorted(arr))
x = int(input("Enter the value of x: "))
def binarysearch(arr, l, r, x):
    if r>=1:
        mid =math.floor(l+(r-l)/2)
        if(arr[mid] == x):
            return mid
        elif(arr[mid]>x):
            return  binarysearch(arr,l,mid-1,x)
        else:
            return  binarysearch(arr,mid+1,r,x)
    else:
          return -1
result = binarysearch(arr, 0, len(arr)-1, x)
if result != -1:
    print("Element is present at index %d" % result)
else:
    print("Element is not present in list.")
```

Output:

```
Enter the number of elements: 5

Enter the elements: 4

Enter the elements: 3

Enter the elements: 5
Enter the elements: 1

Enter the elements: 2

sorted elements:  [1, 2, 3, 4, 5]

Enter the value of x: 4

Element is present at index 3
```

Practical 6

Aim: Develop programs to understand concepts of threading:

(a) Demonstrate the custom thread and use of join function.

```
import threading
def add(x,y,z):
   print("addition:{}".format(x+y+z))
def sub(x,y,z):
    print("\n subtraction:{}".format(x-y-z))
def mul(x,y,z):
    print("\n multiplication:{}".format(x*y*z))
def div(x,y,z):
    print("\n division:{}".format(x/y/z))
if __name__ == "__main__":
   t1=threading.Thread(target=add, args=(10,20,30,))
   t2=threading.Thread(target=sub, args=(10,20,30,))
   t3=threading.Thread(target=mul, args=(10,20,30,))
   t4=threading.Thread(target=div, args=(10,20,30,))
   t1.start()
   t2.start()
   t3.start()
   t4.start()
   t1.join()
   t2.join()
   t3.join()
   t4.join()
```

Output:

```
addition:60

subtraction:-40

division:0.016666666666666666
```

```
multiplication:6000
```

(b) Demonstrate the use of lock for threading.

```
import threading
x=0
def increment():
    global x
    x+=1
def thread_task(Lock):
    for _ in range(100000):
        Lock.acquire()
        increment()
        Lock.release()
def main_task():
    global x
    x=0
    lock1=threading.Lock()
    t1=threading.Thread(target=thread_task, args=(lock1,))
    t2=threading.Thread(target=thread_task, args=(lock1,))
    t1.start()
    t2.start()
    t1.join()
    t2.join()
if __name__ == "__main__" :
    for i in range(10):
        main_task()
        print("iteration{0}:x={1}".format(i,x))
```

Output:

```
iteration0:x=200000

iteration1:x=200000

iteration2:x=200000

iteration3:x=200000
```

```
iteration4:x=200000

iteration5:x=200000

iteration6:x=200000

iteration7:x=200000

iteration8:x=200000

iteration9:x=200000
```

Practical 7

Aim: Develop program for socket programming in Python.

(a) Write a program to perform TCP server and client.

Server:

```
import socket

def Main():
    host='127.0.0.1'
    port=5000
    s=socket.socket()
    s.bind((host,port))
    s.listen(1)
    c,addr=s.accept()
    print "Connection from:" +str(addr)
    print c
    while True:
        data=c.recv(1024)
        if not data:
            break
        print"from connected user:"+str(data)
        data=str(data).upper()
        print "sending :" + str(data)
        c.send(data)
    c.close()
if __name__=='__main__':
    Main()
```

Client:

```
import socket
```

```
def Main():
    host='127.0.0.1'
    port=5000

    s=socket.socket()
    s.connect((host,port))

    mess=raw_input("Enter message:")
    while mess!='q':
        s.send(mess)
        data=s.recv(1024)

        print "Received from server:"+str(data)
        mess=raw_input("Enter data:")
    s.close()
if __name__=='__main__':
    Main()
```

Output:

Server:

```
 Connection from: ('127.0.0.1', 50057)
 from connected user : hello
sending : HELLO
```

Client:

```
 Enter data: hello
Received from server: HELLO

Enter data: q

Connection Terminated
```

(b) Write a program to perform UDP server and client.

Server:

```
import socket
UDP_IP ="localhost"
UDP_PORT = 8080
MESSAGE = input('Send message : ')
print("message:",MESSAGE)
print("message sent")
sock = socket.socket(socket.AF_INET, socket.SOCK_DGRAM)
sock.sendto(bytes(MESSAGE, "utf-8"), (UDP_IP, UDP_PORT))
```

Client:

```
import socket
UDP_IP = "localhost"
UDP_PORT = 8080
sock = socket.socket(socket.AF_INET, socket.SOCK_DGRAM)
sock.bind((UDP_IP, UDP_PORT))
while True:
    # buffer size is 1024 bytes
  data, addr = sock.recvfrom(1024)
  print("Received message:",
    data.decode())
```

Output:

Server:

```
Send message :
hello
message: hello
message sent
```

Client:

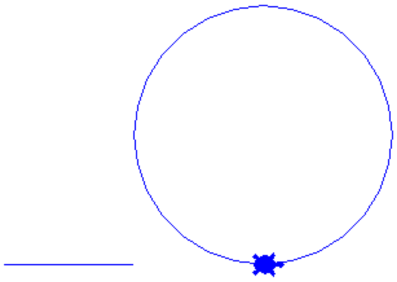
```
Received message:hello
```

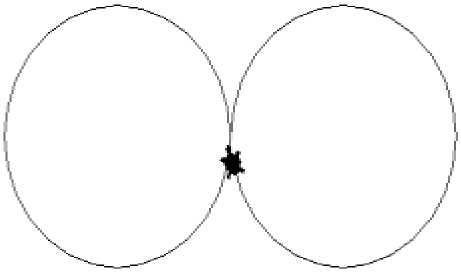
Practical 8

Aim: Demonstrate various functions of turtle

```
import turtle

a=turtle.Pen()

a.shape("turtle")

a.speed(10)

a.color("red")

a.width(5)

a.forward(100)

a.reset()

a.circle(100)

a.circle(-100)

a.reset()

a.color("blue")

a.forward(100)

a.up()

a.forward(100)

a.down()

a.circle(100)
```

Output:



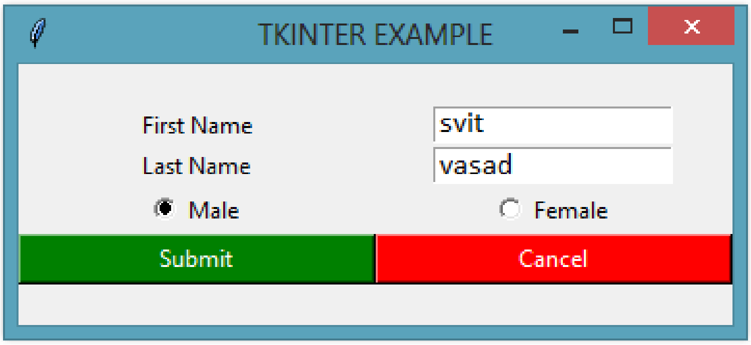


Practical 9

Aim: Develop program to demonstrate Tkinter for GUI. Demonstrate the use of radio button and button using Tkinter.

```
from tkinter import *

master = Tk()

master.title("TKINTER EXAMPLE")

Label(master).grid(row=0)

Label(master, text='First Name').grid(row=1)

Label(master, text='Last Name').grid(row=2)

e1 = Entry(master)

e2 = Entry(master)

e1.grid(row=1, column=1)

e2.grid(row=2, column=1)

v = IntVar()

Radiobutton(master, text='Male', variable=v, value=1).grid(row=4,column=0)

Radiobutton(master, text='Female', variable=v, value=2).grid(row=4,column=1)

Button(master, bg='green',fg='white',text='Submit', width=25, ).grid(row=5)

Button(master, bg='red',fg='white',text='Cancel', width=25,

command=master.destroy).grid(row=5,column=1)

Label(master, text=e1.get()).grid(row=6)

mainloop()
```

Output:



TKINTER EXAMPLE

First Name svit

Last Name vasad

● Male ○ Female

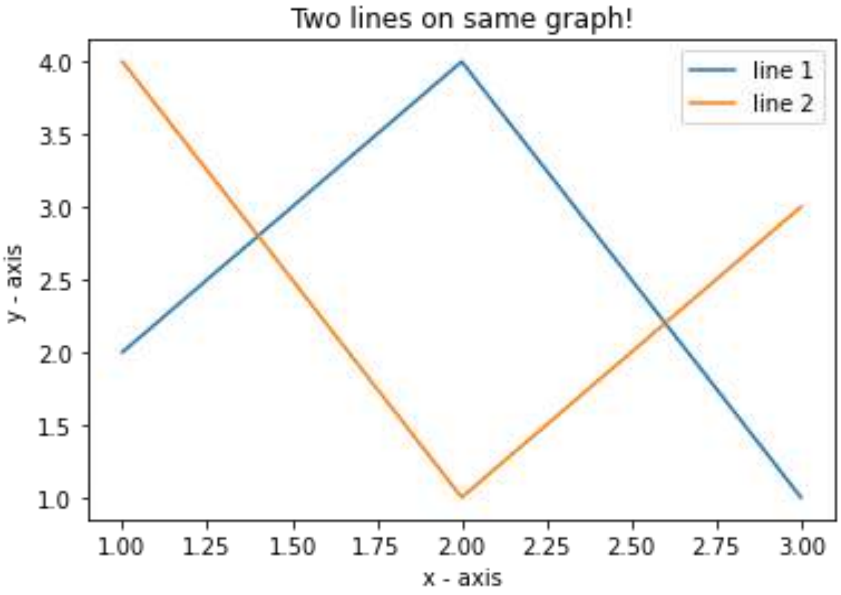
Practical 10

Aim: Learn to plot different types of graphs using pyplot.

(a) Simple Plot

```
import matplotlib.pyplot as plt
x1 = [1,2,3]
y1 = [2,4,1]
plt.plot(x1, y1, label = "line 1")
x2 = [1,2,3]
y2 = [4,1,3]
plt.plot(x2, y2, label = "line 2")
plt.xlabel('x - axis')
plt.ylabel('y - axis')
plt.title('Two lines on same graph!')
plt.legend()
plt.show()
```

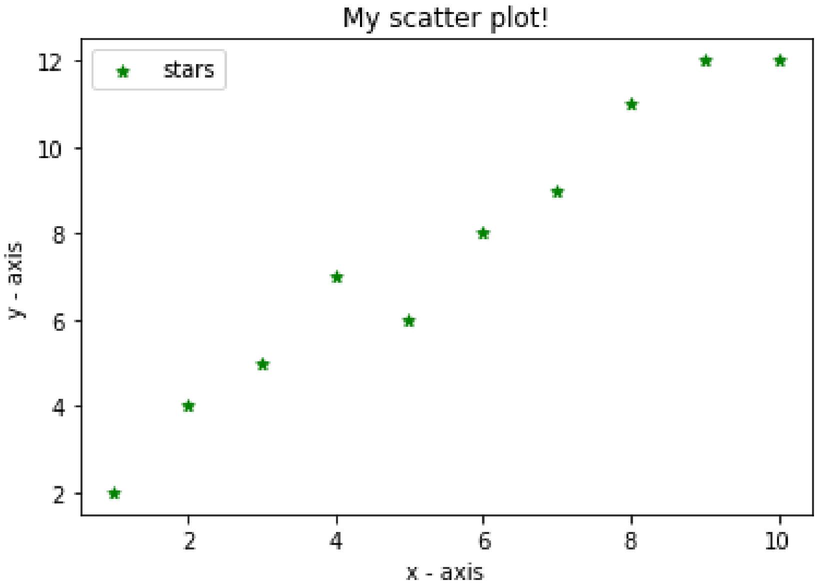
Output:



(b) Scatter Plot

```
import matplotlib.pyplot as plt
x = [1,2,3,4,5,6,7,8,9,10]
y = [2,4,5,7,6,8,9,11,12,12]
plt.scatter(x, y, label= "stars", color= "green",marker= "*", s=30)
plt.xlabel('x - axis')
plt.ylabel('y - axis')
plt.title('My scatter plot!')
plt.legend()
plt.show()
```

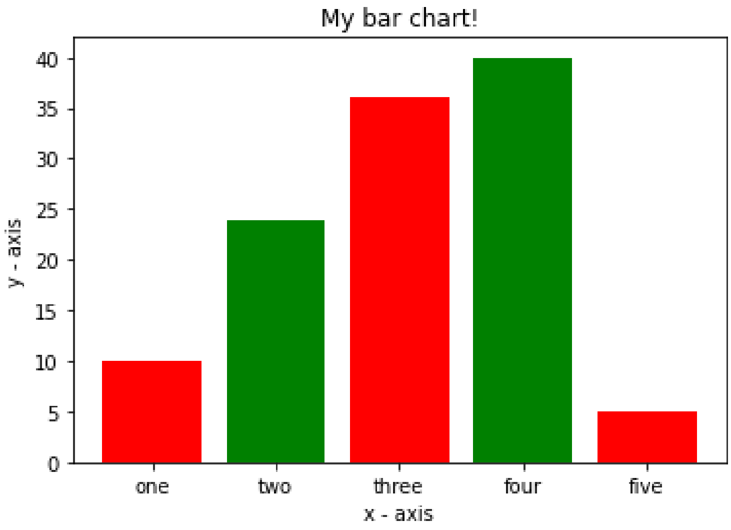
Output:



(c) Bar Graph Plot

```
import matplotlib.pyplot as plt
left = [1, 2, 3, 4, 5]
height = [10, 24, 36, 40, 5]
tick_label = ['one', 'two', 'three', 'four', 'five']
plt.bar(left, height, tick_label = tick_label,width = 0.8, color = ['red', 'green'])
plt.xlabel('x - axis')
plt.ylabel('y - axis')
plt.title('My bar chart!')
plt.show()
```

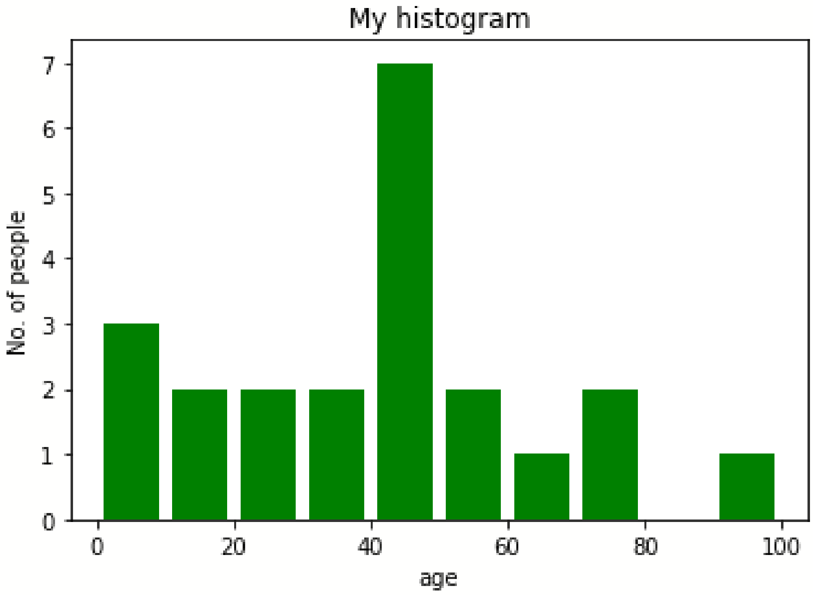
Output:



(d) Histogram Plot

```
import matplotlib.pyplot as plt
ages = [2,5,70,40,30,45,50,45,43,40,44,60,7,13,57,18,90,77,32,21,20,40]
range = (0, 100)
bins = 10
plt.hist(ages, bins, range, color = 'green',histtype = 'bar', rwidth = 0.8)
plt.xlabel('age')
plt.ylabel('No. of people')
plt.title('My histogram')
plt.show()
```

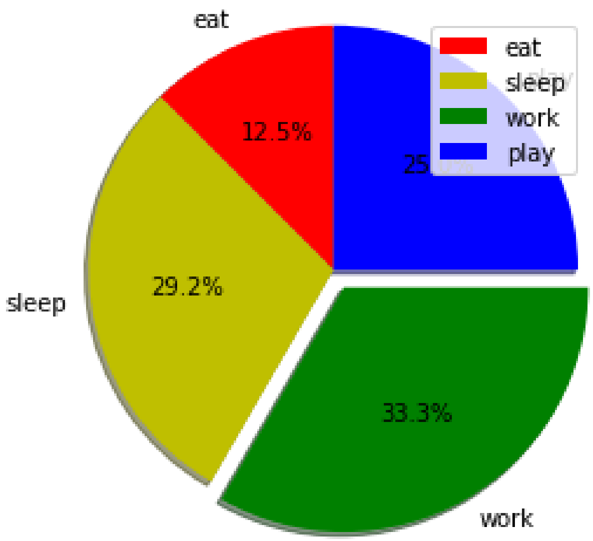
Output:



(e) Pie Plot

```
import matplotlib.pyplot as plt
activities = ['eat', 'sleep', 'work', 'play']
slices = [3, 7, 8, 6]
colors = ['r', 'y', 'g', 'b']
plt.pie(slices, labels = activities, colors=colors,startangle=90, shadow = True, explode = (0, 0,
 0.1, 0),
radius = 1.2, autopct = '%1.1f%%')
plt.legend()
plt.show()
```

Output:



Practical 11

Aim: Implement classical ciphers using python.

```
def encrypt(text, s):
    result = ""
    for i in range(len(text)):
        char = text[i]
        if (char.isupper()):
            result += chr((ord(char) + s - 65) % 26 + 65)
        else:
            result += chr((ord(char) + s - 97) % 26 + 97)
    return result
text = input("Enter text: ")
s=int(input("enter key: "))
print("Text  : " ,text)
print("Shift : " ,str(s))
print("Cipher: " , encrypt(text, s) )
```

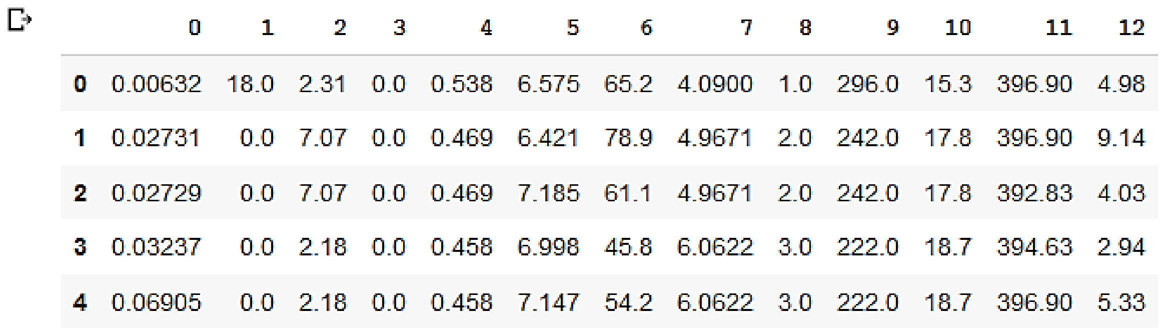
Output:

```
Enter text: apqyz
enter key: 2
Text  : apqyz
Shift :  2
Cipher:  crtab
```

Beyond Syllabus Practical

Aim: Implement Linear regression technique on boston_house dataset in python.

```
# -*- coding: utf-8 -*-
"""beyond_linear_reg.ipynb
Automatically generated by Colaboratory.
"""
# import all the important libraries.
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
import seaborn as sns
# %matplotlib inline
import sklearn
from sklearn.model_selection import train_test_split
from sklearn.linear_model import LinearRegression
from sklearn import metrics
from sklearn.metrics import r2_score

# load the boston dataset from the sklearn library.
from sklearn.datasets import load_boston
boston = load_boston()

# load the data into a pandas dataframe and then will print the first few rows of the data
bos = pd.DataFrame(boston.data)
bos.head()
```

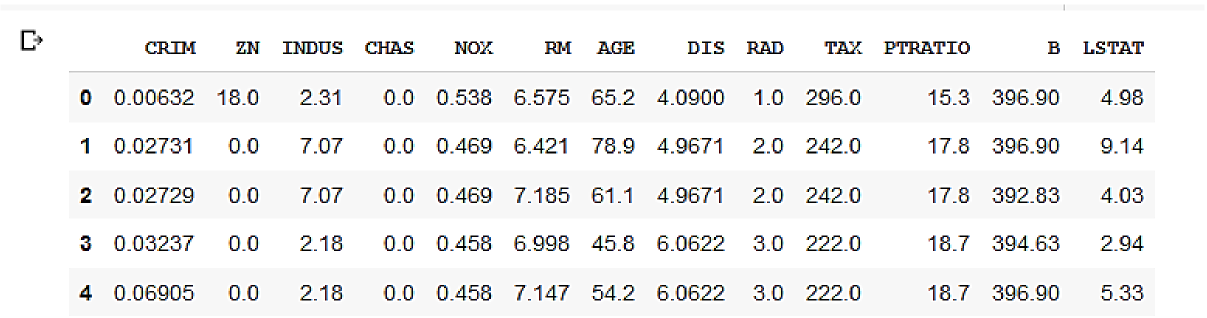


	0	1	2	3	4	5	6	7	8	9	10	11	12
0	0.00632	18.0	2.31	0.0	0.538	6.575	65.2	4.0900	1.0	296.0	15.3	396.90	4.98
1	0.02731	0.0	7.07	0.0	0.469	6.421	78.9	4.9671	2.0	242.0	17.8	396.90	9.14
2	0.02729	0.0	7.07	0.0	0.469	7.185	61.1	4.9671	2.0	242.0	17.8	392.83	4.03
3	0.03237	0.0	2.18	0.0	0.458	6.998	45.8	6.0622	3.0	222.0	18.7	394.63	2.94
4	0.06905	0.0	2.18	0.0	0.458	7.147	54.2	6.0622	3.0	222.0	18.7	396.90	5.33

# rename the columns as the description of the dataset given above.

bos.columns = ['CRIM', 'ZN', 'INDUS', 'CHAS', 'NOX', 'RM', 'AGE', 'DIS', 'RAD', 'TAX', 'PTRATIO', 'B', 'LSTAT']

bos.head()



	CRIM	ZN	INDUS	CHAS	NOX	RM	AGE	DIS	RAD	TAX	PTRATIO	B	LSTAT
0	0.00632	18.0	2.31	0.0	0.538	6.575	65.2	4.0900	1.0	296.0	15.3	396.90	4.98
1	0.02731	0.0	7.07	0.0	0.469	6.421	78.9	4.9671	2.0	242.0	17.8	396.90	9.14
2	0.02729	0.0	7.07	0.0	0.469	7.185	61.1	4.9671	2.0	242.0	17.8	392.83	4.03
3	0.03237	0.0	2.18	0.0	0.458	6.998	45.8	6.0622	3.0	222.0	18.7	394.63	2.94
4	0.06905	0.0	2.18	0.0	0.458	7.147	54.2	6.0622	3.0	222.0	18.7	396.90	5.33

# The variable MEDV indicates the prices of the houses and is the target variable.

# The rest of the variables are the predictors based on which we will predict the value of the house.

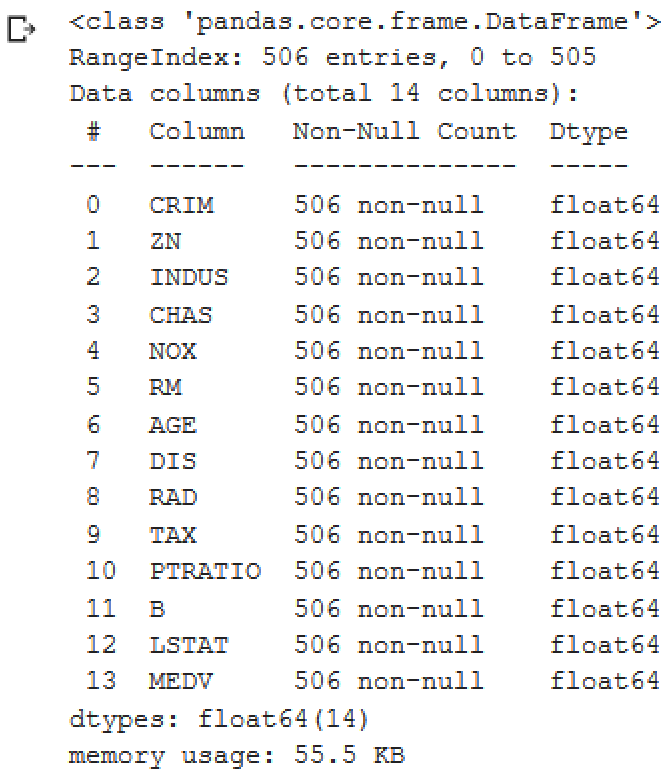
# In the above result, we can see that the target variable ‘MEDV’ is missing from the data.

# We will create a new column of target values and add them to the dataframe.

bos['MEDV'] = boston.target

# fetching more information about the dataset

bos.info()

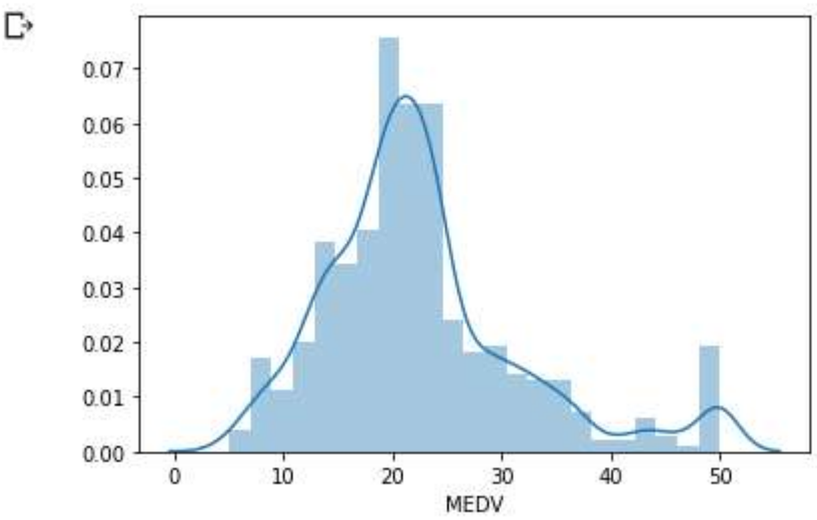


```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 506 entries, 0 to 505
Data columns (total 14 columns):
 #   Column   Non-Null Count  Dtype  
---  ------   --------------  -----  
 0   CRIM     506 non-null    float64
 1   ZN       506 non-null    float64
 2   INDUS    506 non-null    float64
 3   CHAS     506 non-null    float64
 4   NOX      506 non-null    float64
 5   RM       506 non-null    float64
 6   AGE      506 non-null    float64
 7   DIS      506 non-null    float64
 8   RAD      506 non-null    float64
 9   TAX      506 non-null    float64
 10  PTRATIO  506 non-null    float64
 11  B        506 non-null    float64
 12  LSTAT    506 non-null    float64
 13  MEDV     506 non-null    float64
dtypes: float64(14)
memory usage: 55.5 KB
```

# understand the relationship of the target variable with other variables using Exploratory Data Analysis(EDA)

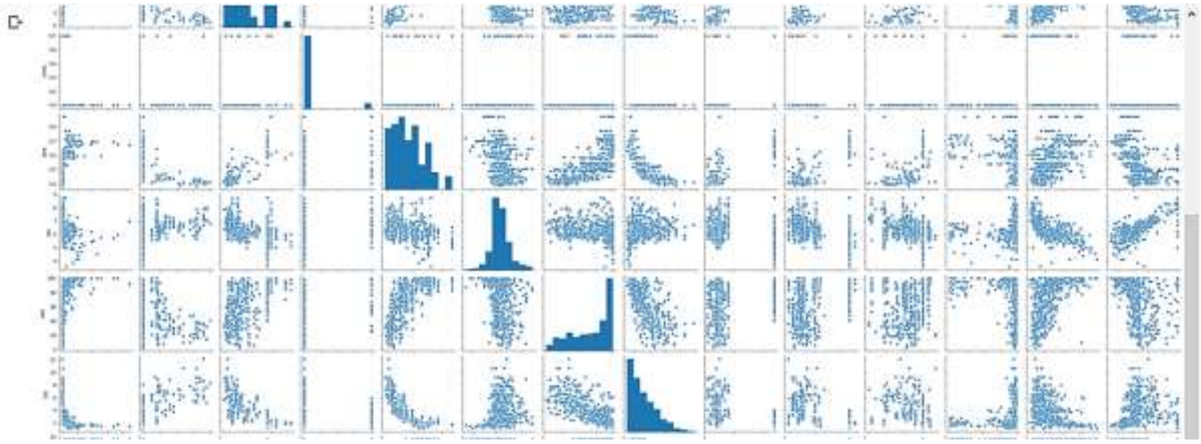
sns.distplot(bos['MEDV'])

plt.show()



# visualize the pairplot which shows the relationships between all the features present in the dataset.

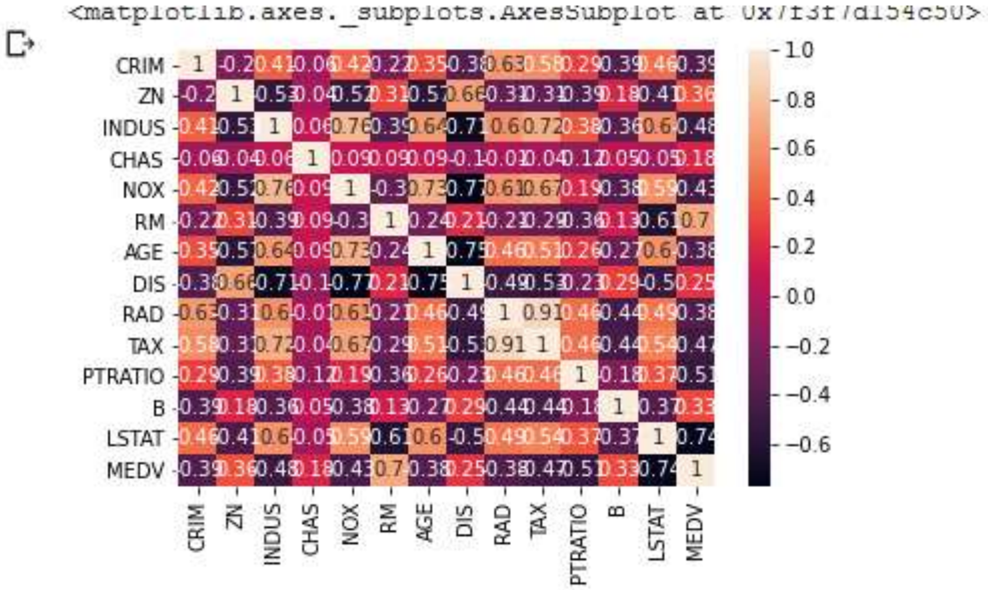
sns.pairplot(bos)



# use the heatmap function from the seaborn library to plot the correlation matrix.

corr_mat = bos.corr().round(2)

sns.heatmap(data=corr_mat, annot=True)

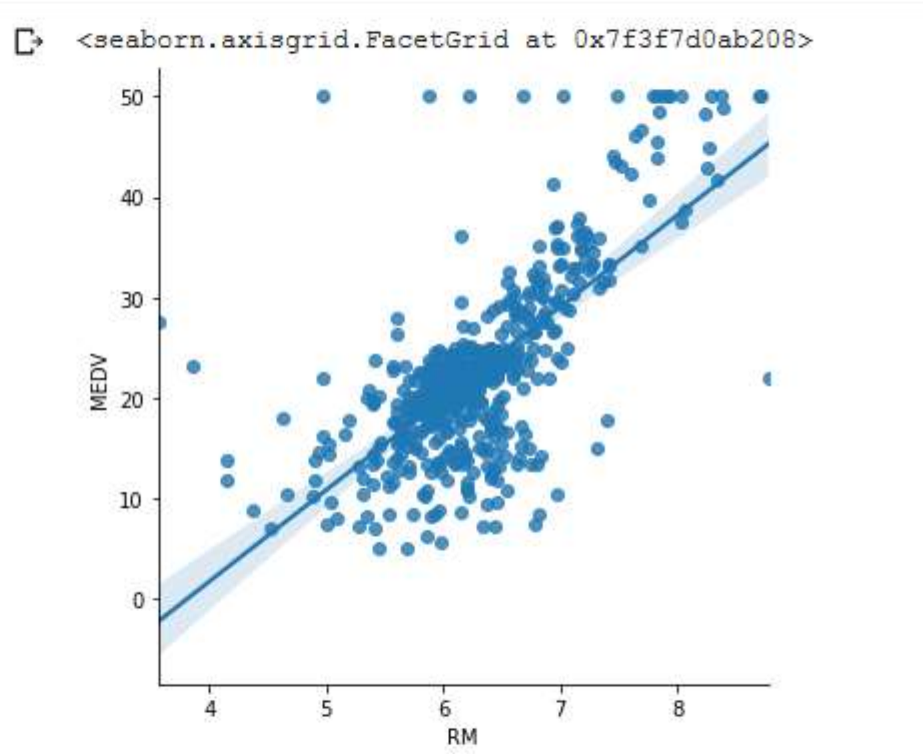


```
<matplotlib.axes._subplots.AxesSubplot at 0x7f3f7d154c50>
```

# feature RM has a positive correlation with MEDV from above two plots.

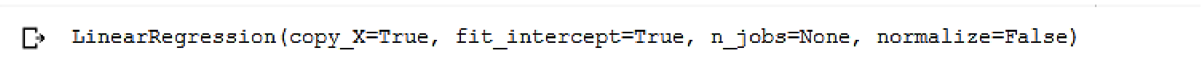
# plot an lmplot between RM and MEDV to see the relationship between the two more clearly.

sns.lmplot(x = 'RM', y = 'MEDV', data = bos)



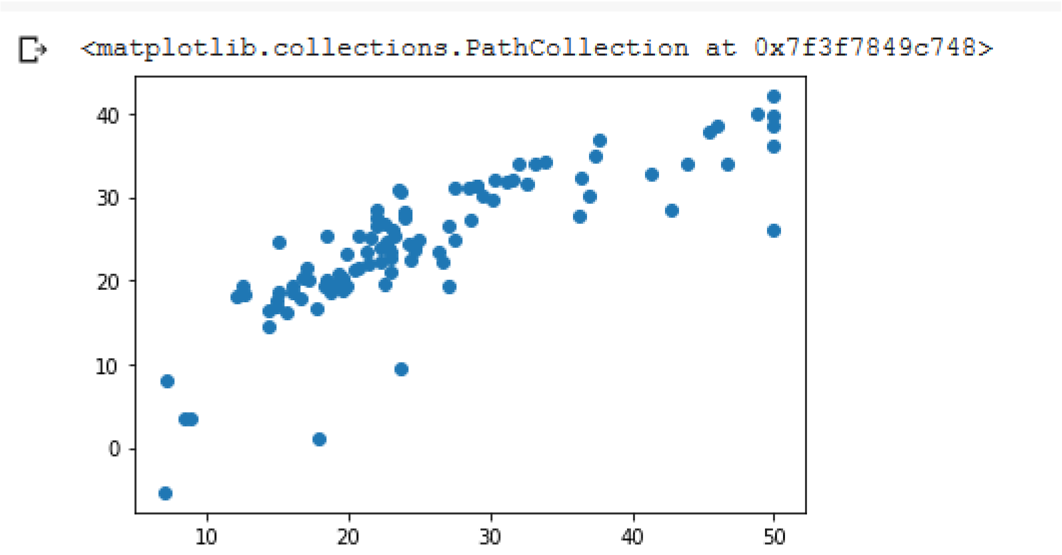
```
<seaborn.axisgrid.FacetGrid at 0x7f3f7d0ab208>
```

```
# split the dataset into training and test data

# train our model with 80% of the samples and test with the remaining 20%

X = bos[['CRIM', 'ZN', 'INDUS', 'CHAS', 'NOX', 'RM', 'AGE', 'DIS', 'RAD',
'TAX','PTRATIO', 'B', 'LSTAT']]

y = bos['MEDV']

X_train, X_test, y_train, y_test = train_test_split(X, y, test_size = 0.2, random_state = 10)

# train our model using the LinearRegression function from the sklearn library

lm = LinearRegression()

lm.fit(X_train, y_train)
```



```
LinearRegression(copy_X=True, fit_intercept=True, n_jobs=None, normalize=False)
```

```
# make prediction on the test data using the LinearRegression function

# plot a scatterplot between the test data and the predicted value

prediction = lm.predict(X_test)

plt.scatter(y_test, prediction)
```



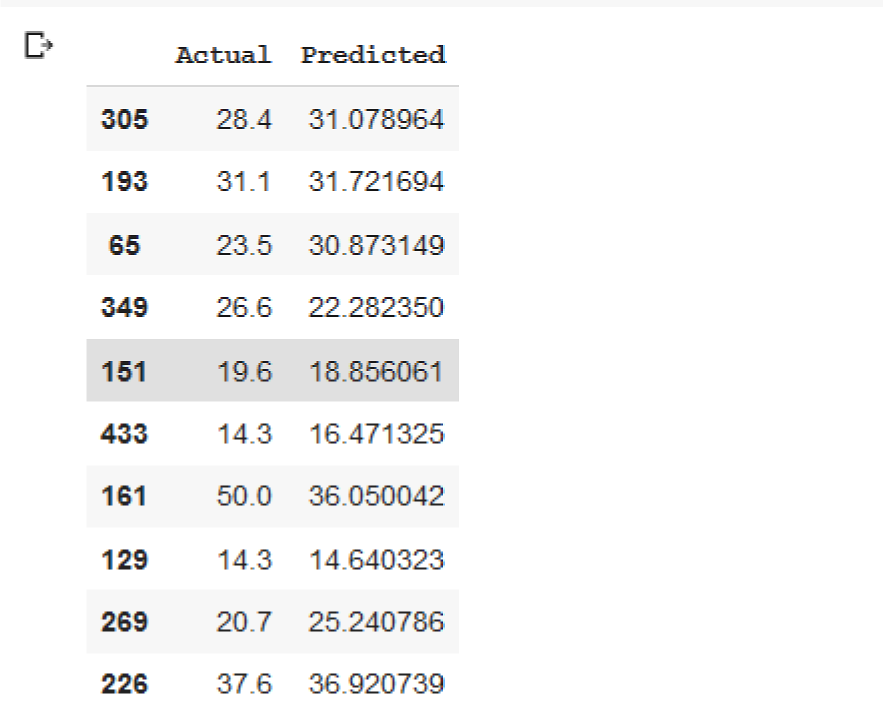
```
<matplotlib.collections.PathCollection at 0x7f3f7849c748>
```

# Plotting the data frame for the actual and predicted value

df1 = pd.DataFrame({'Actual': y_test, 'Predicted':prediction})

df2 = df1.head(10)

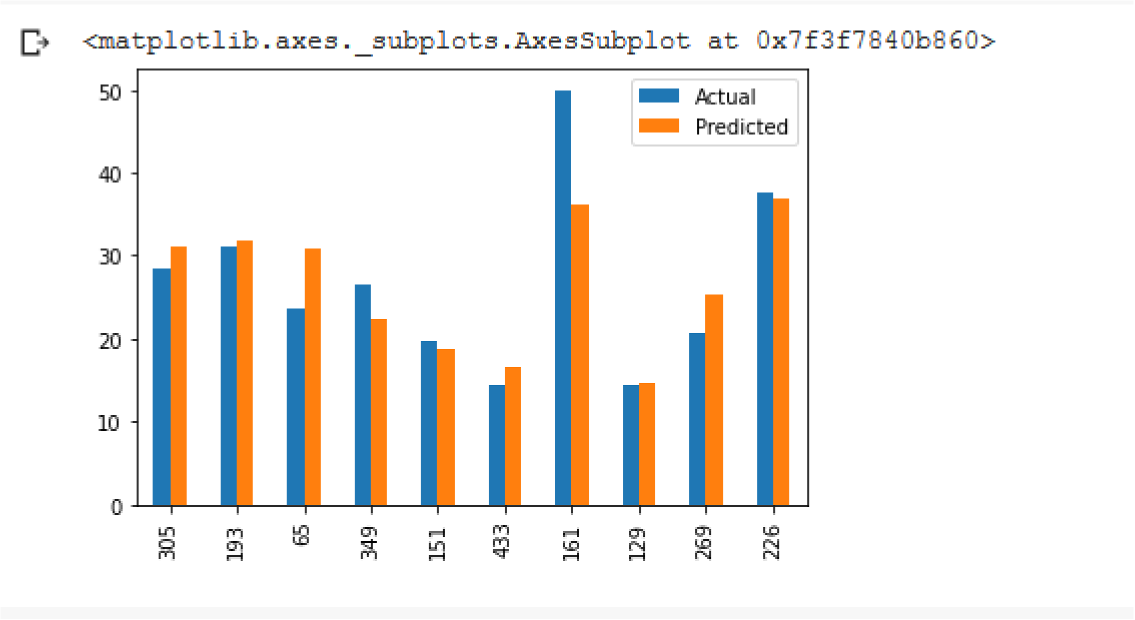
df2



	Actual	Predicted
305	28.4	31.078964
193	31.1	31.721694
65	23.5	30.873149
349	26.6	22.282350
151	19.6	18.856061
433	14.3	16.471325
161	50.0	36.050042
129	14.3	14.640323
269	20.7	25.240786
226	37.6	36.920739

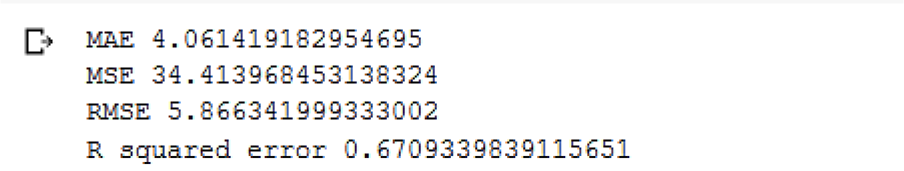
# plotting graph

df2.plot(kind = 'bar')



```
<matplotlib.axes._subplots.AxesSubplot at 0x7f3f7840b860>
```

```
# evaluate the model

print('MAE', metrics.mean_absolute_error(y_test, prediction))
print('MSE', metrics.mean_squared_error(y_test, prediction))
print('RMSE', np.sqrt(metrics.mean_squared_error(y_test, prediction)))
print('R squared error', r2_score(y_test, prediction))
```



```
MAE 4.061419182954695
MSE 34.413968453138324
RMSE 5.866341999333002
R squared error 0.6709339839115651
```