SRI VASAVI ENGINEERING COLLEGE(AUTONOMOUS) PEDATADEPALLI,

TADEPALLIGUDEM.

DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

Certificate

This is to certify that this is a bonafide record of Practical Work done in **Machine Learning Lab** by Mr./Mrs ____________________________ Bearing Reg.No. ____________________ of CSE Branch of **VI Semester** during the academic year **2024-25.**

No. of Experiments Done: 11

Faculty Incharge of the Laboratory   Head of the Department

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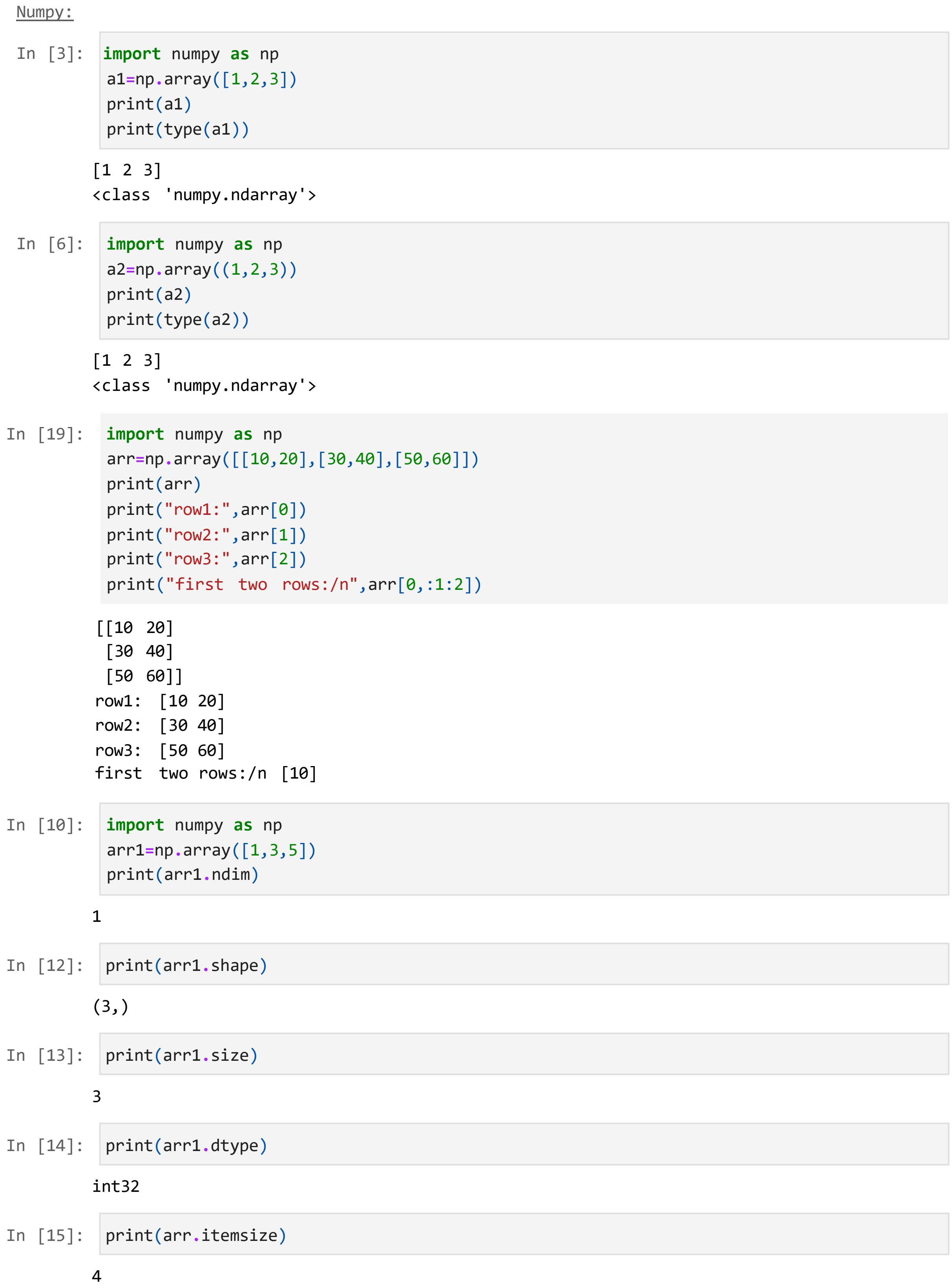
Experiment-1

Aim: Introduction to required python libraries such as Numpy, Pandas, Matplotlib, Scipy, Sklearn



Numpy:

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

```
[1 2 3]
<class 'numpy.ndarray'>
```

In [6]:
```
import numpy as np
a2=np.array((1,2,3))
print(a2)
print(type(a2))
```

```
[1 2 3]
<class 'numpy.ndarray'>
```

In [19]:
```
import numpy as np
arr=np.array([[10,20],[30,40],[50,60]])
print(arr)
print("row1:",arr[0])
print("row2:",arr[1])
print("row3:",arr[2])
print("first two rows:/n",arr[0,:1:2])
```

```
[[10 20]
 [30 40]
 [50 60]]
row1: [10 20]
row2: [30 40]
row3: [50 60]
first two rows:/n [10]
```

In [10]:
```
import numpy as np
arr1=np.array([1,3,5])
print(arr1.ndim)
```

```
1
```

In [12]:
```
print(arr1.shape)
```

```
(3,)
```

In [13]:
```
print(arr1.size)
```

```
3
```

In [14]:
```
print(arr1.dtype)
```

```
int32
```

In [15]:
```
print(arr.itemsize)
```

```
4
```

In [24]:

```
import numpy as np
z1=np.zeros(5)
print(z1)
```

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

In [26]:

```
import  numpy  as  np
z2=np.zeros((2,3))
print(z2)
```

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

In [28]:

```
import numpy as np
z3=np.zeros((2,3),dtype=np.uint8)
print(z3)
```

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

In [37]:

```
import numpy as np
a=np.array([1,2,3])
b=np.array([[1,2,3],[4,5,6]])
c=np.array([[[1,2,3],[4,5,6]],[[7,8,9],[2,8,4]]])
print(c)
print(a.ndim)
print(b.ndim)
print(c.ndim)
```

```
[[[1 2 3]
  [4 5 6]]

 [[7 8 9]
  [2 8 4]]]
1
2
3
```

In [42]:

```
import numpy as np
arr=np.array([[1,2,3,4,5],[6,7,8,9,10]])
print('last  element  from  2nd  dim:',arr[1,-3])
```

```
last element from 2nd dim: 8
```

In [49]:

```
import numpy as np
arr3=np.array([1,2,3,4,5,6,7,8])
print(arr3[1:4])
print(arr3[-3:-1])
print(arr3[1:5:2])
```

```
[2 3 4]
[6 7]
[2 4]
```

```
In [54]: import numpy as np
         a4=np.array([[1,2,3,4,5],[6,7,8,9,10]])
         print(a4[1,1:4])
```

```
[7 8 9]
```

```
In [56]: print(a4[1,-3:-1])
```

```
[8 9]
```

```
In [59]: print(a4[0:2,1:4])
```

```
[[2 3 4]
 [7 8 9]]
```

```
In [60]: print(a4[::,2:5])
```

```
[[ 3  4  5]
 [ 8  9 10]]
```

```
In [66]: import numpy as np
         a=np.array([[1,2,3,4,5],[6,7,8,9,10]])
         a1=a.copy()
         print(a1)
         print(a.shape)
```

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

```
In [63]: a=a1.view()
         print(a1)
```

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

```
In [64]: a=np.array(['a','b'])
         print(a.dtype)
```

```
<U1
```

```
In [77]: import numpy as np
         arr1=np.array([1,2,3,4,5,6,7,8,9,10,11,12])
         arr2=arr1.reshape(4,3)
         arr3=arr1.reshape(2,3,2)
```

```
print(arr2)
print(arr3)
```

```
[[ 1  2  3]
 [ 4  5  6]
 [ 7  8  9]
 [10 11 12]]
[[[ 1  2]
  [ 3  4]
  [ 5  6]]

 [[ 7  8]
  [ 9 10]
  [11 12]]]
```

In [81]:

```
import numpy as np
a=np.array([[1,2,3],[6,7,8]])
for x in a:
     for y in x:
         print(y)
```

```
1
2
3
6
7
8
```

In [118…

```
import numpy as np

a1 = np.array([[1, 2, 3], [4, 5, 6]])
a2 = np.array([[7, 8, 9], [11, 12, 13]])


a3 = np.concatenate((a1, a2), axis=0)
print(a3)

a4 = np.concatenate((a1, a2), axis=1)
print(a4)
```

```
[[ 1  2  3]
 [ 4  5  6]
 [ 7  8  9]
 [11 12 13]]
[[ 1  2  3  7  8  9]
 [ 4  5  6 11 12 13]]
```

In [116…

```
s1=np.array([1,2,3,4,5])
s2=np.array([6,7,8,9,10])
s3=np.concatenate((s1,s2))
print(s3)
```

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

In [96]:

```
import numpy as np
a1=np.array([[1,2,3],[4,5,6]])
a2=np.array([[7,8,9],[11,12,13]])
a3=np.concatenate((a1,a2),axis=0)
print(a3)
```

```
[[ 1  2  3]
 [ 4  5  6]
 [ 7  8  9]
 [11 12 13]]
```

In [100…

```
import numpy as np
s1=np.array([1,2,3,4,5])
s2=np.array([6,7,8,9,10])
s3=np.stack((s1,s2),axis=1)
print(s3)
```

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

In [102…

```
import numpy as np
s1=np.array([1,2,3,4,5])
s2=np.array([6,7,8,9,10])
s3=np.hstack((s1,s2))
print(s3)
```

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

In [104…

```
import numpy as np
s1=np.array([1,2,3,4,5])
s2=np.array([6,7,8,9,10])
s3=np.dstack((s1,s2))
print(s3)
```

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

In [106…

```
import numpy as np
s1=np.array([1,2,3,4,5])
s2=np.array([6,7,8,9,10])
s3=np.vstack((s1,s2))
print(s3)
```

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

In [110…

```
import numpy as np
arr1=np.array([1,2,3,4,5,6,7,8,9,10,11,12])
arr2=np.split(arr1,4)
print(arr2)
```

```
[array([1, 2, 3]), array([4, 5, 6]), array([7, 8, 9]), array([10, 11, 12])]
```

In [111…

```
import numpy as np
arr1=np.array([1,2,3,4,5,6,7,8,9,10,11,12])
arr2=np.hsplit(arr1,4)
print(arr2)
```

```
[array([1, 2, 3]), array([4, 5, 6]), array([7, 8, 9]), array([10, 11, 12])]
```

```
s2=np.vsplit(s1,2)
print(s2)
```

```
[array([[1, 2, 3],
       [4, 5, 6]]), array([[ 7,  8,  9],
       [10, 11, 12]])]
```

In [122…

```
import numpy as np
s1=np.array([[1,2,3],[4,5,6],[7,8,9],[10,11,12]])
s2=np.split(s1,3,axis=1)
print(s2)
```

```
[array([[ 1],
       [ 4],
       [ 7],
       [10]]), array([[ 2],
       [ 5],
       [ 8],
       [11]]), array([[ 3],
       [ 6],
       [ 9],
       [12]])]
```

In [125…

```
import numpy as np
a1=np.arange(20).reshape(4,5)
print(a1)
print(np.vsplit(a1,4))
```

```
[[ 0  1  2  3  4]
 [ 5  6  7  8  9]
 [10 11 12 13 14]
 [15 16 17 18 19]]
[array([[0, 1, 2, 3, 4]]), array([[5, 6, 7, 8, 9]]), array([[10, 11, 12, 13, 1
4]]), array([[15, 16, 17, 18, 19]])]
```

In [120…

```
import numpy as np

a = np.array([4, 5, 2, 7, 8])

# Correct usage of np.split
a1 = np.split(a, [2, 4])  # Split at indices 2 and 4

print(a1)

a2 = np.split(a, 5) # split into 5 equal parts

print(a2)
```

```
[array([4, 5]), array([2, 7]), array([8])]
[array([4]), array([5]), array([2]), array([7]), array([8])]
```

In [ ]:

Pandas:

```
In [ ]: AIM:Introduction to required python libraries such as Numpy,Pandas,Scipy,Matplot
```

```
In [ ]: Description:Pandas is a python library used for working with datasets.
        It has functions for analysis,cleaning,exploration and manipulating the data.
```

```
In [2]: import pandas as pd
```

```
In [6]: a=[1,7,2]
        x=pd.Series(a)
        print(x)
```

```
0    1
1    7
2    2
dtype: int64
```

```
In [7]: print(x[0])
```

```
1
```

```
In [9]: import pandas as pd
        a=[1,7,2]
        x=pd.Series(a,index=["x","y","z"])
        print(x)
```

```
x    1
y    7
z    2
dtype: int64
```

```
In [10]: import pandas as pd
         calories={"day1":320,"day2":230,"day3":430}
         x=pd.Series(calories)
         print(x)
```

```
day1    320
day2    230
day3    430
dtype: int64
```

```
In [11]: import pandas as pd
         calories={"day1":320,"day2":230,"day3":430}
         x=pd.Series(calories,index=["day1","day2"])
         print(x)
```

```
day1    320
day2    230
dtype: int64
```

```
In [12]: sl1 = pd.Series([10, 20, 30, 40])
         print(sl1)
         print(type(sl1))
```

```
0    10
1    20
2    30
3    40
```

In [15]:

```
import numpy as np
x=np.array([1,2,3,4,5])
p=pd.Series(x)
print(p)
```

```
0    1
1    2
2    3
3    4
4    5
dtype: int32
```

In [16]:

```
y={1:'a',2:'b',3:'c'}
x=pd.Series(y)
print(y)
```

```
{1: 'a', 2: 'b', 3: 'c'}
```

In [19]:

```
import pandas as pd
x=pd.Series(data=[1,2,3,4],index=['i','ii','iii','iv'])
y=pd.Series(data=['a','b','c','d','e'])
print(x)
print(x.index)
print(x.values)
print(x.shape)
print(x.dtype)
print(x.size)
print(x.ndim)
print(x.nbytes)
print(y)
```

```
i      1
ii     2
iii    3
iv     4
dtype: int64
Index(['i', 'ii', 'iii', 'iv'], dtype='object')
[1 2 3 4]
(4,)
int64
4
1
32
0    a
1    b
2    c
3    d
4    e
dtype: object
```

In [48]:

```
import numpy as np
import pandas as pd
```

In [47]:
```
a=pd.Series(['java','c','c++',np.nan])
a.map({'java':'core'})
```

Out[47]:
```
0    core
1     NaN
2     NaN
3     NaN
dtype: object
```

In [26]:
```
import pandas as pd
import numpy as np
a=pd.Series(['java','c','c++',np.nan])
a.map({'java':'core'})
a.map('i like {}'.format,na_action='ignore')
```

Out[26]:
```
0    i like java
1       i like c
2     i like c++
3            NaN
dtype: object
```

In [28]:
```
a=pd.Series(['java','c','c++',np.nan])
a.map({'java':'core','c':'ANSII c'})
```

Out[28]:
```
0       core
1    ANSII c
2        NaN
3        NaN
dtype: object
```

In [29]:
```
a.map('i like {}'.format,na_action='ignore')
```

Out[29]:
```
0    i like java
1       i like c
2     i like c++
3            NaN
dtype: object
```

In [37]:
```
x=np.array(['ram','hari','sita','krishna','radha'])
y=pd.Series(x)
print("Sorting the string array\n",y.sort_values())
print("In Desending order\n",y.sort_values(ascending=False))
```

```
Sorting the string array
 1        hari
3     krishna
4       radha
0         ram
2        sita
dtype: object
In Desending order
 2        sita
0         ram
4       radha
3     krishna
1        hari
dtype: object
```

In [41]:

```
import pandas as pd
data=[1,2,3,4,5]
df=pd.DataFrame(data)
print(df)
```

```
   0
0  1
1  2
2  3
3  4
4  5
```

In [53]:

```
data=[['Alex',10],['Bob',12],['clarke',13]]
df=pd.DataFrame(data,columns=['Name','Age'])
print(df)
```

```
     Name  Age
0    Alex   10
1     Bob   12
2  clarke   13
```

In [54]:

```
df=pd.DataFrame(data,columns=['Name','Age'],
                  dtype=float)
print(df)
```

```
     Name   Age
0    Alex  10.0
1     Bob  12.0
2  clarke  13.0
```

```
C:\Users\HP\AppData\Local\Temp\ipykernel_3688\4138737743.py:1: FutureWarning: Cou
ld not cast to float64, falling back to object. This behavior is deprecated. In a
future version, when a dtype is passed to 'DataFrame', either all columns will be
cast to that dtype, or a TypeError will be raised.
  df=pd.DataFrame(data,columns=['Name','Age'],
```

In [45]:

```
#dict of lists
data={'Name':['Tom','jack','steve','Ricky'],'Age':[12,23,13,24]}
df=pd.DataFrame(data,index=['Rank1','Rank2','Rank3','Rank4'])
print(df)
```

```
        Name  Age
Rank1    Tom   12
Rank2   jack   23
```

```
In [49]: #multiple  dict
         data=[{'a':1,'b':2},{'a':10,'b':20,'c':30}]
         df=pd.DataFrame(data,index=['first','second'])
         print(df)
```

```
         a   b     c
first    1   2   NaN
second  10  20  30.0
```

```
In [60]: df=pd.DataFrame(data,columns=['Name','Age'])
         df['Age']=df['Age'].astype(float)
         print(df)
```

```
     Name   Age
0    Alex  10.0
1     Bob  12.0
2  clarke  13.0
```

```
In [76]: #create a dataframedict of series
         import pandas as pd

         d = {
             'one': pd.Series([1, 2, 3], index=['a', 'b', 'c']),
             'two': pd.Series([1, 2, 3, 4], index=['a', 'b', 'c', 'd'])
         }

         df = pd.DataFrame(d)

         print(df)
```

```
   one  two
a  1.0    1
b  2.0    2
c  3.0    3
d  NaN    4
```

```
In [77]: df['three']=pd.Series([10,20,30,40],index=['a','b','c','d'])
         print(df)
         df['four']=df['one']+df['three']
         print(df)
         df['sub']=df['one']+df['three']
         print(df)
         #deleting col three
         del df['three']
         print(df)
```

```
   one  two  three
a  1.0    1     10
b  2.0    2     20
c  3.0    3     30
d  NaN    4     40
   one  two  three  four
a  1.0    1     10  11.0
b  2.0    2     20  22.0
c  3.0    3     30  33.0
d  NaN    4     40   NaN
   one two three four      sub
a  1.0    1     10  11.0  11.0
b  2.0    2     20  22.0  22.0
c  3.0    3     30  33.0  33.0
d NaN     4     40   NaN   NaN
   one two four     sub
a  1.0    1  11.0  11.0
b  2.0    2  22.0  22.0
c  3.0    3  33.0  33.0
d  NaN    4   NaN   NaN
```

In [78]:

```
df1=pd.DataFrame([[1,2],[3,4]],columns=['a','b'])
df1.drop(0,inplace=False)#rowise deletion
print(df1)
```

```
   a  b
0  1  2
1  3  4
```

In [80]:

```
df1.drop(columns=['a'],inplace=True)
print(df1)
```

```
   b
0  2
1  4
```

In [81]:

```
df2=pd.DataFrame([[5,6],[7,8]],columns=['a','b'])
print(df2)
df2['c']=pd.Series([10,20])
print(df2)
df2.drop(columns=['a','b'],inplace=True)#colwisedeletion
print(df2)
```

```
   a  b
0  5  6
1  7  8
   a  b   c
0  5  6  10
1  7  8  20
    c
0  10
1  20
```

In [11]:

```
#create  a  dataframe  with  columns  Name,Age,University,Percentage,for  5  students
data={'Name':['Tom','jack','steve','Ricky','jio'],'Age':[12,23,13,24,23],'univer
df_students = pd.DataFrame(data,index=['s1','s2','s3','s4','s5'])
print(df_students)
```

```
      Name  Age  university  Percentage
s1     Tom   12      aditya        85.5
s2    jack   23         vst        90.0
s3   steve   13       JNTUK        78.5
s4   Ricky   24        srkr        88.0
s5     jio   23        svec        92.5
```

In [12]:

```
print(df_students[0:3])
```

```
      Name  Age  university  Percentage
s1     Tom   12      aditya        85.5
s2    jack   23         vst        90.0
s3   steve   13       JNTUK        78.5
```

In [13]:

```
print(df_students[['Name','Age']])
```

```
      Name  Age
s1     Tom   12
s2    jack   23
s3   steve   13
s4   Ricky   24
s5     jio   23
```

In [15]:

```
print(df_students.loc['s1':'s3', ['Name', 'university']])
print(df_students.iloc[0,0:3])
```

```
     Name university
s1    Tom     aditya
s2   jack        vst
s3  steve      JNTUK
Name               Tom
Age                 12
university      aditya
Name: s1, dtype: object
```

In [134…

```
print(df_students.loc[(df_students['Name']=='Tom')&(df_students['university']=='
```

```
   Name  Age  university  Percentage
s1  Tom   12      aditya        85.5
```

In [ ]:

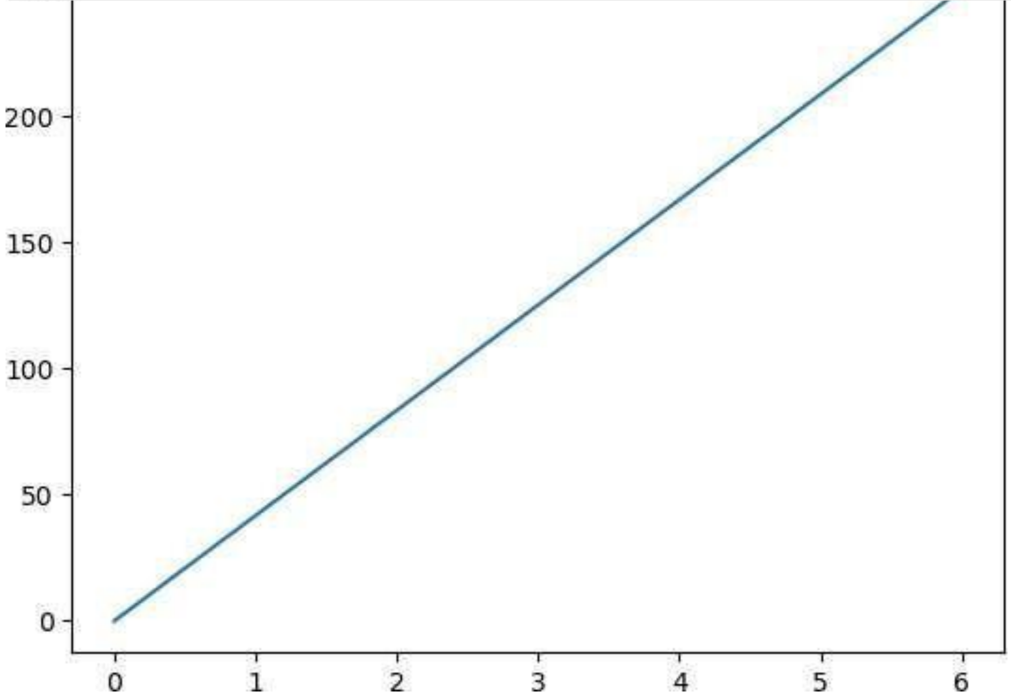
Matplot:

```
In [ ]: AIM:Introduction to required python libraries such as Numpy,Pandas,Scipy,Matplot
```

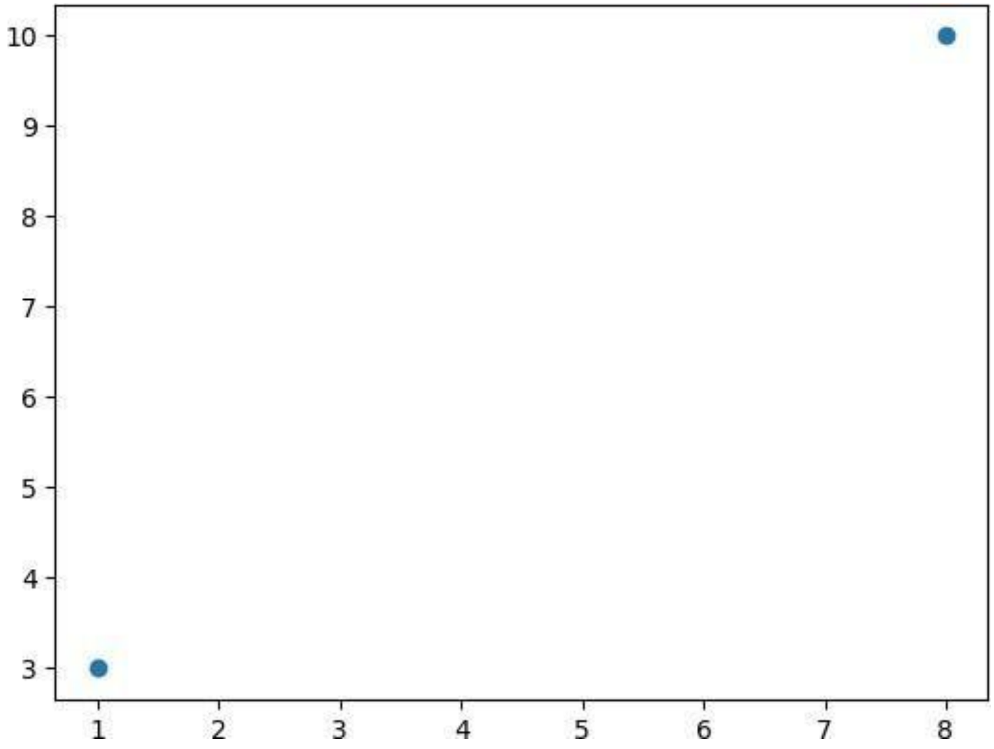
```
In [ ]: Description:Matplotlib is a lowlevel graph plotting library in python serves as
        Matplotlib library is open source.
```

```
In [3]: import matplotlib.pyplot as plt
        import numpy as np
```

```
In [5]: xpoints =np.array([0,6])
        ypoints =np.array([0,250])
        plt.plot(xpoints,ypoints)
        plt.show()
```

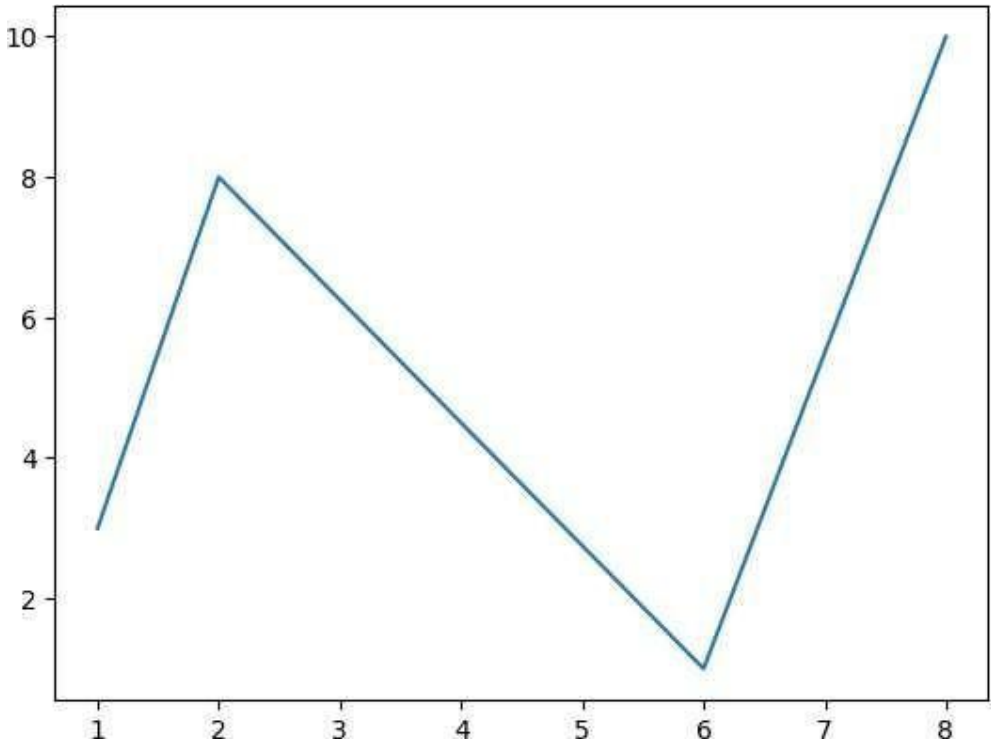


```
In [11]: xpoints =np.array([1,8])
         ypoints =np.array([3,10])
         plt.plot(xpoints,ypoints,'o')
         plt.show()
```



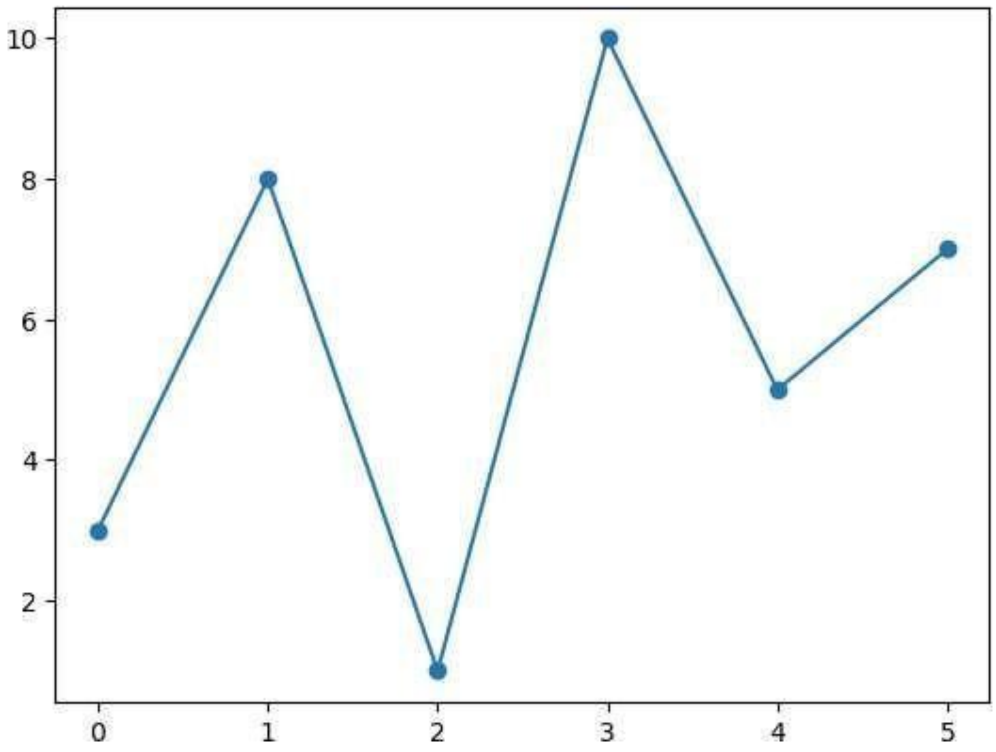
In [13]:

```
xpoints =np.array([1,2,6,8])
ypoints =np.array([3,8,1,10])
plt.plot(xpoints,ypoints)
plt.show()
```



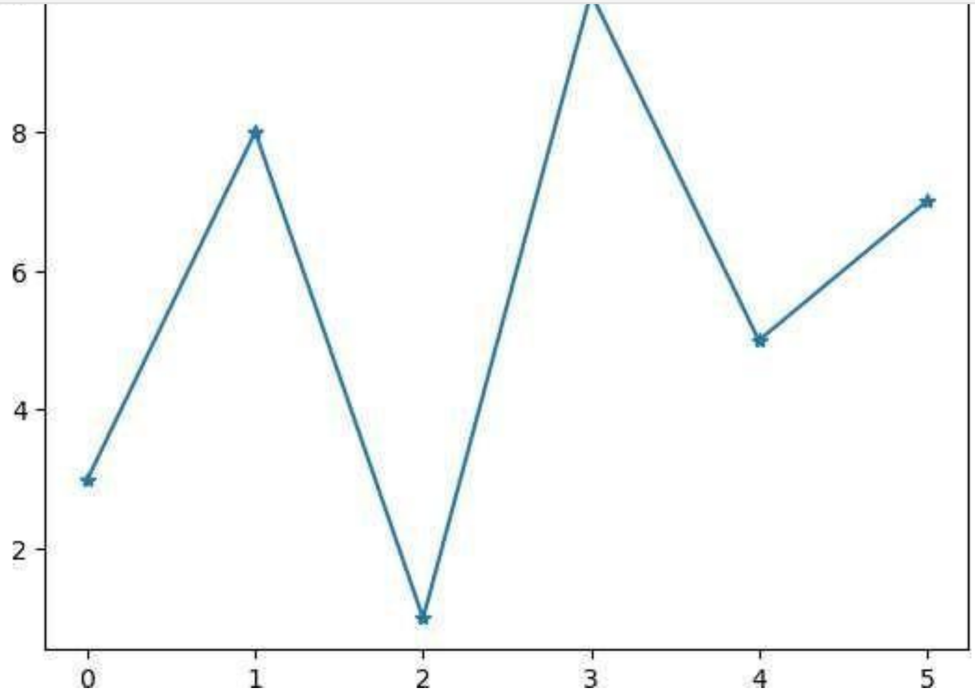
In [21]:

```
import  matplotlib.pyplot  as  plt
import  numpy  as  np
ypoints  =np.array([3,8,1,10,5,7])
plt.plot(ypoints,marker='o')
plt.show()
```



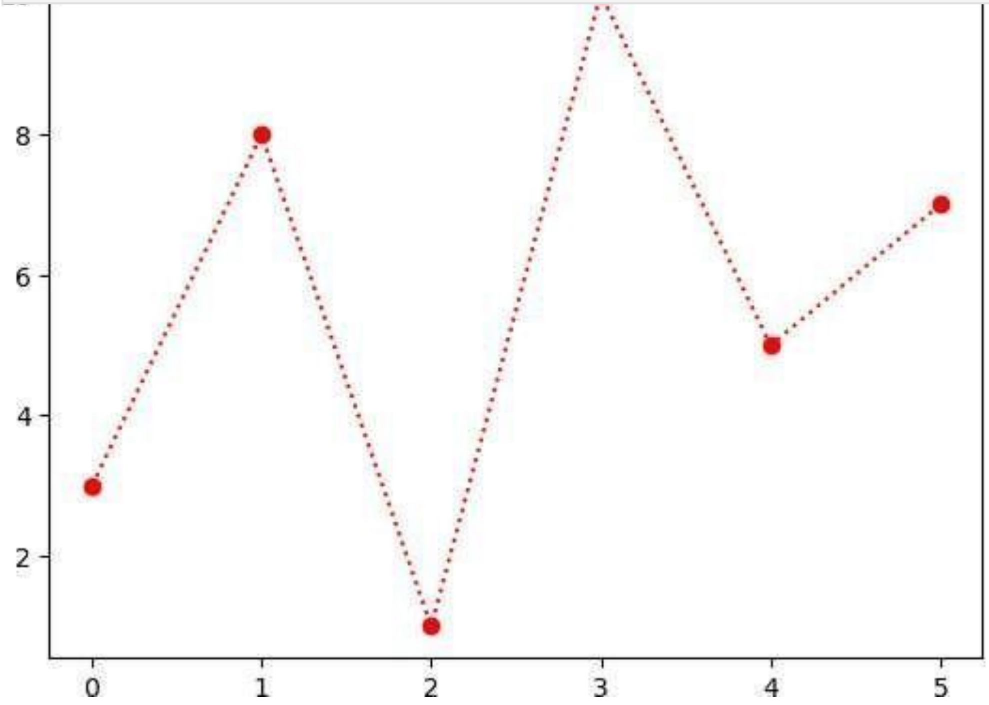
In [23]:

```
import  matplotlib.pyplot  as  plt
import numpy as np
ypoints =np.array([3,8,1,10,5,7])
plt.plot(ypoints,marker='*')
plt.show()
```



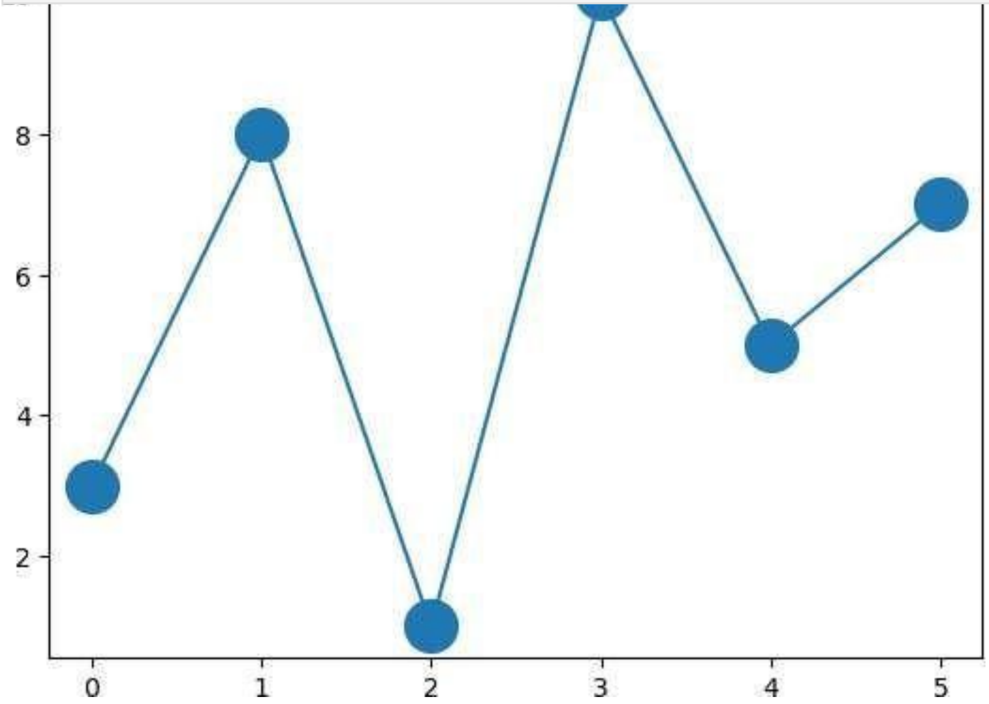
In [27]:

```
ypoints =np.array([3,8,1,10,5,7])
plt.plot(ypoints,'o:r')
plt.show()
```



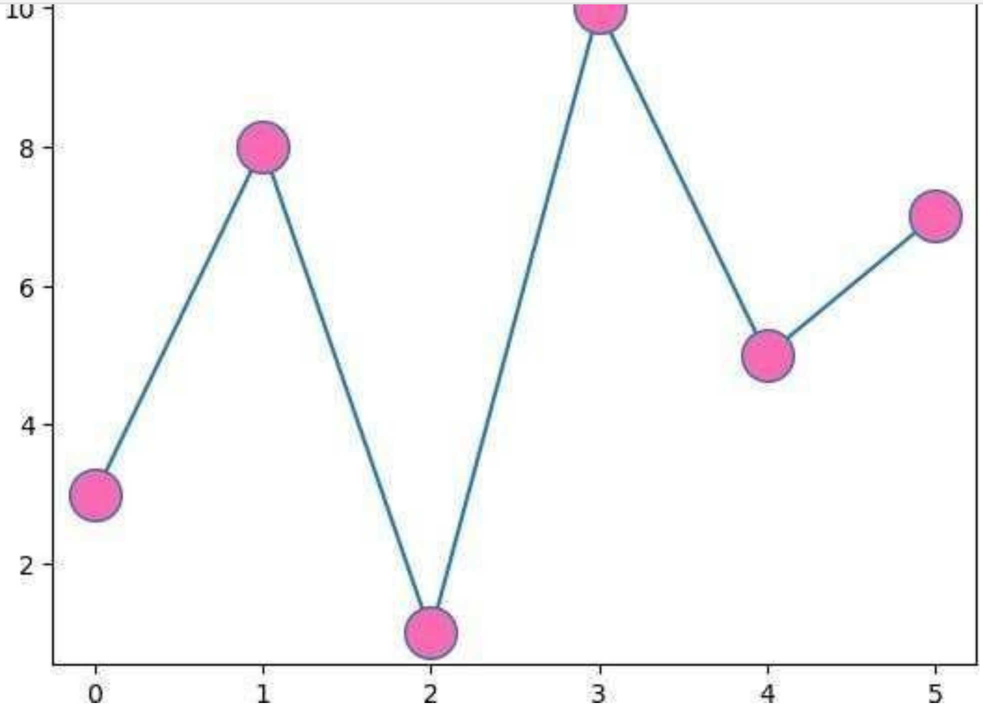
In [61]:

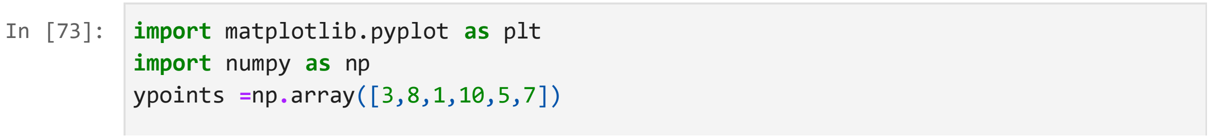
```
ypoints =np.array([3,8,1,10,5,7])
plt.plot(ypoints,marker='o',ms=20)
plt.show()
```



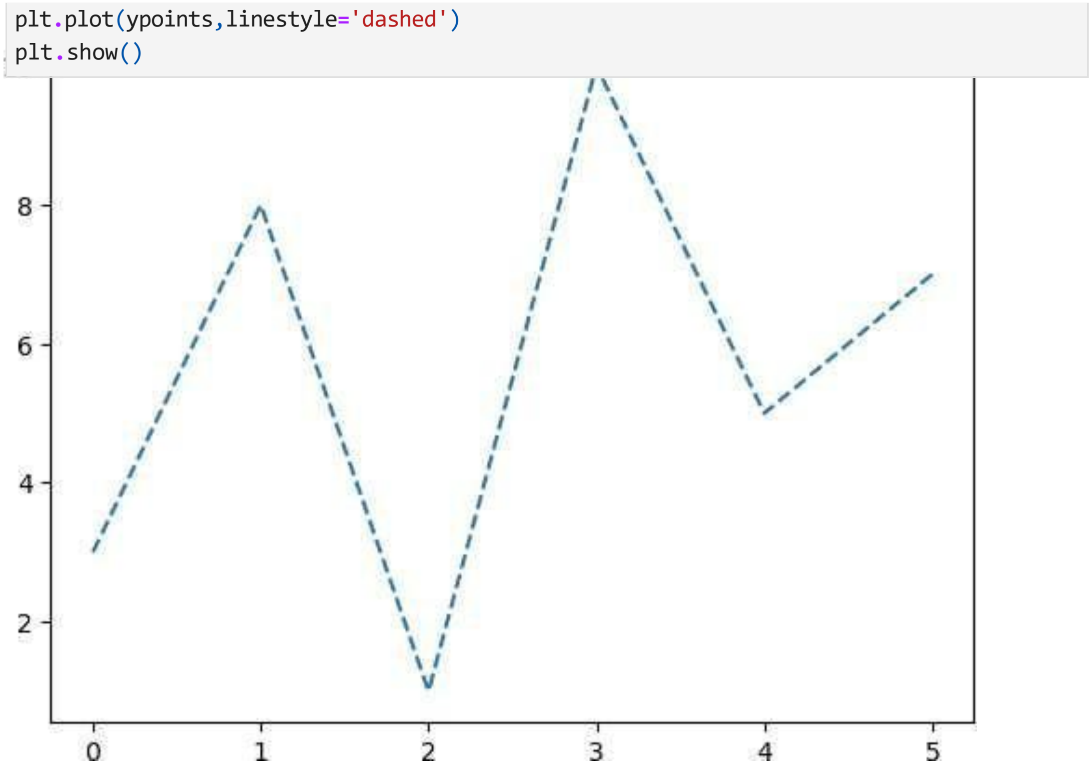
In [63]:

```
ypoints =np.array([3,8,1,10,5,7])
plt.plot(ypoints,marker='o',ms=20,mfc='hotpink')
plt.show()
```





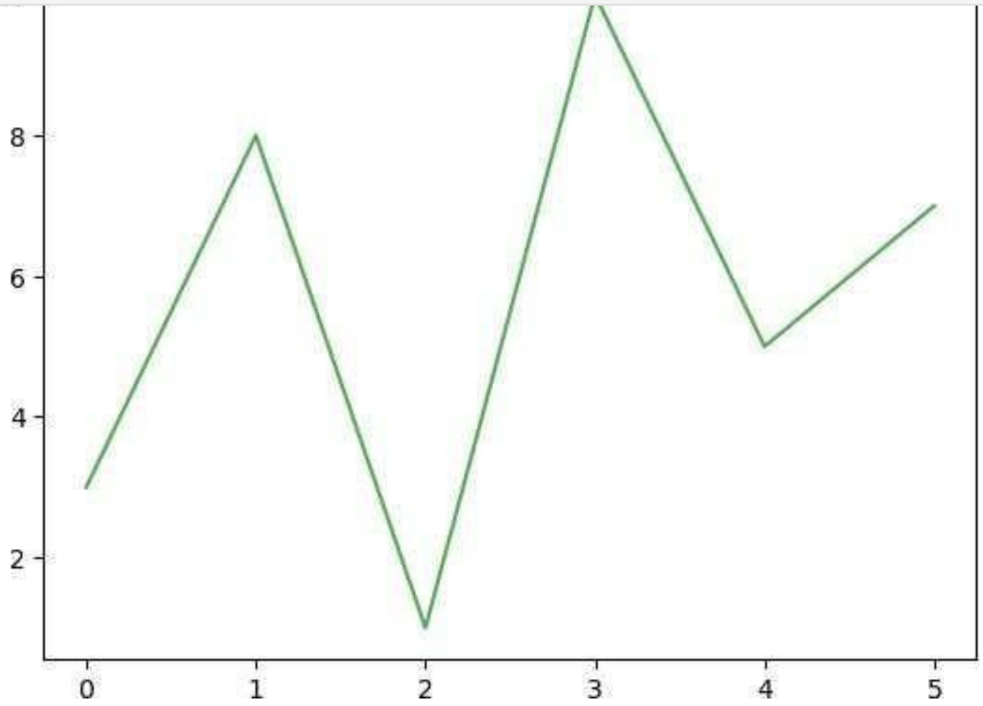
```
In [73]: import matplotlib.pyplot as plt
         import numpy as np
         ypoints =np.array([3,8,1,10,5,7])
```



```
plt.plot(ypoints,linestyle='dashed')
plt.show()
```

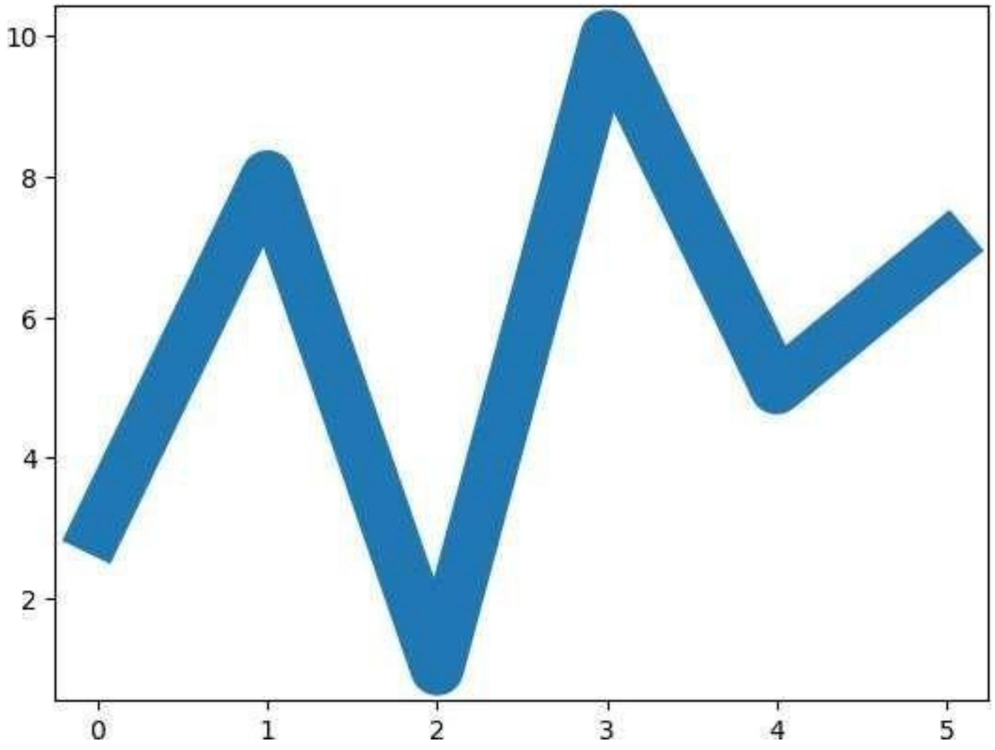
In [77]:

```
import matplotlib.pyplot as plt
import numpy as np
ypoints =np.array([3,8,1,10,5,7])
plt.plot(ypoints,c = '#4CAF50')
plt.show()
```



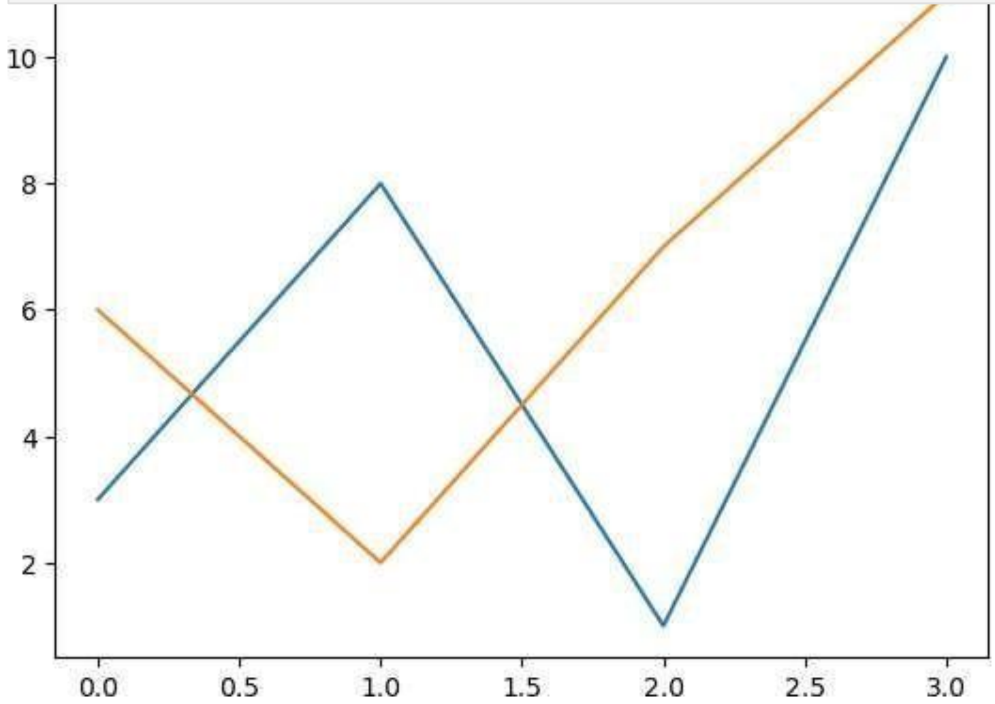
In [79]:

```
import matplotlib.pyplot as plt
import numpy as np
ypoints =np.array([3,8,1,10,5,7])
plt.plot(ypoints,linewidth='20.5')
plt.show()
```



In [83]:

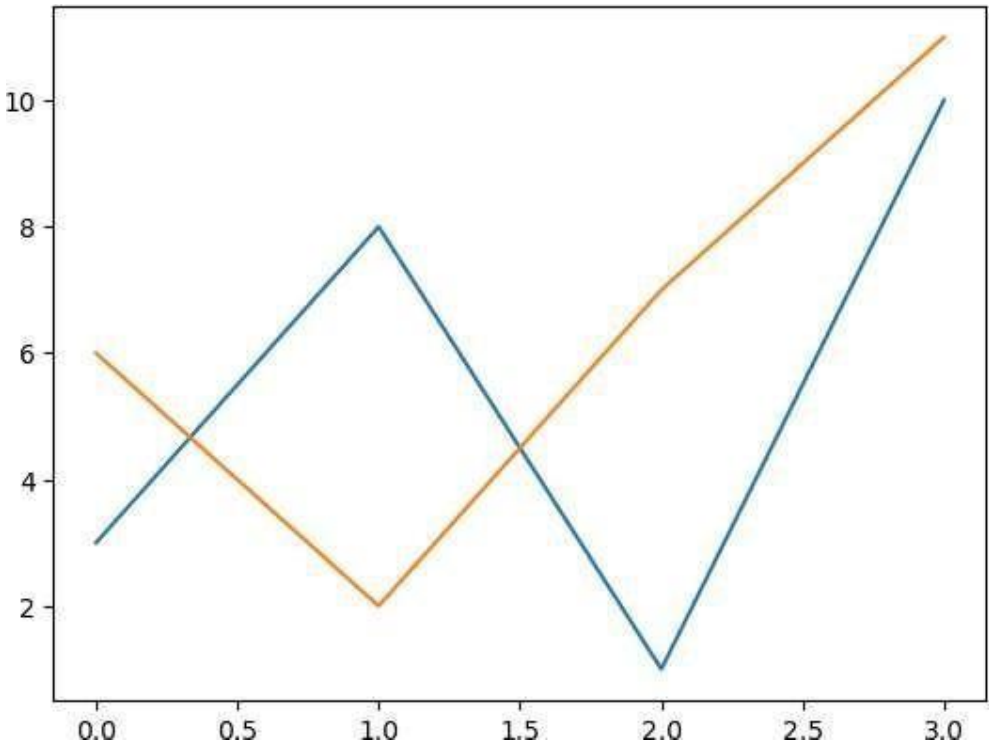
```
y1=np.array([3,8,1,10])
y2=np.array([6,2,7,11])
plt.plot(y1)
plt.plot(y2)
plt.show()
```



In [85]:

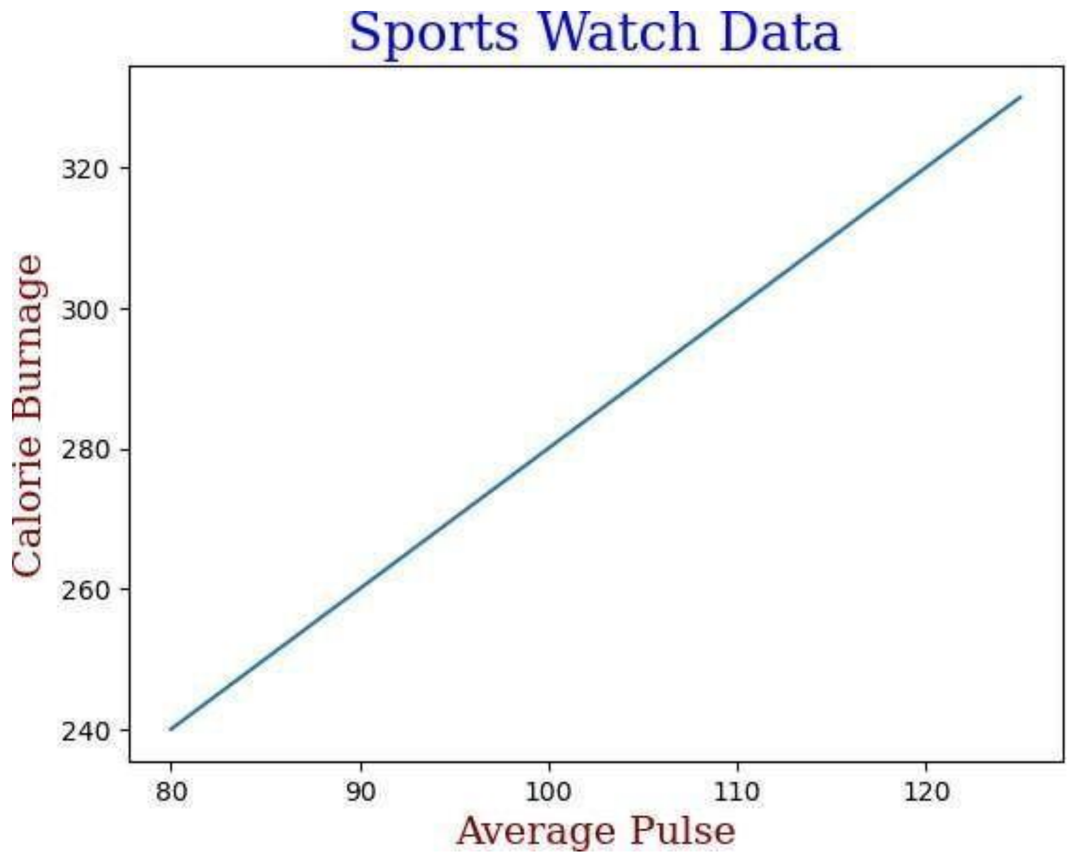
```
import matplotlib.pyplot as plt
import numpy as np
```

```
x1 = np.array([0, 1, 2, 3])
y1 = np.array([3, 8, 1, 10])
x2 = np.array([0, 1, 2, 3])
y2 = np.array([6, 2, 7, 11])
plt.show()
```



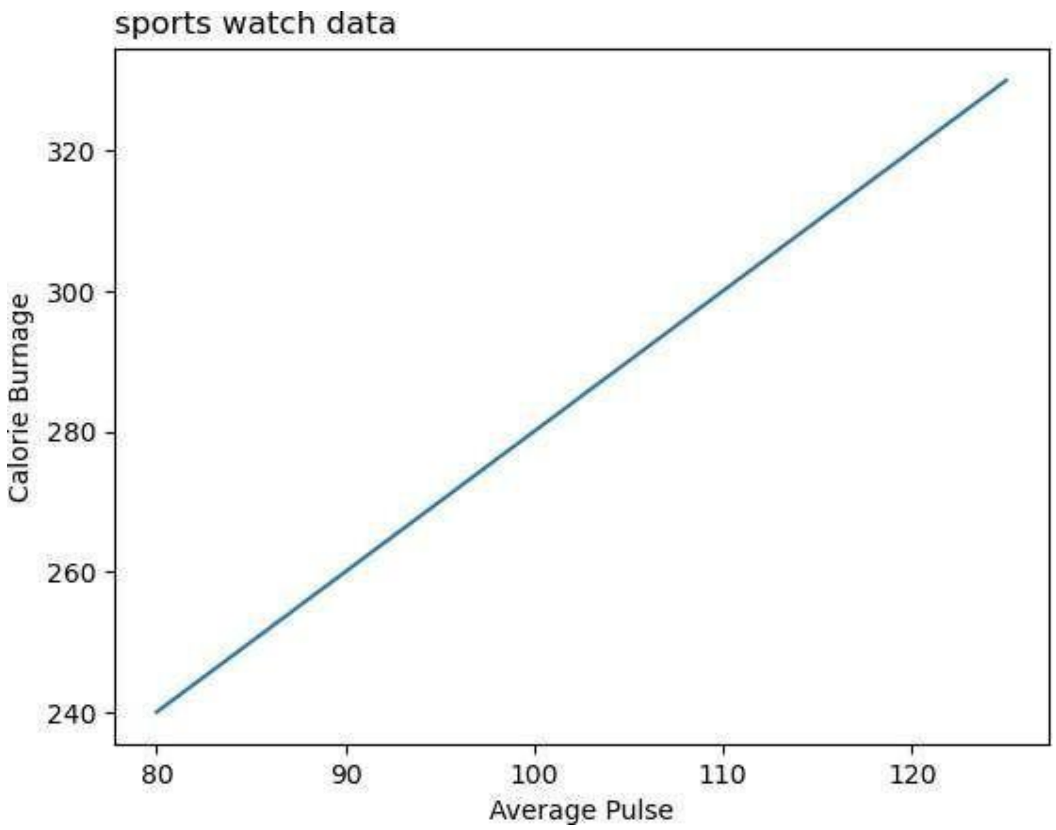
In [99]:

```
import numpy as np
import matplotlib.pyplot as plt

x = np.array([80, 85, 90, 95, 100, 105, 110, 115, 120, 125])
y = np.array([240, 250, 260, 270, 280, 290, 300, 310, 320, 330])

font1 = {'family':'serif','color':'blue','size':20}
font2 = {'family':'serif','color':'darkred','size':15}

plt.title("Sports Watch Data", fontdict = font1)
plt.xlabel("Average Pulse", fontdict = font2)
plt.ylabel("Calorie  Burnage", fontdict = font2)

plt.plot(x, y)
plt.show()
```



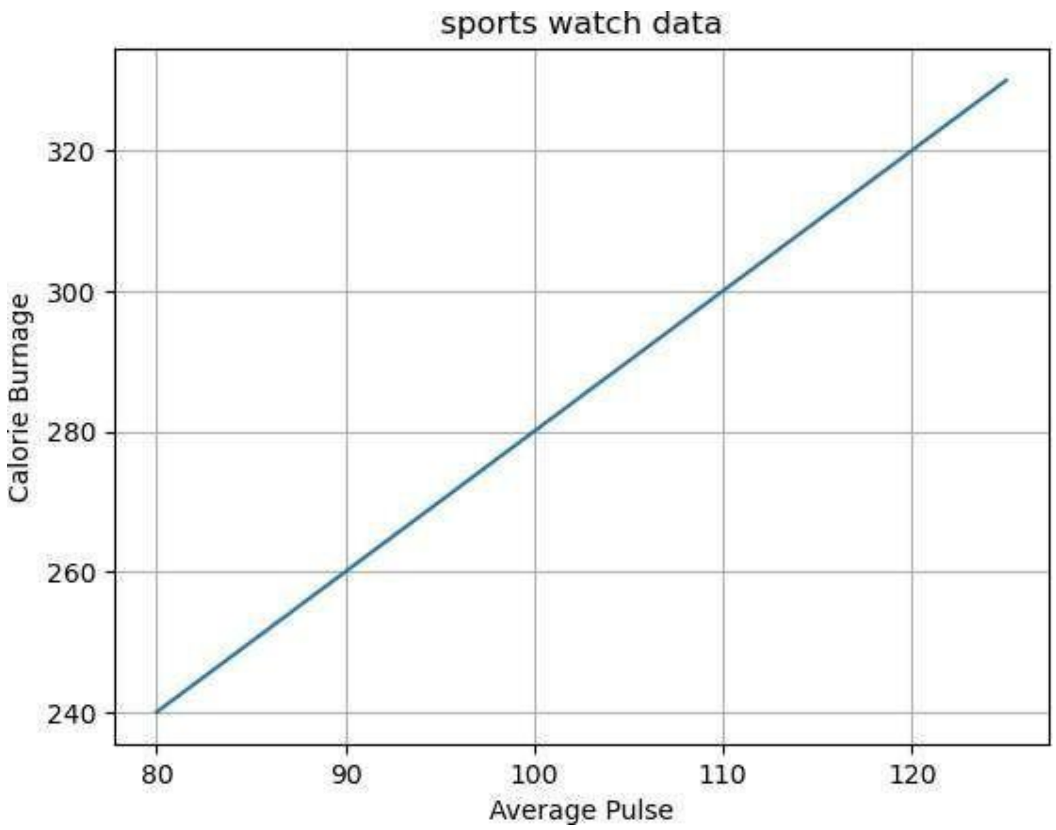
In [101…

```
import numpy as np
import matplotlib.pyplot as plt

x = np.array([80, 85, 90, 95, 100, 105, 110, 115, 120, 125])
y = np.array([240, 250, 260, 270, 280, 290, 300, 310, 320, 330])

plt.plot(x, y)
plt.title("sports watch data",loc='left')
plt.xlabel("Average Pulse")
plt.ylabel("Calorie Burnage")

plt.show()
```



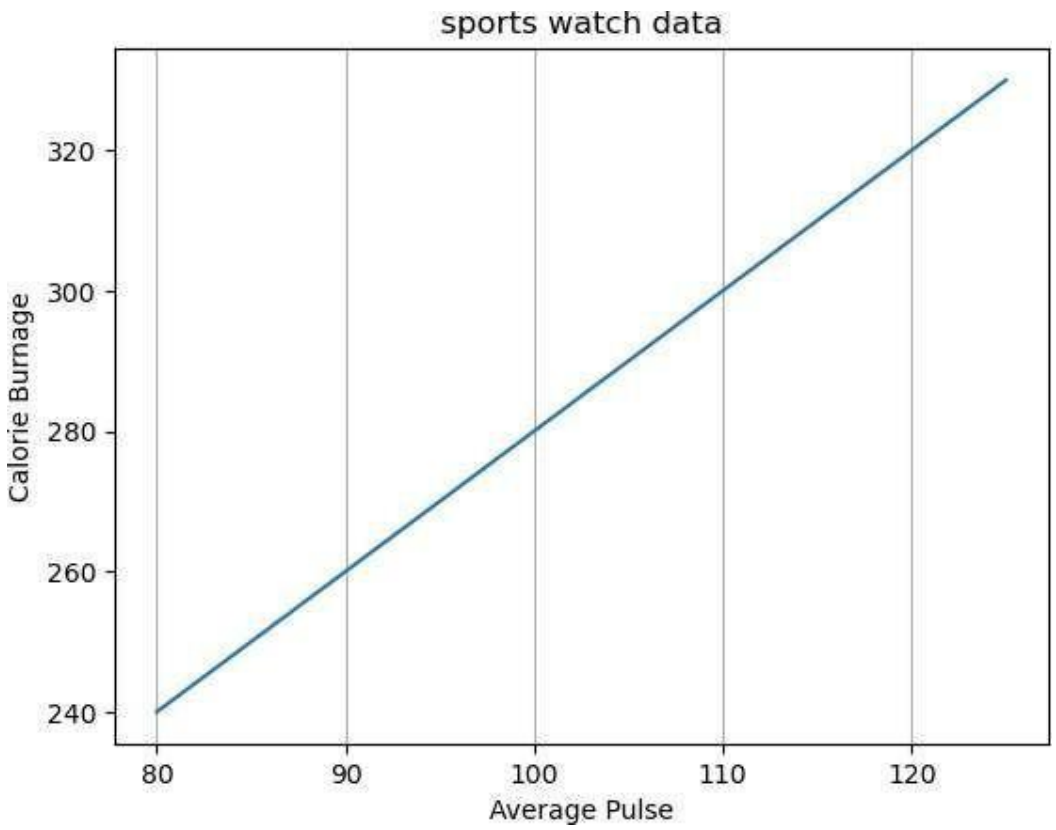
In [103…

```
import numpy as np
import matplotlib.pyplot as plt

x = np.array([80, 85, 90, 95, 100, 105, 110, 115, 120, 125])
y = np.array([240, 250, 260, 270, 280, 290, 300, 310, 320, 330])

plt.plot(x, y)
plt.title("sports watch data")
plt.xlabel("Average Pulse")
plt.ylabel("Calorie Burnage")
plt.grid()

plt.show()
```



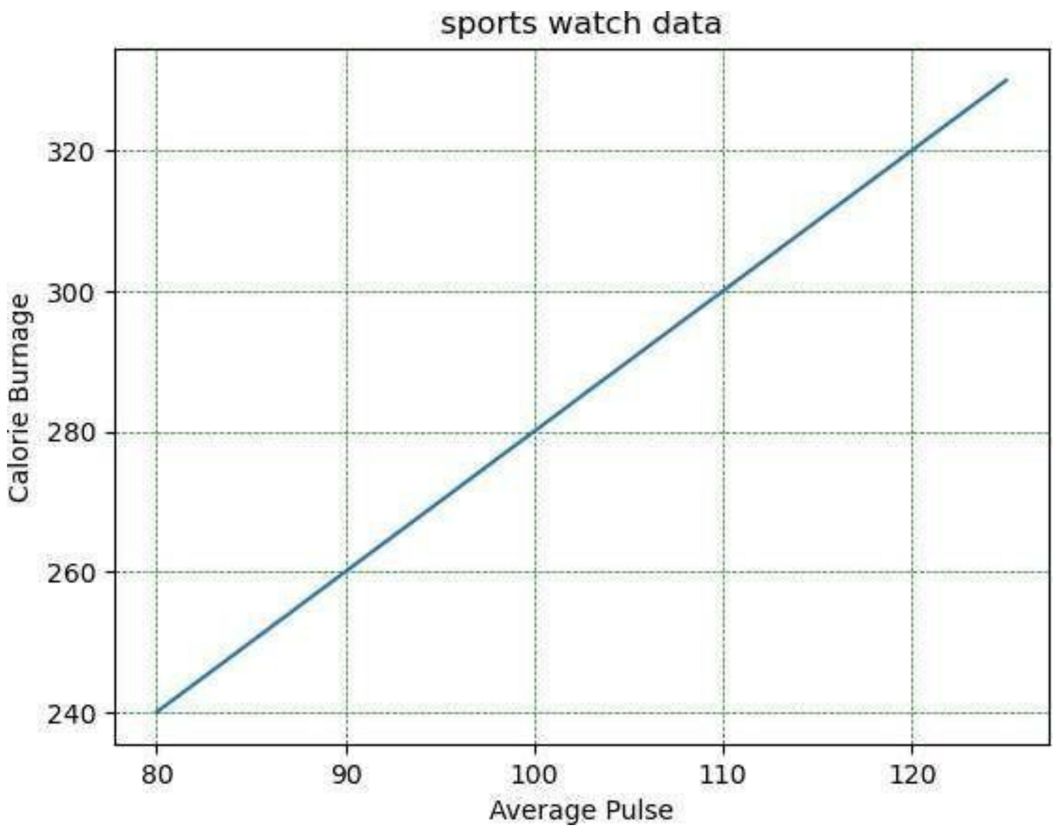
In [107…

```
import numpy as np
import matplotlib.pyplot as plt

x = np.array([80, 85, 90, 95, 100, 105, 110, 115, 120, 125])
y = np.array([240, 250, 260, 270, 280, 290, 300, 310, 320, 330])

plt.plot(x, y)
plt.title("sports watch data")
plt.xlabel("Average Pulse")
plt.ylabel("Calorie Burnage")
plt.grid(axis = 'x')

plt.show()
```



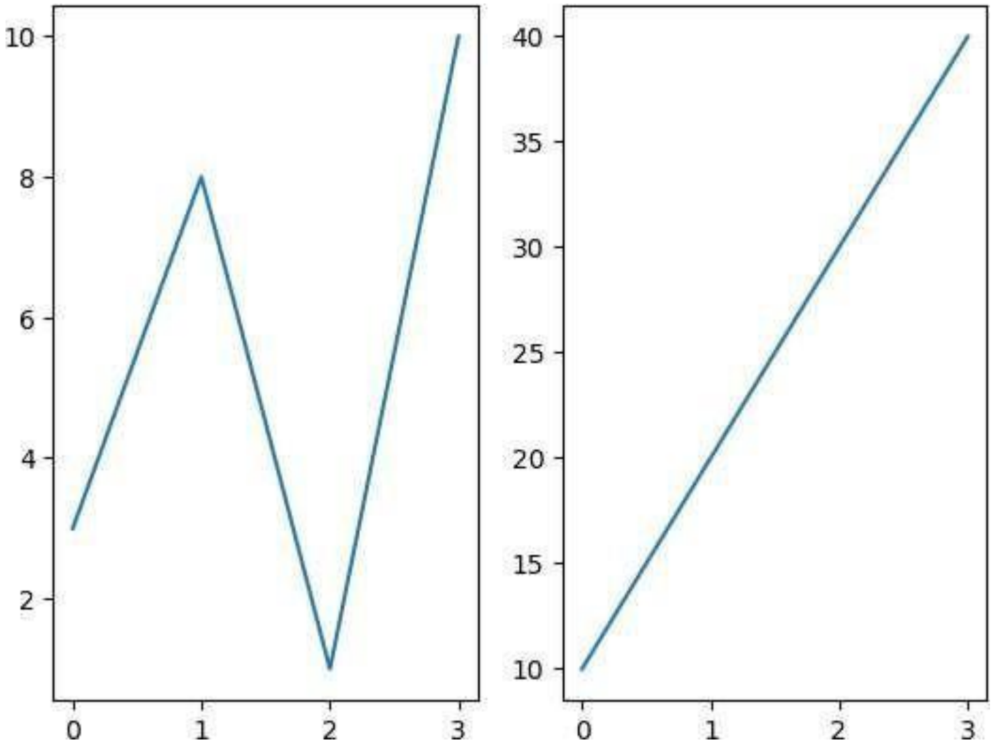
In [113…

```
import numpy as np
import matplotlib.pyplot as plt

x = np.array([80, 85, 90, 95, 100, 105, 110, 115, 120, 125])
y = np.array([240, 250, 260, 270, 280, 290, 300, 310, 320, 330])

plt.plot(x, y)
plt.title("sports watch data")
plt.xlabel("Average Pulse")
plt.ylabel("Calorie Burnage")
plt.grid(color = 'green', linestyle = '--', linewidth = 0.5)
plt.show()
```



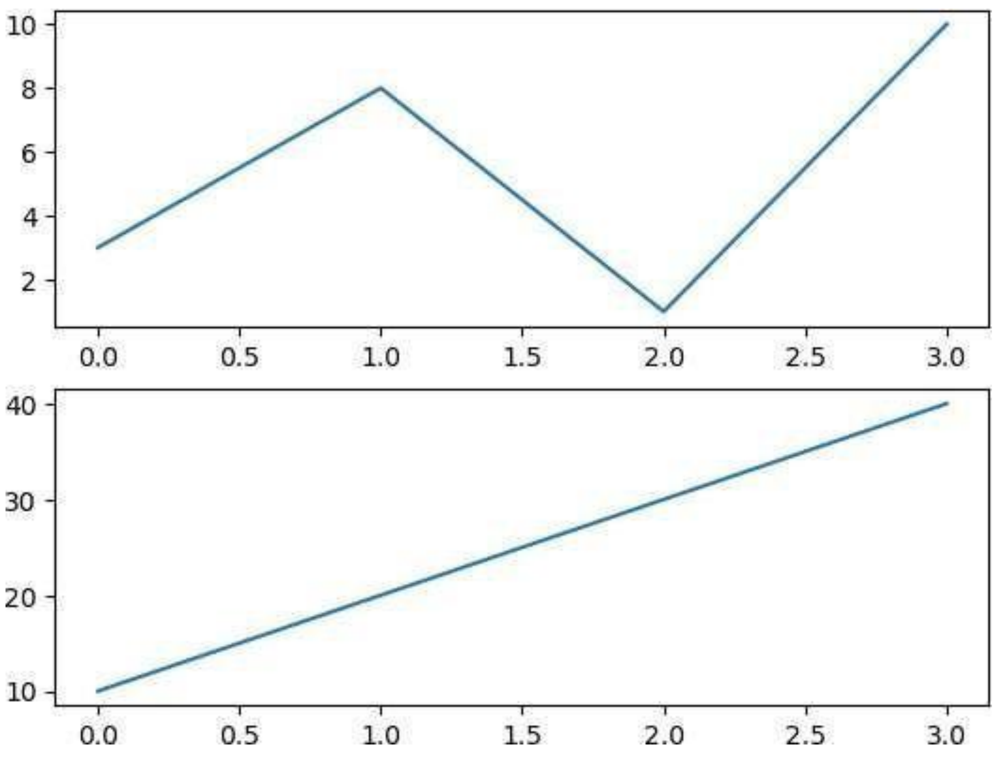
In [115…

```
import matplotlib.pyplot as plt
import numpy as np

#plot 1:
x = np.array([0, 1, 2, 3])
y = np.array([3, 8, 1, 10])

plt.subplot(1, 2, 1)
plt.plot(x,y)

#plot 2:
x = np.array([0, 1, 2, 3])
y = np.array([10, 20, 30, 40])

plt.subplot(1, 2, 2)
plt.plot(x,y)

plt.show()
```



In [117…

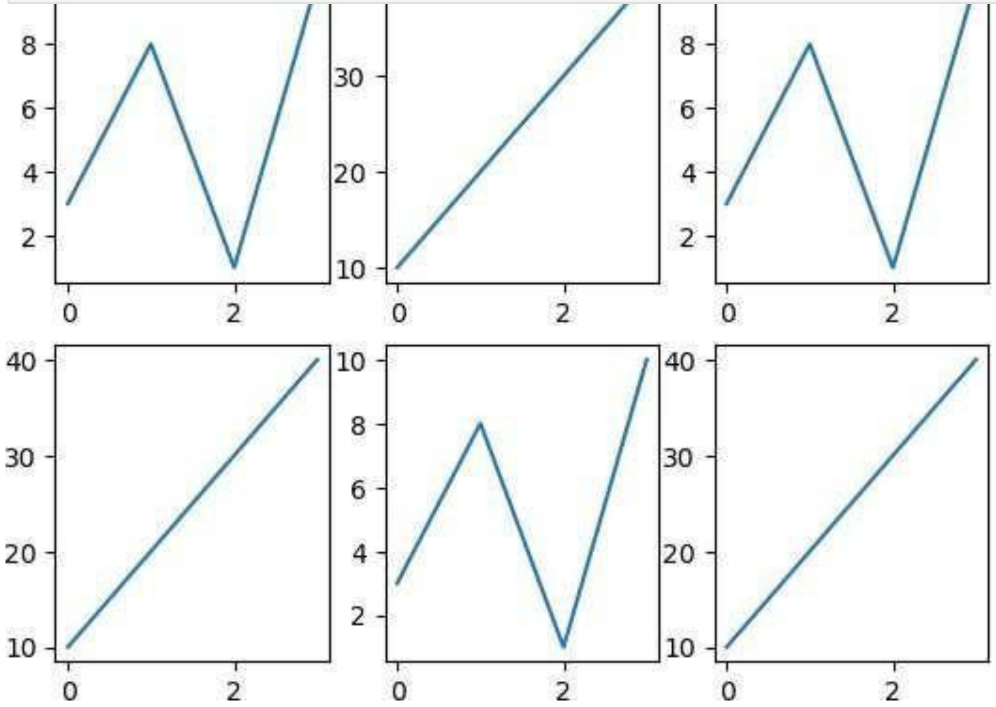
```
import matplotlib.pyplot as plt
import numpy as np

#plot 1:
x = np.array([0, 1, 2, 3])
y = np.array([3, 8, 1, 10])

plt.subplot(2, 1, 1)
plt.plot(x,y)

#plot 2:
x = np.array([0, 1, 2, 3])
y = np.array([10, 20, 30, 40])

plt.subplot(2, 1, 2)
plt.plot(x,y)

plt.show()
```



In [119…

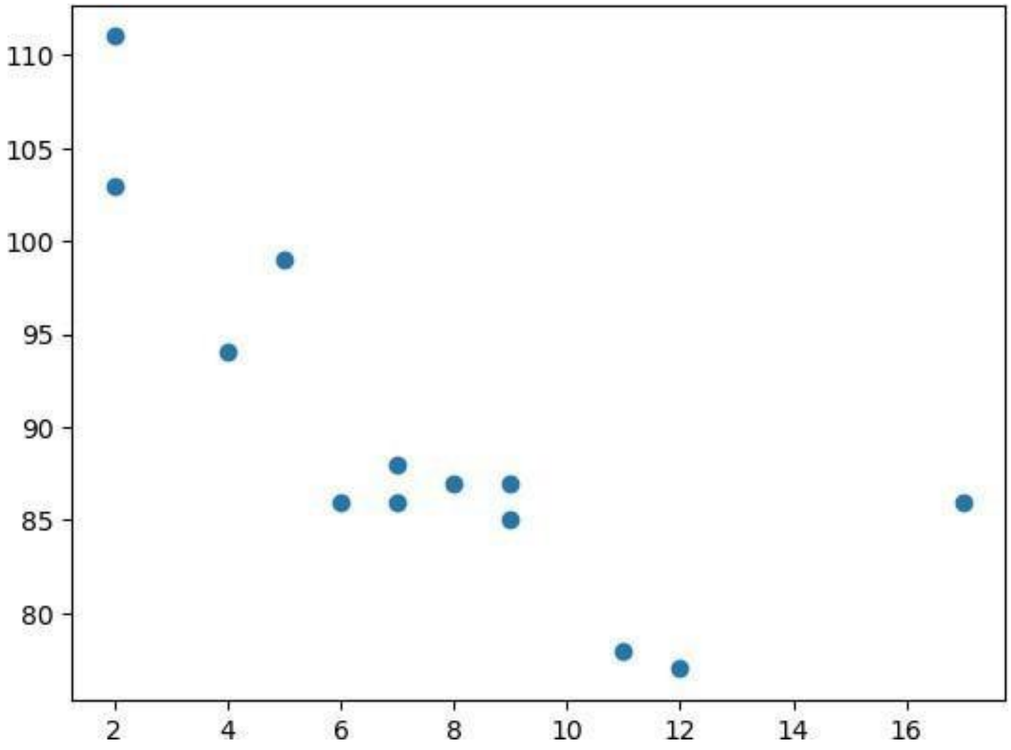
```
import matplotlib.pyplot as plt
import numpy as np

x = np.array([0, 1, 2, 3])
y = np.array([3, 8, 1, 10])

plt.subplot(2, 3, 1)
plt.plot(x,y)

x = np.array([0, 1, 2, 3])
y = np.array([10, 20, 30, 40])

plt.subplot(2, 3, 2)
plt.plot(x,y)

x = np.array([0, 1, 2, 3])
y = np.array([3, 8, 1, 10])

plt.subplot(2, 3, 3)
plt.plot(x,y)

x = np.array([0, 1, 2, 3])
y = np.array([10, 20, 30, 40])

plt.subplot(2, 3, 4)
plt.plot(x,y)

x = np.array([0, 1, 2, 3])
y = np.array([3, 8, 1, 10])

plt.subplot(2, 3, 5)
plt.plot(x,y)

x = np.array([0, 1, 2, 3])
```

```
y = np.array([10,   20,  30,  40])

plt.subplot(2, 3,   6)
plt.plot(x,y)

plt.show()
```



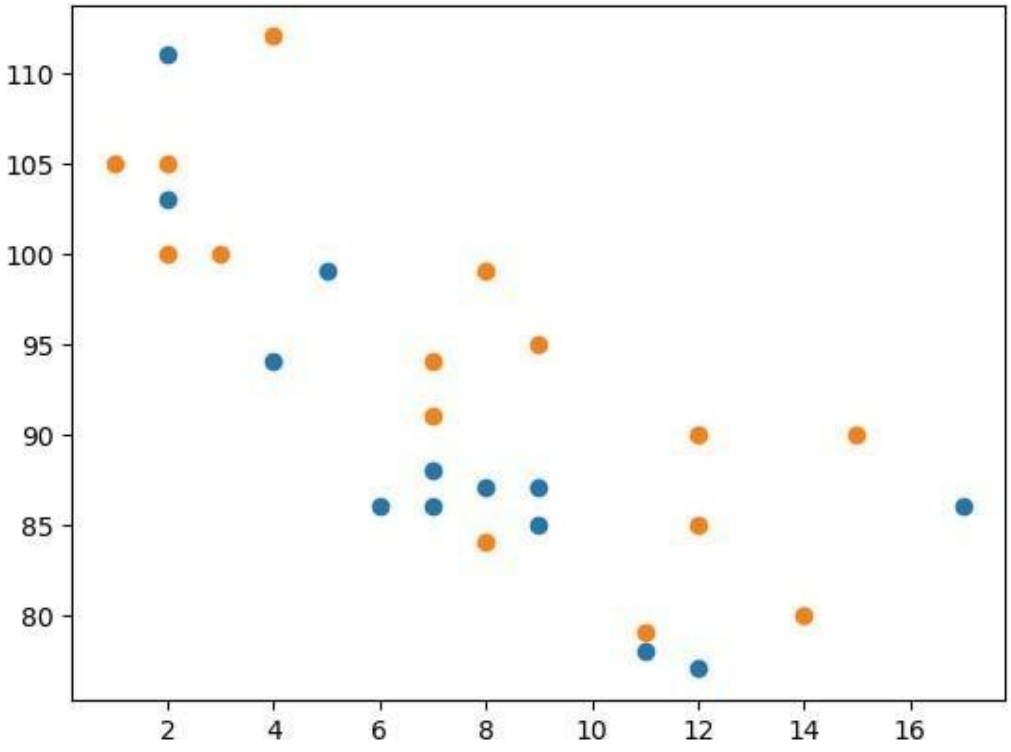
In [123…

```
import  matplotlib.pyplot  as  plt
import  numpy  as  np

x  =  np.array([5,7,8,7,2,17,2,9,4,11,12,9,6])
y  =  np.array([99,86,87,88,111,86,103,87,94,78,77,85,86])

plt.scatter(x,  y)
plt.show()
```



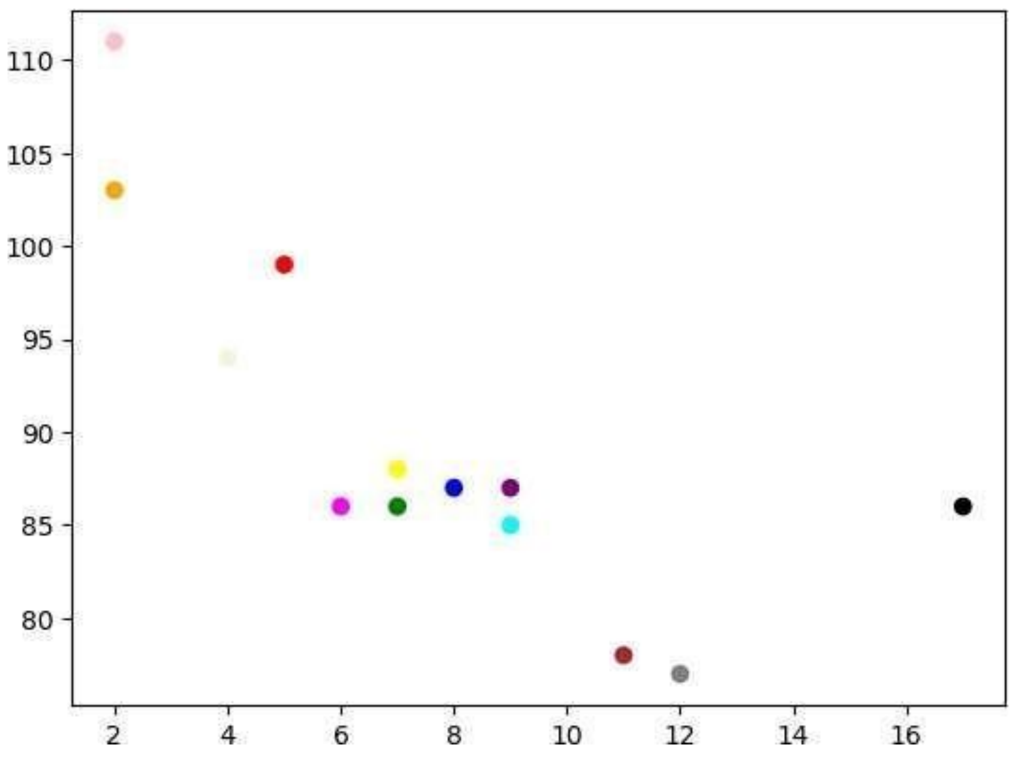
In [125…

```
import matplotlib.pyplot as plt
import numpy as np

#day one, the age and speed of 13 cars:
x = np.array([5,7,8,7,2,17,2,9,4,11,12,9,6])
y = np.array([99,86,87,88,111,86,103,87,94,78,77,85,86])
plt.scatter(x, y)

#day two, the age and speed of 15 cars:
x = np.array([2,2,8,1,15,8,12,9,7,3,11,4,7,14,12])
y = np.array([100,105,84,105,90,99,90,95,94,100,79,112,91,80,85])
plt.scatter(x, y)

plt.show()
```



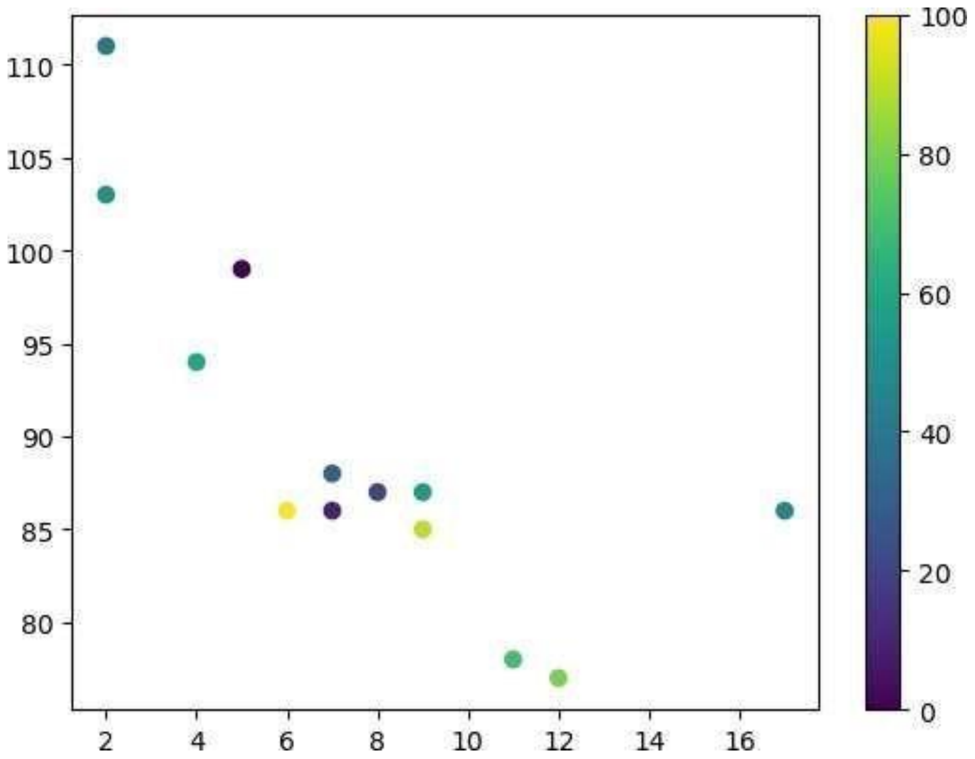
In [129…

```
import matplotlib.pyplot as plt
import numpy as np

x = np.array([5,7,8,7,2,17,2,9,4,11,12,9,6])
y = np.array([99,86,87,88,111,86,103,87,94,78,77,85,86])
colors = np.array(["red","green","blue","yellow","pink","black","orange","purple

plt.scatter(x, y, c=colors)

plt.show()
```



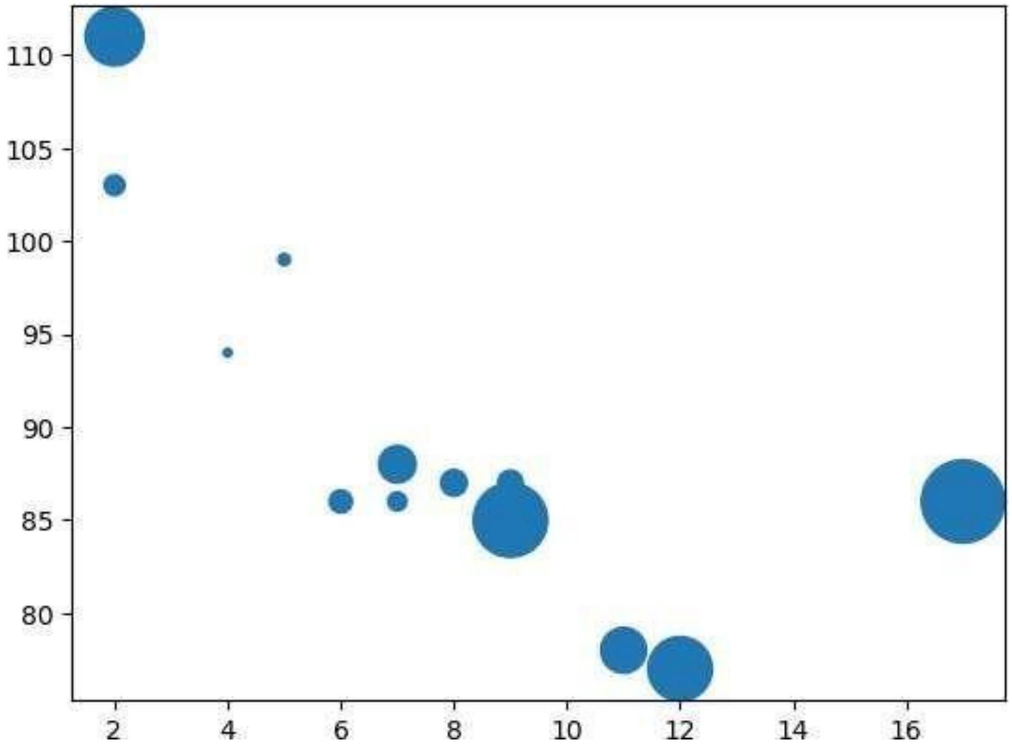
In [139…

```
import matplotlib.pyplot as plt
import numpy as np

x = np.array([5,7,8,7,2,17,2,9,4,11,12,9,6])
y = np.array([99,86,87,88,111,86,103,87,94,78,77,85,86])
colors = np.array([0, 10, 20, 30, 40, 45, 50, 55, 60, 70, 80, 90, 100])

plt.scatter(x, y, c=colors, cmap='viridis')
plt.colorbar()
plt.show()
```



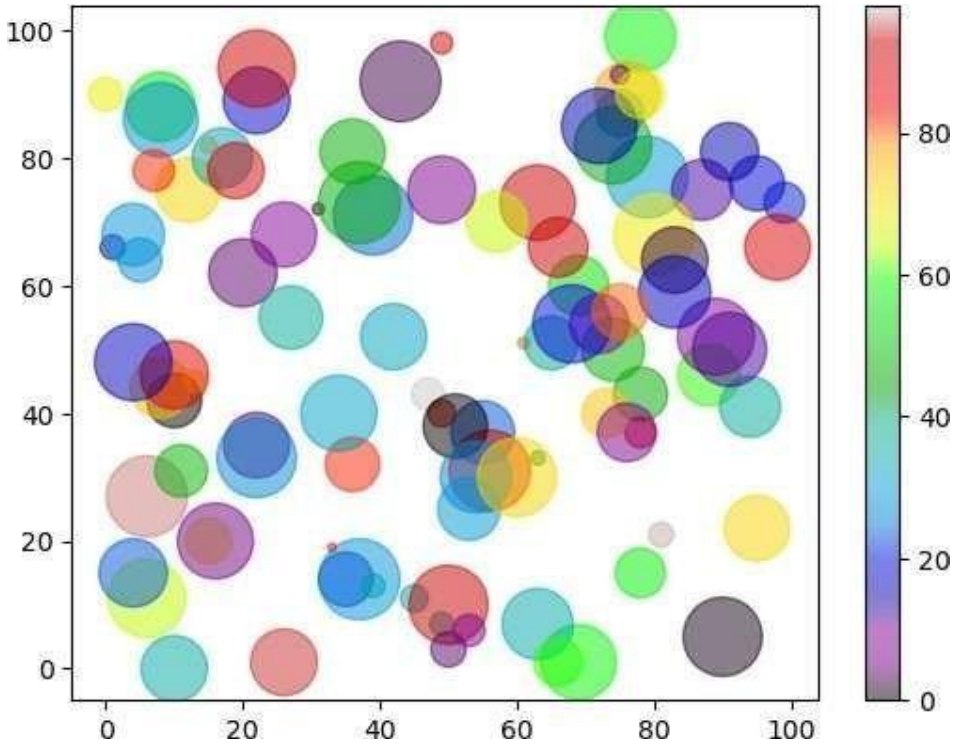
In [141…

```
import matplotlib.pyplot as plt
import numpy as np

x = np.array([5,7,8,7,2,17,2,9,4,11,12,9,6])
y = np.array([99,86,87,88,111,86,103,87,94,78,77,85,86])
sizes = np.array([20,50,100,200,500,1000,60,90,10,300,600,800,75])

plt.scatter(x, y, s=sizes)

plt.show()
```



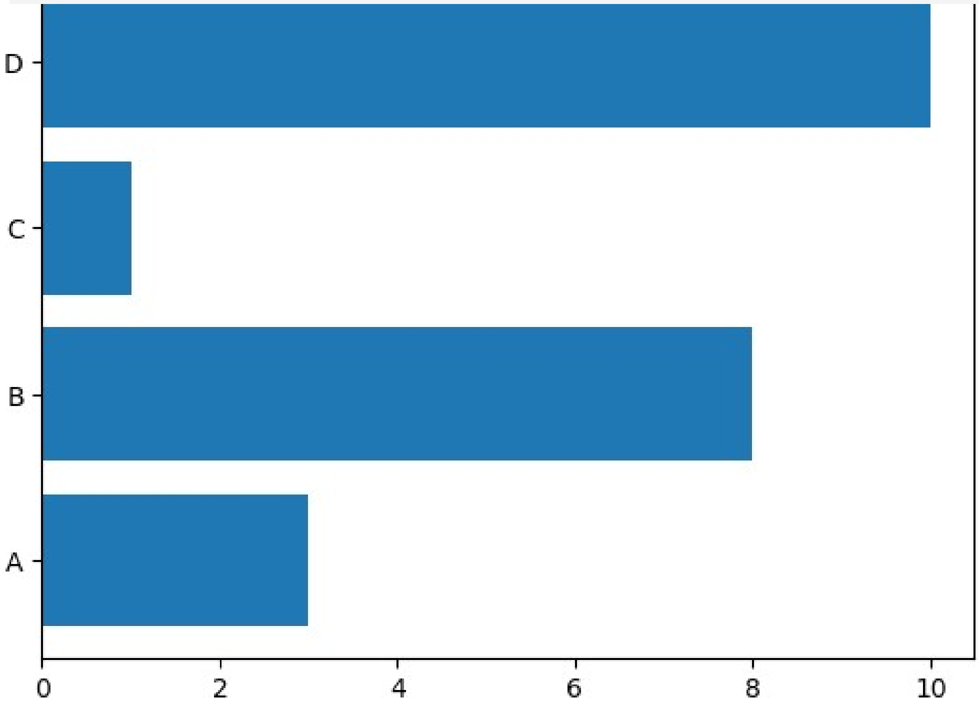
In [143…

```
import matplotlib.pyplot as plt
import numpy as np

x = np.random.randint(100, size=(100))
y = np.random.randint(100, size=(100))
colors = np.random.randint(100, size=(100))
sizes = 10 * np.random.randint(100, size=(100))

plt.scatter(x, y, c=colors, s=sizes, alpha=0.5, cmap='nipy_spectral')

plt.colorbar()

plt.show()
```



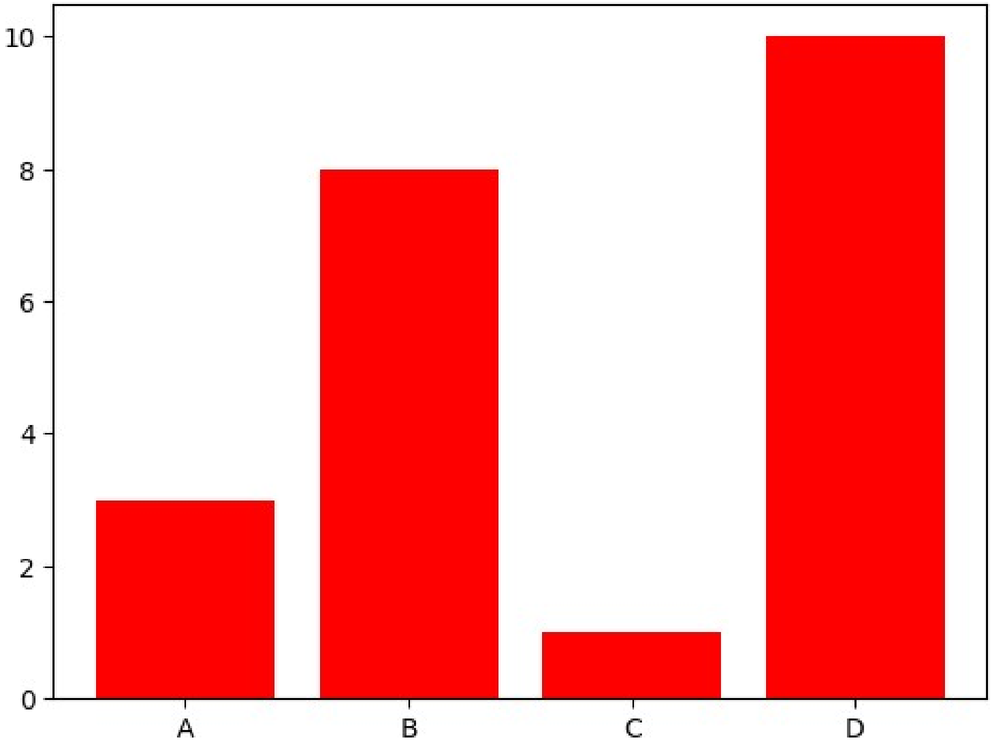
In [147…

```python
import matplotlib.pyplot as plt
import numpy as np

x = np.array(["A", "B", "C", "D"])
y = np.array([3, 8, 1, 10])

plt.barh(x, y)
plt.show()
```



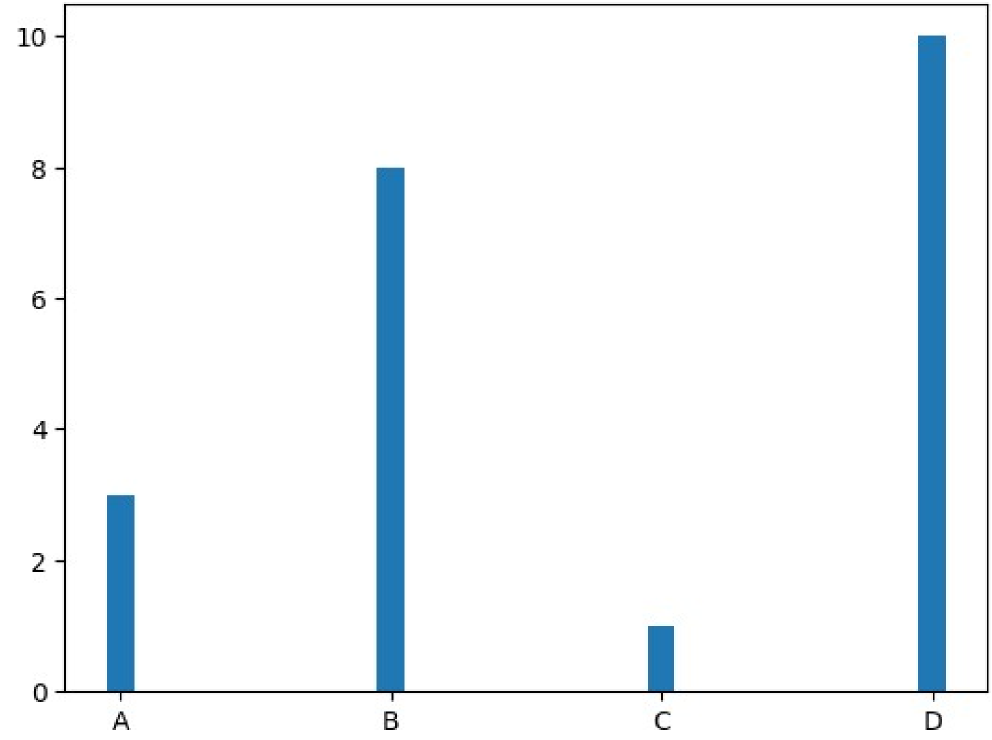
In [149…

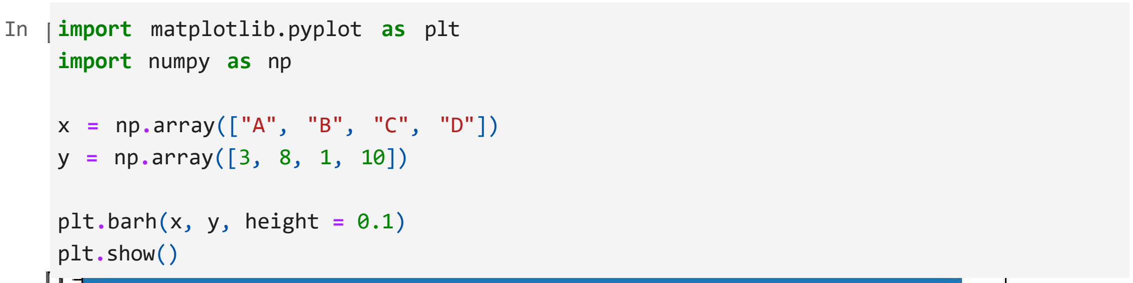
```
import matplotlib.pyplot as plt
import numpy as np

x = np.array(["A", "B", "C", "D"])
y = np.array([3, 8, 1, 10])

plt.bar(x, y, color = "red")
plt.show()
```



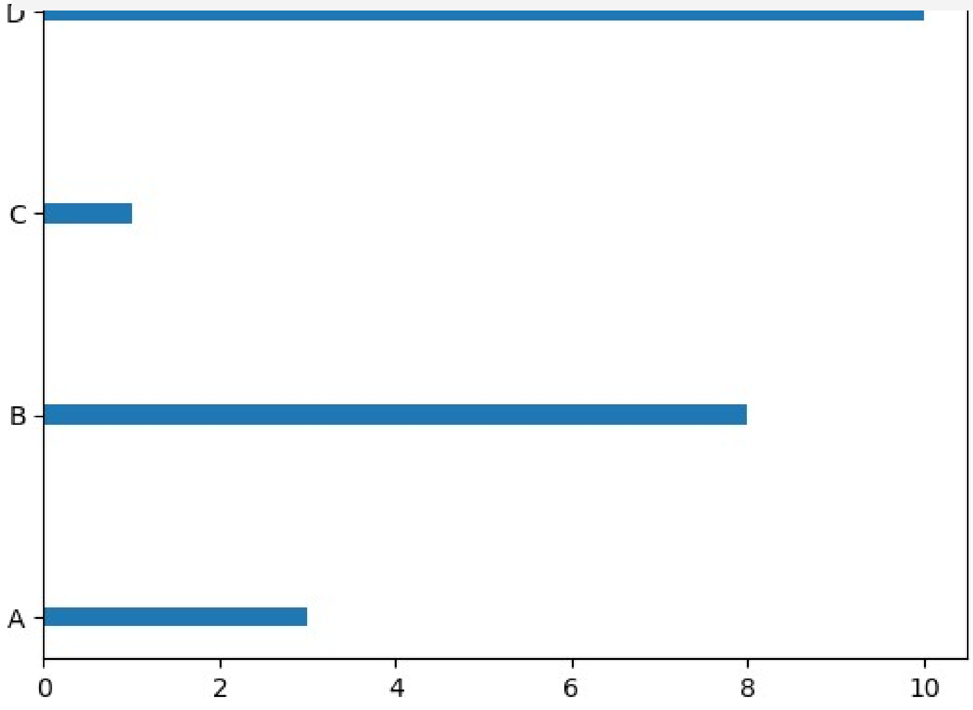
In [151…

```
import matplotlib.pyplot as plt
import numpy as np

x = np.array(["A", "B", "C", "D"])
y = np.array([3, 8, 1, 10])

plt.bar(x, y, width = 0.1)
plt.show()
```





```
In [ import matplotlib.pyplot as plt
     import numpy as np

     x = np.array(["A", "B", "C", "D"])
     y = np.array([3, 8, 1, 10])

     plt.barh(x, y, height = 0.1)
     plt.show()
```



Scipy:

In [1]:
```
from scipy import constants
print(constants.pi)
```

```
3.141592653589793
```

In [3]:
```
from scipy import constants
print(dir(constants))
```

```
['Avogadro', 'Boltzmann', 'Btu', 'Btu_IT', 'Btu_th', 'ConstantWarning', 'G', 'Jul
ian_year', 'N_A', 'Planck', 'R', 'Rydberg', 'Stefan_Boltzmann', 'Wien', '__all_
_', '__builtins__', '__cached__', '__doc__', '__file__', '__loader__', '__name_
_', '__package__', '__path__', '__spec__', '_codata', '_constants', '_obsolete_co
nstants', 'acre', 'alpha', 'angstrom', 'arcmin', 'arcminute', 'arcsec', 'arcsecon
d', 'astronomical_unit', 'atm', 'atmosphere', 'atomic_mass', 'atto', 'au', 'bar',
'barrel', 'bbl', 'blob', 'c', 'calorie', 'calorie_IT', 'calorie_th', 'carat', 'ce
nti', 'codata', 'constants', 'convert_temperature', 'day', 'deci', 'degree', 'deg
ree_Fahrenheit', 'deka', 'dyn', 'dyne', 'e', 'eV', 'electron_mass', 'electron_vol
t', 'elementary_charge', 'epsilon_0', 'erg', 'exa', 'exbi', 'femto', 'fermi', 'fi
nd', 'fine_structure', 'fluid_ounce', 'fluid_ounce_US', 'fluid_ounce_imp', 'foo
t', 'g', 'gallon', 'gallon_US', 'gallon_imp', 'gas_constant', 'gibi', 'giga', 'go
lden', 'golden_ratio', 'grain', 'gram', 'gravitational_constant', 'h', 'hbar', 'h
ectare', 'hecto', 'horsepower', 'hour', 'hp', 'inch', 'k', 'kgf', 'kibi', 'kilo',
'kilogram_force', 'kmh', 'knot', 'lambda2nu', 'lb', 'lbf', 'light_year', 'liter',
'litre', 'long_ton', 'm_e', 'm_n', 'm_p', 'm_u', 'mach', 'mebi', 'mega', 'metric_
ton', 'micro', 'micron', 'mil', 'mile', 'milli', 'minute', 'mmHg', 'mph', 'mu_0',
'nano', 'nautical_mile', 'neutron_mass', 'nu2lambda', 'ounce', 'oz', 'parsec', 'p
ebi', 'peta', 'physical_constants', 'pi', 'pico', 'point', 'pound', 'pound_forc
e', 'precision', 'proton_mass', 'psi', 'pt', 'quecto', 'quetta', 'ronna', 'ront
o', 'short_ton', 'sigma', 'slinch', 'slug', 'speed_of_light', 'speed_of_sound',
'stone', 'survey_foot', 'survey_mile', 'tebi', 'tera', 'test', 'ton_TNT', 'torr',
'troy_ounce', 'troy_pound', 'u', 'unit', 'value', 'week', 'yard', 'year', 'yobi',
'yocto', 'yotta', 'zebi', 'zepto', 'zero_Celsius', 'zetta']
```

In [7]:
```
print(constants.micro)
print(constants.degree)
```

```
1e-06
0.017453292519943295
```

In [9]:
```
import numpy as np
from scipy.sparse import csr_matrix
arr = np.array([0, 0, 0, 0, 0, 1, 1, 0, 2])
print(csr_matrix(arr))
```

```
  (0, 5)	1
  (0, 6)	1
  (0, 8)	2
```

In [11]:
```
import numpy as np
from scipy.sparse import csr_matrix
arr = np.array([[0,0,0],[0,0,1],[1,0,2]])
print(csr_matrix(arr).data)
```

```
[1 1 2]
```

In [13]:
```
arr = np.array([[0,0,0],[0,0,1],[1,0,2]])
print(csr_matrix(arr).count_nonzero())
```

```
3
```

In [15]:
```
arr = np.array([0, 0, 0, 0, 0, 1, 1, 0, 2])
mat=csr_matrix(arr)
mat.eliminate_zeros()
print(mat)
```

```
  (0, 5)	1
  (0, 6)	1
  (0, 8)	2
```

In [17]:
```
arr = np.array([[0, 0, 0], [0, 0, 1], [1, 0, 2]])
mat = csr_matrix(arr)
mat.sum_duplicates()
print(mat)
```

```
  (1, 2)	1
  (2, 0)	1
  (2, 2)	2
```

In [19]:
```
arr = np.array([[0, 0, 0], [0, 0, 1], [1, 0, 2]])
newarr = csr_matrix(arr).tocsc()
print(newarr)
```

```
  (2, 0)	1
  (1, 2)	1
  (2, 2)	2
```

In [21]:
```
import numpy as np
from scipy.sparse.csgraph import connected_components
from scipy.sparse import csr_matrix
arr = np.array([
  [0, 1, 2],
  [1, 0, 0],
  [2, 0, 0]
])
newarr = csr_matrix(arr)
print(connected_components(newarr))
```

```
(1, array([0, 0, 0]))
```

In [ ]:

In [ ]:
```
AIM:Introduction to required python libraries such as Numpy,Pandas,Scipy,Matplot
```

In [ ]:
```
Description:Scikit-learn (sklearn) is a powerful, open-source Python library
             widely used for machine learning,.Offering a comprehensive suite
             of algorithms and tools for tasks like classification, regression,
              clustering, and dimensionality reduction.
```

In [52]:
```
import numpy as np
from sklearn.datasets import load_iris
from sklearn.model_selection import train_test_split
```

In [53]:
```
x=np.arange(16).reshape(8,2)
y=range(8)
print(x,"",y)
```

```
[[ 0  1]
 [ 2  3]
 [ 4  5]
 [ 6  7]
 [ 8  9]
 [10 11]
 [12 13]
 [14 15]]  range(0, 8)
```

In [54]:
```
#training
x_train,x_test,y_train,y_test=train_test_split(x,y,train_size=0.8,random_state=4
print(x_train)
print(x_test)
```

```
[[ 0  1]
 [14 15]
 [ 4  5]
 [ 8  9]
 [ 6  7]
 [12 13]]
[[ 2  3]
 [10 11]]
```

In [55]:
```
#testing
x_train,x_test,y_train,y_test=train_test_split(x,y,test_size=0.2,random_state=42
print(x_test)
print(y_test)
```

```
[[ 2  3]
 [10 11]]
[1, 5]
```

In [56]:
```
#validation train
x_train,x_combine,y_train,y_combine=train_test_split(x,y,test_size=0.5,random_st
print(x_train)
print(y_train)
```

```
[[ 4  5]
 [ 8  9]
 [ 6  7]
 [12 13]]
[2, 4, 3, 6]
```

```
In [57]: #validation test
         x_val,x_test,y_val,y_test=train_test_split(x,y,test_size=0.5,random_state=42)
         print(x_test)
         print(y_test)
```

```
[[ 2  3]
 [10 11]
 [ 0  1]
 [14 15]]
[1, 5, 0, 7]
```

Experiment-2

Aim: Import, Preprocess and split the datasets using scikit learn

```
In [ ]:  Description:Scikit-learn (sklearn) is a powerful, open-source Python library
                 widely used for machine learning, offering a comprehensive suite of
                 algorithms and tools for tasks like classification, regression,
                 clustering, and dimensionality reduction.
```

```
In [58]: import numpy as np
         from sklearn.datasets import load_iris
         iris=load_iris()
         print(iris.data)
```

```
[[6.9  3.2  5.7  2.3]
[5.6   2.8 4.9  2. ]
[7.7   2.8 6.7  2. ]
[6.3   2.7 4.9  1.8]
[6.7   3.3 5.7  2.1]
[7.2   3.2 6.   1.8]
[6.2   2.8 4.8  1.8]
[6.1   3.  4.9  1.8]
[6.4   2.8 5.6  2.1]
[7.2   3.  5.8  1.6]
[7.4   2.8 6.1  1.9]
[7.9   3.8 6.4  2. ]
[6.4   2.8 5.6  2.2]
[6.3   2.8 5.1  1.5]
[6.1   2.6 5.6  1.4]
[7.7   3.  6.1  2.3]
[6.3   3.4 5.6  2.4]
[6.4   3.1 5.5  1.8]
[6.    3.  4.8  1.8]
[6.9   3.1 5.4  2.1]
[6.7   3.1 5.6  2.4]
[6.9   3.1 5.1  2.3]
[5.8   2.7 5.1  1.9]
[6.8   3.2 5.9  2.3]
[6.7   3.3 5.7  2.5]
[6.7   3.  5.2  2.3]
[6.3   2.5 5.   1.9]
[6.5   3.  5.2  2. ]
[6.2   3.4 5.4  2.3]
[5.9   3.  5.1  1.8]
[5.1   3.5 1.4  0.2]
  [4.9 3.  1.4  0.2]
  [4.7 3.2 1.3  0.2]
  [4.6 3.1 1.5  0.2]
  [5.  3.6 1.4  0.2]
  [5.4 3.9 1.7  0.4]
  [4.6 3.4 1.4  0.3]
  [5.  3.4 1.5  0.2]
  [4.4 2.9 1.4  0.2]
  [4.9 3.1 1.5  0.1]
  [5.4 3.7 1.5  0.2]
  [4.8 3.4 1.6  0.2]
  [4.8 3.  1.4  0.1]
  [4.3 3.  1.1  0.1]
  [5.8 4.  1.2  0.2]
  [5.7 4.4 1.5  0.4]
  [5.4 3.9 1.3  0.4]
[5.4  3.4 1.7  0.2]
[5.1  3.7 1.5  0.4]
[4.6  3.6 1.   0.2]
[5.1  3.3 1.7  0.5]
[4.8  3.4 1.9  0.2]
[5.   3.  1.6  0.2]
[5.   3.4 1.6  0.4]
[5.2  3.5 1.5  0.2]
[5.2  3.4 1.4  0.2]
[4.7  3.2 1.6  0.2]
[4.8  3.1 1.6  0.2]
[5.4  3.4 1.5  0.4]
[5.2  4.1 1.5  0.1]
[5.5  4.2 1.4  0.2]
[4.9  3.1 1.5  0.2]
[5.   3.2 1.2  0.2]
[5.5  3.5 1.3  0.2]
[4.9  3.6 1.4  0.1]
[4.4  3.  1.3  0.2]
[5.1  3.4 1.5  0.2]
[5.   3.5 1.3  0.3]
[4.5  2.3 1.3  0.3]
[4.4  3.2 1.3  0.2]
[5.   3.5 1.6  0.6]
[5.1  3.8 1.9  0.4]
[4.8  3.  1.4  0.3]
[5.1  3.8 1.6  0.2]
[4.6  3.2 1.4  0.2]
[5.3  3.7 1.5  0.2]
[5.   3.3 1.4  0.2]
[7.   3.2 4.7  1.4]
[6.4  3.2 4.5  1.5]
[6.9  3.1 4.9  1.5]
[5.5  2.3 4.   1.3]
[6.5  2.8 4.6  1.5]
[5.7  2.8 4.5  1.3]
[6.3  3.3 4.7  1.6]
[4.9  2.4 3.3  1. ]
[6.6  2.9 4.6  1.3]
[5.2  2.7 3.9 1.4]]
```

```
In [59]:  featurenames=iris.feature_names
           print(featurenames)
           targetnames=iris.target_names
           print(targetnames)

          ['sepal length (cm)', 'sepal width (cm)', 'petal length (cm)', 'petal width (c
          m)']
          ['setosa' 'versicolor' 'virginica']
```

```
In [60]:  y=iris.target
           print(y)

          [0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
           0 0 0 0 0 0 0 0 0 0 0 0 0 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
           1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 2 2 2 2 2 2 2 2 2 2 2
           2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2
           2 2]
```

```
In [1]:   from sklearn.datasets import load_iris, load_digits
           dig = load_digits()
           print(dig.data)
           print(load_iris().data)
```

```
[[ 0.   0.  5. ...  0.   0.   0.]
 [ 0.   0.  0. ... 10.   0.   0.]
 [ 0.   0.  0. ... 16.   9.   0.]
 ...
 [ 0.   0.  1. ...  6.   0.   0.]
 [ 0.   0.  2. ... 12.   0.   0.]
 [ 0.   0. 10. ... 12.   1.   0.]]
[[5.1  3.5 1.4  0.2]
 [4.9 3.   1.4  0.2]
 [4.7  3.2 1.3  0.2]
 [4.6  3.1 1.5  0.2]
 [5.   3.6 1.4  0.2]
 [5.4  3.9 1.7  0.4]
 [4.6  3.4 1.4  0.3]
 [5.   3.4 1.5  0.2]
 [4.4  2.9 1.4  0.2]
 [4.9  3.1 1.5  0.1]
 [5.4  3.7 1.5  0.2]
 [4.8  3.4 1.6  0.2]
 [4.8 3.   1.4  0.1]
 [4.3 3.   1.1  0.1]
 [5.8 4.   1.2  0.2]
 [5.7  4.4 1.5  0.4]
 [5.4  3.9 1.3  0.4]
 [5.1  3.5 1.4  0.3]
 [5.7  3.8 1.7  0.3]
 [5.1  3.8 1.5  0.3]
 [5.4  3.4 1.7  0.2]
 [5.1  3.7 1.5  0.4]
 [4.6  3.6 1.   0.2]
 [5.1  3.3 1.7  0.5]
 [4.8  3.4 1.9  0.2]
 [5.  3.   1.6  0.2]
 [5.   3.4 1.6  0.4]
 [5.2  3.5 1.5  0.2]
 [5.2  3.4 1.4  0.2]
 [4.7  3.2 1.6  0.2]
 [4.8  3.1 1.6  0.2]
 [5.4  3.4 1.5  0.4]
 [5.2  4.1 1.5  0.1]
 [5.5  4.2 1.4  0.2]
 [4.9  3.1 1.5  0.2]
 [5.   3.2 1.2  0.2]
 [5.5  3.5 1.3  0.2]
 [4.9  3.6 1.4  0.1]
 [4.4 3.   1.3  0.2]
 [5.1  3.4 1.5  0.2]
 [5.   3.5 1.3  0.3]
 [4.5  2.3 1.3  0.3]
 [4.4  3.2 1.3  0.2]
 [5.   3.5 1.6  0.6]
 [5.1  3.8 1.9  0.4]
 [4.8 3.   1.4  0.3]
 [5.1  3.8 1.6  0.2]
 [4.6  3.2 1.4  0.2]
 [5.3  3.7 1.5  0.2]
 [5.   3.3 1.4  0.2]
 [7.   3.2 4.7  1.4]
 [6.4  3.2 4.5  1.5]
 [6.9  3.1 4.9  1.5]
 [5.7  2.5  5.   2. ]
 [5.8  2.8  5.1  2.4]
 [6.4  3.2  5.3  2.3]
 [6.5  3.   5.5  1.8]
 [7.7  3.8  6.7  2.2]
 [7.7  2.6  6.9  2.3]
 [6.   2.2  5.   1.5]
 [6.9  3.2  5.7  2.3]
 [5.6  2.8  4.9  2. ]
 [7.7  2.8  6.7  2. ]
 [6.3  2.7  4.9  1.8]
 [6.7  3.3  5.7  2.1]
 [7.2  3.2  6.   1.8]
 [6.2  2.8  4.8  1.8]
 [6.1  3.   4.9  1.8]
 [6.4  2.8  5.6  2.1]
 [7.2  3.   5.8  1.6]
 [7.4  2.8  6.1  1.9]
 [7.9  3.8  6.4  2. ]
 [6.4  2.8  5.6  2.2]
 [6.3  2.8  5.1  1.5]
 [6.1  2.6  5.6  1.4]
 [7.7  3.   6.1  2.3]
 [6.3  3.4  5.6  2.4]
 [6.4  3.1  5.5  1.8]
 [6.   3.   4.8  1.8]
 [6.9  3.1  5.4  2.1]
 [6.7  3.1  5.6  2.4]
 [6.9  3.1  5.1  2.3]
 [5.8  2.7  5.1  1.9]
 [6.8  3.2  5.9  2.3]
 [6.7  3.3  5.7  2.5]
 [6.7  3.   5.2  2.3]
 [6.3  2.5  5.   1.9]
 [6.5  3.   5.2  2. ]
 [6.2  3.4  5.4  2.3]
 [5.9  3.   5.1  1.8]]
```

In [ ]:

```
print(x[1:10])
print(type(x))
```

In [ ]:

```
#train data
x1=iris.data
x=x1[1:20]
y1=iris.target
y=y1[1:20]
print(x)
print(y)
x_train,x_test,y_train,y_test=train_test_split(x,y,train_size=0.8,random_state=4
print(x_train)
print(x_test)
```

In [ ]:

```
x1=iris.data
y1=iris.target
x_train,x_test,y_train,y_test=train_test_split(x,y,train_size=0.7,random_state=4
print(x.shape)
print(x_train)
print(x_train.shape)
print(y_train)
print(y_train.shape)
```

In [ ]:

```
#testing data
x1=iris.data
y1=iris.target
x_train,x_test,y_train,y_test=train_test_split(x,y,test_size=0.2,random_state=42
print(x_test)
print(x_test.shape)
print(y_test)
print(y_test.shape)
```

In [ ]:

```
# datset on diabetes
import numpy as np
from sklearn.datasets import load_diabetes
from sklearn.model_selection import train_test_split
```

In [ ]:

```
x=np.arange(16).reshape(8,2)
y=range(8)
print(x,"",y)
```

In [ ]:

```
#training
x_train,x_test,y_train,y_test=train_test_split(x,y,train_size=0.8,random_state=4
print(x_train)
print(x_test)
```

In [ ]:

```
#testing
x_train,x_test,y_train,y_test=train_test_split(x,y,test_size=0.2,random_state=42
print(x_test)
print(y_test)
```

In [ ]:

```
#validation train
x_train,x_combine,y_train,y_combine=train_test_split(x,y,test_size=0.5,random_st
print(x_train)
print(y_train)
```

In [ ]:

```
#validation test
x_val,x_test,y_val,y_test=train_test_split(x,y,test_size=0.5,random_state=42)
print(x_test)
print(y_test)
```

In [ ]:

```
from sklearn.datasets import load_diabetes
diabetes=load_diabetes()
print(diabetes.data)
```

In [ ]:

```
feature_names = diabetes.feature_names
print("Feature Names:", feature_names)

# Access target name
target_name = 'disease_progression'
print("Target Name:", target_name)
```

In [ ]:

```
y=diabetes.target
print(y)
```

In [ ]:

```
print(x[1:10])
print(type(x))
```

In [ ]:

```
#train data
x1=diabetes.data
x=x1[1:20]
y1=diabetes.target
y=y1[1:20]
print(x)
print(y)
x_train,x_test,y_train,y_test=train_test_split(x,y,train_size=0.8,random_state=4
print(x_train)
print(x_test)
```

In [ ]:

```
x1=diabetes.data
y1=diabetes.target
x_train,x_test,y_train,y_test=train_test_split(x,y,train_size=0.7,random_state=4
print(x.shape)
print(x_train)
print(x_train.shape)
print(y_train)
print(y_train.shape)
```

In [ ]:

```
#testing data
x1=iris.data
y1=iris.target
x_train,x_test,y_train,y_test=train_test_split(x,y,test_size=0.2,random_state=42
print(x_test)
print(x_test.shape)
print(y_test)
print(y_test.shape)
```

In [77]:

```
#splitting our own data set
import pandas as pd
df=pd.read_csv('diabetes.csv')
```

In [79]:

```
x=df['Glucose']
y=df['Outcome']
print(x)
print(y)
```

```
0      148
1       85
2      183
3       89
4      137
      ...
763    101
764    122
765    121
766    126
767     93
Name: Glucose,  Length: 768, dtype: int64
0      1
1      0
2      1
3      0
4      1
      ..
763    0
764    0
765    0
766    1
767    0
Name: Outcome,  Length: 768, dtype: int64
```

```
In [81]: #train data
         x_train,x_test,y_train,y_test=train_test_split(x,y,train_size=0.7,random_state=4
         print(x.shape)
         print(x_train)
         print(x_train.shape)
         print(y_train)
         print(y_train.shape)
```

```
(768,)
334     95
139    105
485    135
547    131
18     103
      ...
71     139
106     96
270    101
435    141
102    125
Name: Glucose,  Length:  537, dtype: int64
(537,)
334    0
139    0
485    1
547    0
18     0
      ..
71     0
106    0
270    1
435    1
102    0
Name: Outcome,  Length:  537, dtype: int64
(537,)
```

Experiment-3

Aim: Construct a classification model using the Bayes classifier using Python Programming

Description:The Bayes classifier is a theoretical concept in machine learning that represents the best possible classifier for a given problem. It is based on Bayes' theorem, which describes how to update probabilities based on new evidence.

The Naive Bayes classifier is a simple probabilistic classifier based on applying Bayes' theorem with a strong (naive) independence assumption between the features. It is widely used for text classification, spam filtering, and other tasks involving high-dimensional data.

```
In [1]: import pandas as pd
        df=pd.read_csv('Titanic-Dataset.csv')
```

```
In [3]: df.head(10)
```

Out[3]:

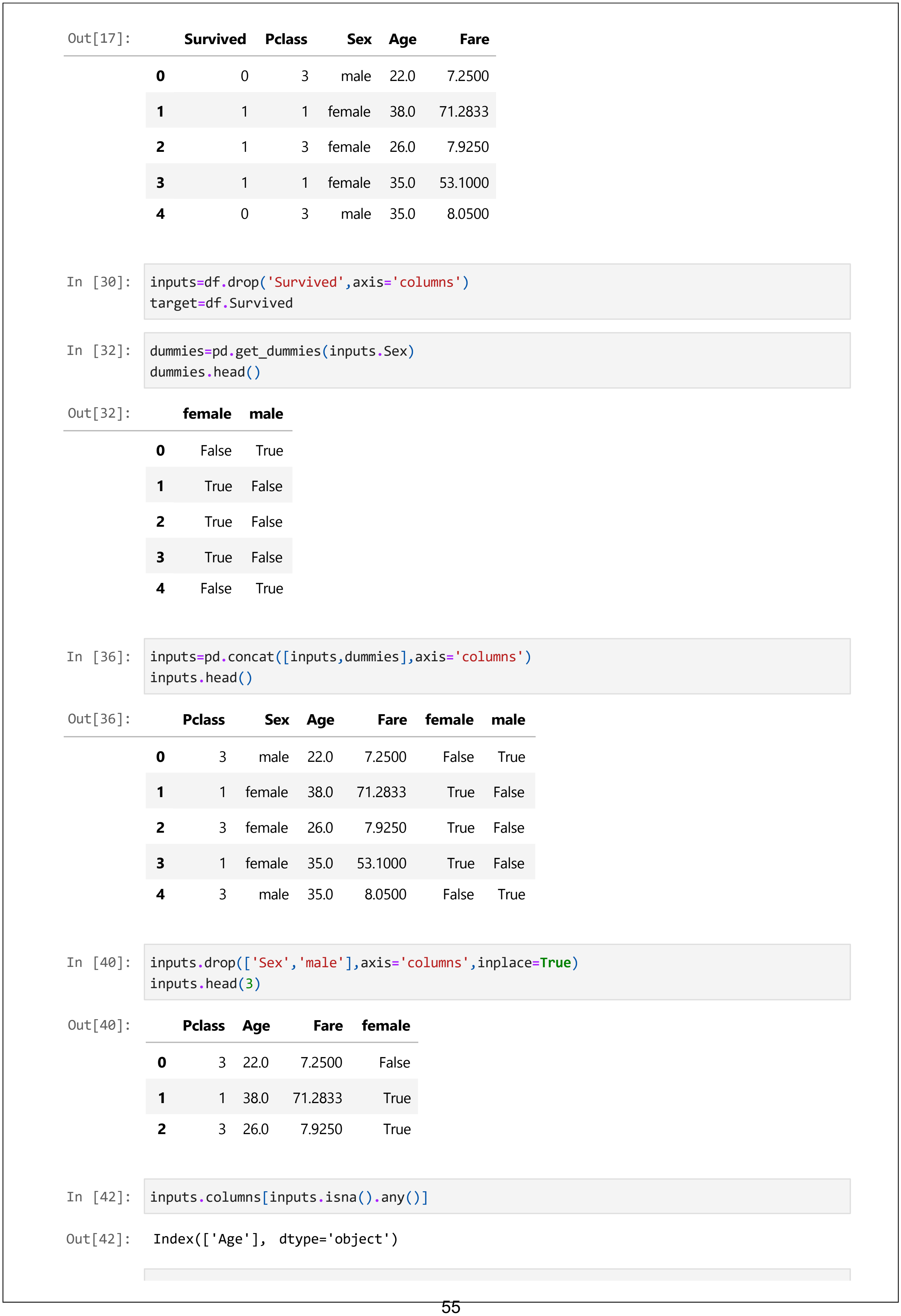
	PassengerId	Survived	Pclass	Name	Sex	Age	SibSp	Parch	Ticket	
0	1	0	3	Braund, Mr. Owen Harris	male	22.0	1	0	A/5 21171	7
1	2	1	1	Cumings, Mrs. John Bradley (Florence Briggs Th...	female	38.0	1	0	PC 17599	71
2	3	1	3	Heikkinen, Miss. ina	female	26.0	0	0	STON/O2. 3101282	7
3	4	1	1	Fut elle, Mrs. Jacues Heath (LilyMay Peel)	female	35.0	1	0	113803	53
4	5	0	3	Allen, Mr. William Henry	male	35.0	0	0	373450	8
5	6	0	3	Moran, Mr. James	male	NaN	0	0	330877	8
6	7	0	1	McC arthy, Mr. Timothy J	male	54.0	0	0	17463	51
7	8	0	3	Palsson, Master. Gosta Leonard	male	2.0	3	1	349909	21
8	9	1	3	Johnson, Mrs. Oscar W (Elisabeth Vilhelmina Berg)	female	27.0	0	2	347742	11
9	10	1	2	Nasser, Mrs. Nicholas (Adele Achem)	female	14.0	1	0	237736	30

In [7]:

```
#droping unrelavent columns
df.drop(['PassengerId','Name','SibSp','Parch','Ticket','Cabin','Embarked'],axis=
```

In [17]:

```
df.head()
```



Out[17]:

	Survived	Pclass	Sex	Age	Fare
0	0	3	male	22.0	7.2500
1	1	1	female	38.0	71.2833
2	1	3	female	26.0	7.9250
3	1	1	female	35.0	53.1000
4	0	3	male	35.0	8.0500

In [30]:

```
inputs=df.drop('Survived',axis='columns')
target=df.Survived
```

In [32]:

```
dummies=pd.get_dummies(inputs.Sex)
dummies.head()
```

Out[32]:

	female	male
0	False	True
1	True	False
2	True	False
3	True	False
4	False	True

In [36]:

```
inputs=pd.concat([inputs,dummies],axis='columns')
inputs.head()
```

Out[36]:

	Pclass	Sex	Age	Fare	female	male
0	3	male	22.0	7.2500	False	True
1	1	female	38.0	71.2833	True	False
2	3	female	26.0	7.9250	True	False
3	1	female	35.0	53.1000	True	False
4	3	male	35.0	8.0500	False	True

In [40]:

```
inputs.drop(['Sex','male'],axis='columns',inplace=True)
inputs.head(3)
```

Out[40]:

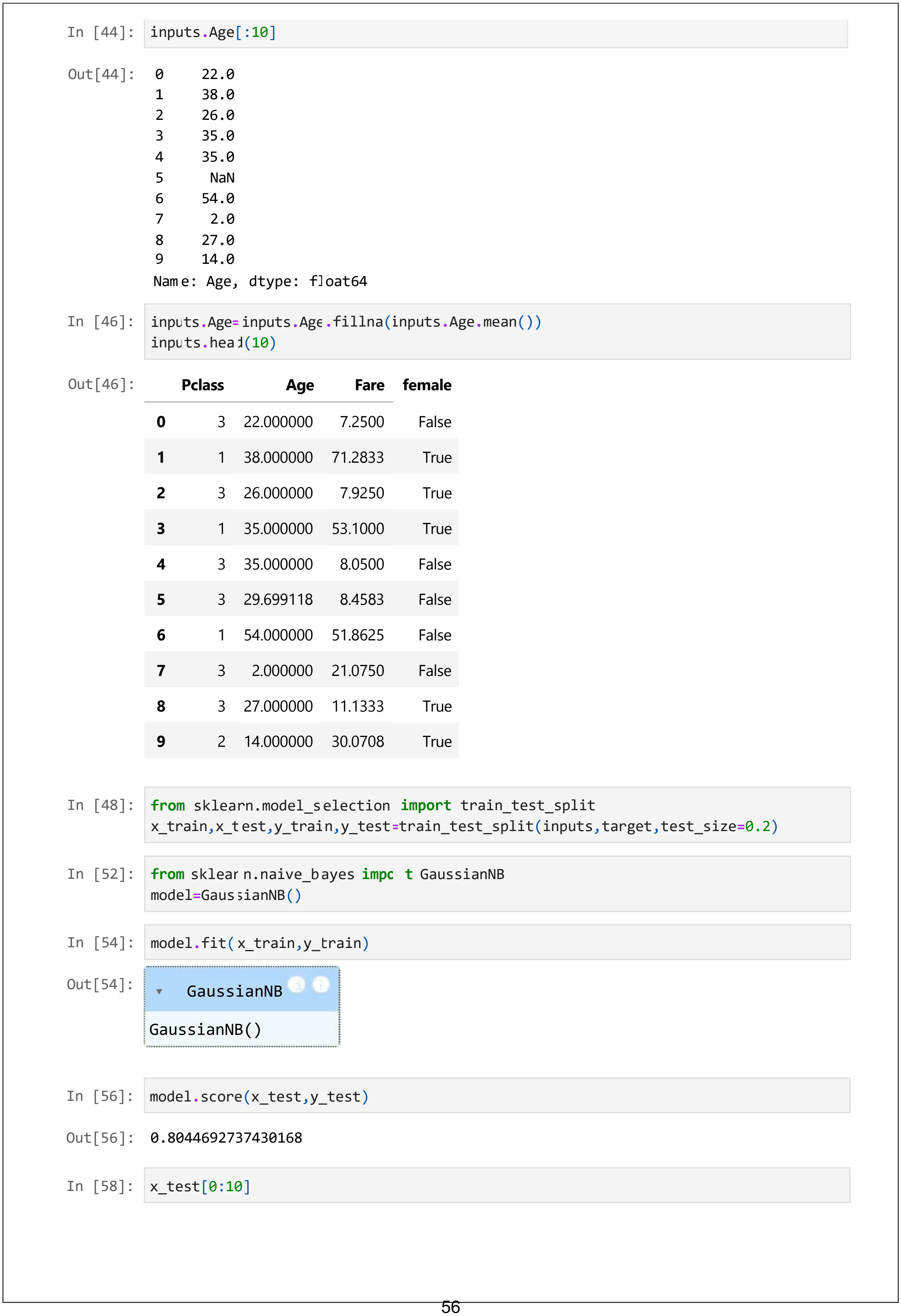
	Pclass	Age	Fare	female
0	3	22.0	7.2500	False
1	1	38.0	71.2833	True
2	3	26.0	7.9250	True

In [42]:

```
inputs.columns[inputs.isna().any()]
```

Out[42]:

```
Index(['Age'], dtype='object')
```



In [44]:
```
inputs.Age[:10]
```

Out[44]:
```
0    22.0
1    38.0
2    26.0
3    35.0
4    35.0
5     NaN
6    54.0
7     2.0
8    27.0
9    14.0
Name: Age, dtype: float64
```

In [46]:
```
inputs.Age=inputs.Age.fillna(inputs.Age.mean())
inputs.head(10)
```

Out[46]:

	Pclass	Age	Fare	female
0	3	22.000000	7.2500	False
1	1	38.000000	71.2833	True
2	3	26.000000	7.9250	True
3	1	35.000000	53.1000	True
4	3	35.000000	8.0500	False
5	3	29.699118	8.4583	False
6	1	54.000000	51.8625	False
7	3	2.000000	21.0750	False
8	3	27.000000	11.1333	True
9	2	14.000000	30.0708	True

In [48]:
```
from sklearn.model_selection import train_test_split
x_train,x_test,y_train,y_test=train_test_split(inputs,target,test_size=0.2)
```

In [52]:
```
from sklearn.naive_bayes import GaussianNB
model=GaussianNB()
```

In [54]:
```
model.fit(x_train,y_train)
```

Out[54]:
```
▾ GaussianNB
GaussianNB()
```

In [56]:
```
model.score(x_test,y_test)
```

Out[56]:
```
0.8044692737430168
```

In [58]:
```
x_test[0:10]
```

Out[58]:

	Pclass	Age	Fare	female
283	3	19.0	8.0500	False
641	1	24.0	69.3000	True
515	1	47.0	34.0208	False
230	1	35.0	83.4750	True
405	2	34.0	21.0000	False
153	3	40.5	14.5000	False
480	3	9.0	46.9000	False
8	3	27.0	11.1333	True
608	2	22.0	41.5792	True
85	3	33.0	15.8500	True

In [60]:

```
y_test[0:10]
```

Out[60]:

```
283     1
641     1
515     0
230     1
405     0
153     0
480     0
8       1
608     1
85      1
Name: Survived, dtype: int64
```

In [62]:

```
model.predict(x_test[0:10])
```

Out[62]:

```
array([0, 1, 0, 1, 0, 0, 0, 1, 1, 1], dtype=int64)
```

In [64]:

```
model.predict_proba(x_test[:10])
```

Out[64]:

```
array([[0.95918239, 0.04081761],
       [0.03543916, 0.96456084],
       [0.75443285, 0.24556715],
       [0.01868306, 0.98131694],
       [0.92868154, 0.07131846],
       [0.9655783 , 0.0344217 ],
       [0.92231314, 0.07768686],
       [0.48324095, 0.51675905],
       [0.23244707, 0.76755293],
       [0.49582998, 0.50417002]])
```

In [68]:

```
test=[[1,25.000000,15.2750,0]]
a=model.predict(test)
if a[0] == 0:
    print("not Servives")
else:
    print("servived")
```

```
not Servives
```

```
C:\ProgramData\anaconda3\Lib\site-packages\sklearn\base.py:493: UserWarning: X do
es not have valid feature names, but GaussianNB was fitted with feature names
  warnings.warn(
```

In [70]:

```
from sklearn.model_selection import cross_val_score
cross_val_score(GaussianNB(),x_train,y_train,cv=5)
```

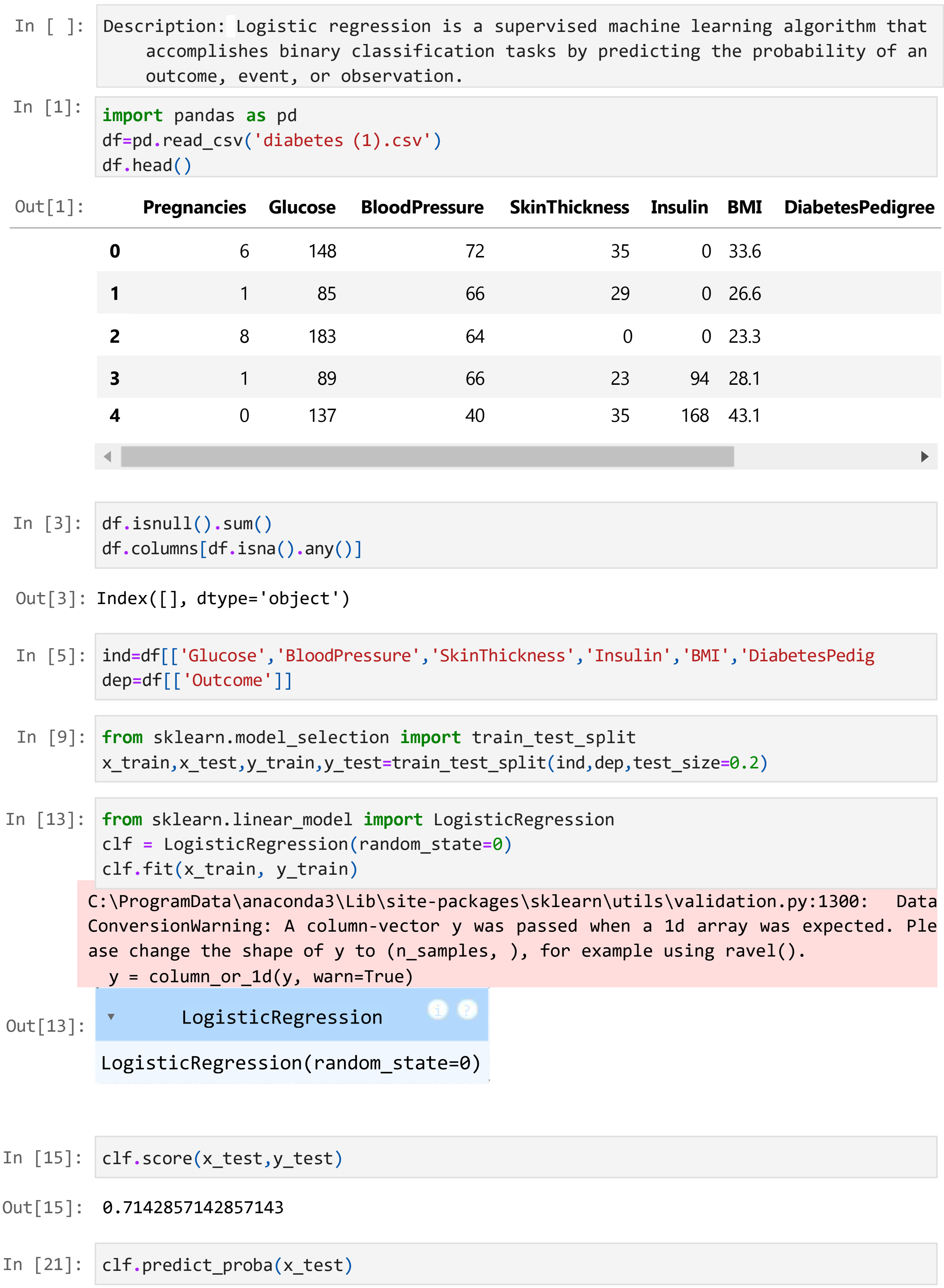
Out[70]:

```
array([0.72727273, 0.81818182, 0.77464789, 0.74647887, 0.78169014])
```

In [ ]:

Experiment-4

Aim: Implement a Logistic Regression algorithm for binary classification using Python Programming



```
In [ ]:  Description: Logistic regression is a supervised machine learning algorithm that
             accomplishes binary classification tasks by predicting the probability of an
             outcome, event, or observation.
```

```
In [1]:  import pandas as pd
         df=pd.read_csv('diabetes (1).csv')
         df.head()
```

Out[1]:

	Pregnancies	Glucose	BloodPressure	SkinThickness	Insulin	BMI	DiabetesPedigree
0	6	148	72	35	0	33.6	
1	1	85	66	29	0	26.6	
2	8	183	64	0	0	23.3	
3	1	89	66	23	94	28.1	
4	0	137	40	35	168	43.1	

```
In [3]:  df.isnull().sum()
         df.columns[df.isna().any()]

Out[3]: Index([], dtype='object')
```

```
In [5]:  ind=df[['Glucose','BloodPressure','SkinThickness','Insulin','BMI','DiabetesPedig
         dep=df[['Outcome']]
```

```
In [9]:  from sklearn.model_selection import train_test_split
         x_train,x_test,y_train,y_test=train_test_split(ind,dep,test_size=0.2)
```

```
In [13]: from sklearn.linear_model import LogisticRegression
         clf = LogisticRegression(random_state=0)
         clf.fit(x_train, y_train)

        C:\ProgramData\anaconda3\Lib\site-packages\sklearn\utils\validation.py:1300:  Data
        ConversionWarning: A column-vector y was passed when a 1d array was expected. Ple
        ase change the shape of y to (n_samples, ), for example using ravel().
          y = column_or_1d(y, warn=True)

Out[13]:  ▾      LogisticRegression
          LogisticRegression(random_state=0)
```

```
In [15]: clf.score(x_test,y_test)

Out[15]: 0.7142857142857143
```

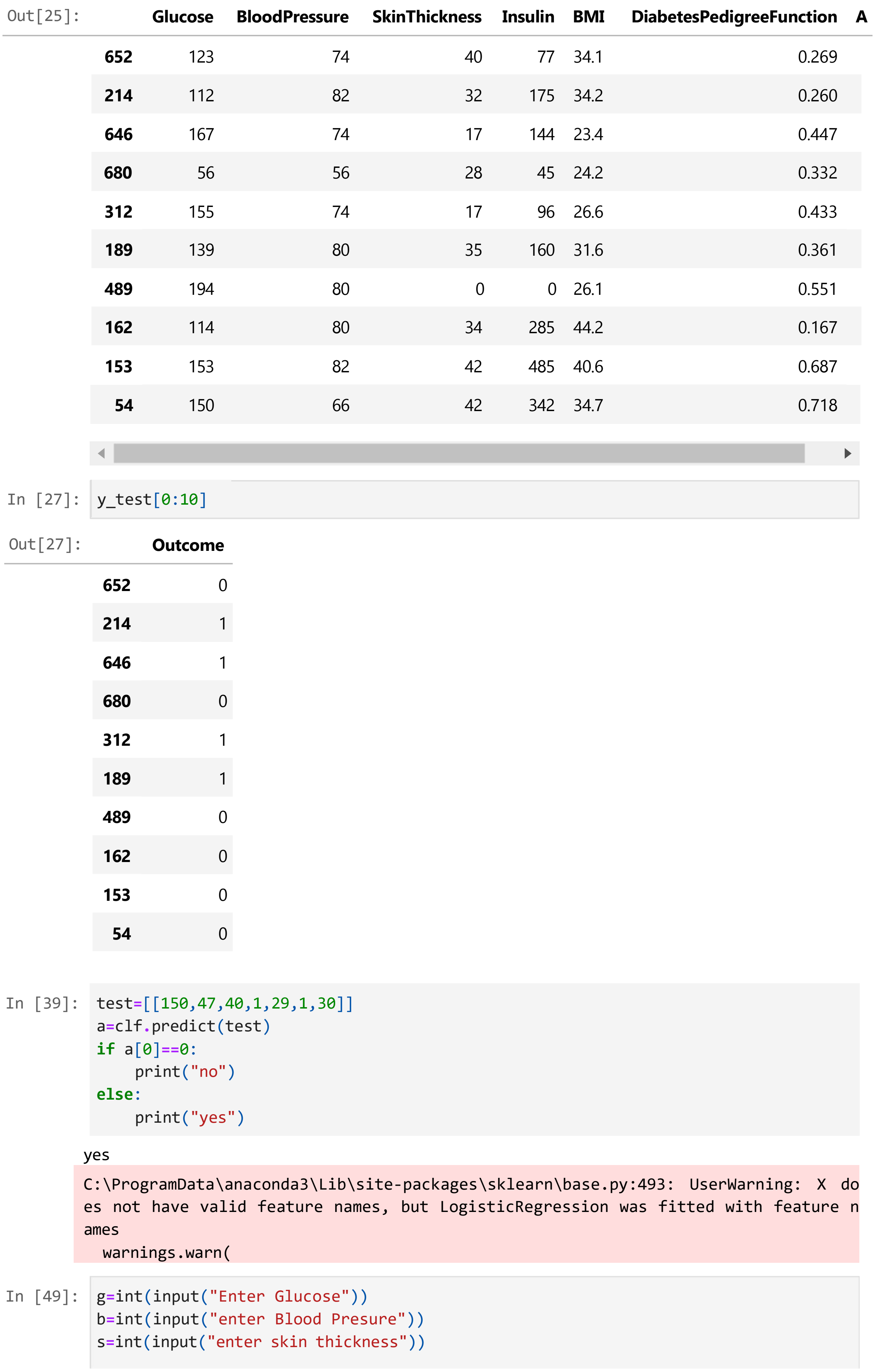
```
In [21]: clf.predict_proba(x_test)
```

```
Out[21]:  array([[0.71622907,  0.28377093],
                 [0.81009205,  0.18990795],
                 [0.59463224,  0.40536776],
                 [0.98544092,  0.01455908],
                 [0.64584897,  0.35415103],
                 [0.71330441,  0.28669559],
                 [0.10329224,  0.89670776],
                 [0.72650187,  0.27349813],
                 [0.49776377,  0.50223623],
                 [0.37667973,  0.62332027],
                 [0.72052599,  0.27947401],
                 [0.86191889,  0.13808111],
                 [0.47654928,  0.52345072],
                 [0.67908081,  0.32091919],
                 [0.7666752 , 0.2333248 ],
                 [0.05401174,  0.94598826],
                 [0.73264195,  0.26735805],
                 [0.93483705,  0.06516295],
                 [0.70590862,  0.29409138],
                 [0.22365303,  0.77634697],
                 [0.80656196,  0.19343804],
                 [0.53267443,  0.46732557],
                 [0.88919897,  0.11080103],
                 [0.92835281,  0.07164719],
                 [0.78139908,  0.21860092],
                 [0.53611385,  0.46388615],
                 [0.8158336 , 0.1841664 ],
                 [0.81093023,  0.18906977],
                 [0.47306878,  0.52693122],
                 [0.46783077,  0.53216923],
                 [0.74614346,  0.25385654],
                 [0.71426116,  0.28573884],
                 [0.91194273,  0.08805727],
                 [0.79221653,  0.20778347],
                 [0.77244967,  0.22755033],
                 [0.97517836,  0.02482164],
                 [0.620061  , 0.379939  ],
                 [0.11019756,  0.88980244],
                 [0.20571949,  0.79428051],
                 [0.70194865,  0.29805135],
                 [0.79533069,  0.20466931],
                 [0.09510267,  0.90489733],
                 [0.84485236,  0.15514764],
                 [0.47921408,  0.52078592],
                 [0.77907517,  0.22092483],
                 [0.5673333 , 0.4326667 ],
                 [0.97345384,  0.02654616],
                 [0.65932125,  0.34067875],
                 [0.8988344 , 0.1011656 ],
                 [0.89010266,  0.10989734],
                 [0.57967007,  0.42032993],
                 [0.26490145,  0.73509855],
                 [0.65296159,  0.34703841],
                 [0.54123515,  0.45876485],
                 [0.22409965,  0.77590035],
                 [0.28705577,  0.71294423],
                 [0.94183493,  0.05816507],
                 [0.78226737,  0.21773263],
                 [0.9780263 , 0.0219737 ],
                 [0.78154232,  0.21845768],
       [0.58746367,  0.41253633],
       [0.91140108,  0.08859892],
       [0.3236746 , 0.6763254 ],
       [0.37067956,  0.62932044],
       [0.9391977 , 0.0608023 ],
       [0.30413127,  0.69586873],
       [0.60897691,  0.39102309],
       [0.99563158,  0.00436842],
       [0.14398838,  0.85601162],
       [0.57015964,  0.42984036],
       [0.24278779,  0.75721221],
       [0.80713986,  0.19286014],
       [0.71411178,  0.28588822],
       [0.8566079 , 0.1433921 ],
       [0.72162031,  0.27837969],
       [0.80262964,  0.19737036],
       [0.77257635,  0.22742365],
       [0.50992607,  0.49007393],
       [0.97243056,  0.02756944],
       [0.5410379 , 0.4589621 ],
       [0.84895895,  0.15104105],
       [0.76476342,  0.23523658],
       [0.8364076 , 0.1635924 ],
       [0.87885388,  0.12114612],
       [0.61023124,  0.38976876],
       [0.91964223,  0.08035777],
       [0.96083667,  0.03916333],
       [0.21784905,  0.78215095],
       [0.81524858,  0.18475142],
       [0.90029458,  0.09970542],
       [0.92420832,  0.07579168],
       [0.98722146,  0.01277854],
       [0.92482487,  0.07517513],
       [0.89143193,  0.10856807]])
```

```
In [23]: clf.score(x_test,y_test)
```

```
Out[23]: 0.7142857142857143
```

```
In [25]: x_test[0:10]
```



Out[25]:

	Glucose	BloodPressure	SkinThickness	Insulin	BMI	DiabetesPedigreeFunction	A
652	123	74	40	77	34.1	0.269	
214	112	82	32	175	34.2	0.260	
646	167	74	17	144	23.4	0.447	
680	56	56	28	45	24.2	0.332	
312	155	74	17	96	26.6	0.433	
189	139	80	35	160	31.6	0.361	
489	194	80	0	0	26.1	0.551	
162	114	80	34	285	44.2	0.167	
153	153	82	42	485	40.6	0.687	
54	150	66	42	342	34.7	0.718	

In [27]:

```
y_test[0:10]
```

Out[27]:

	Outcome
652	0
214	1
646	1
680	0
312	1
189	1
489	0
162	0
153	0
54	0

In [39]:

```
test=[[150,47,40,1,29,1,30]]
a=clf.predict(test)
if a[0]==0:
    print("no")
else:
    print("yes")
```

```
yes
C:\ProgramData\anaconda3\Lib\site-packages\sklearn\base.py:493: UserWarning: X do
es not have valid feature names, but LogisticRegression was fitted with feature n
ames
  warnings.warn(
```

In [49]:

```
g=int(input("Enter Glucose"))
b=int(input("enter Blood Presure"))
s=int(input("enter skin thickness"))
```

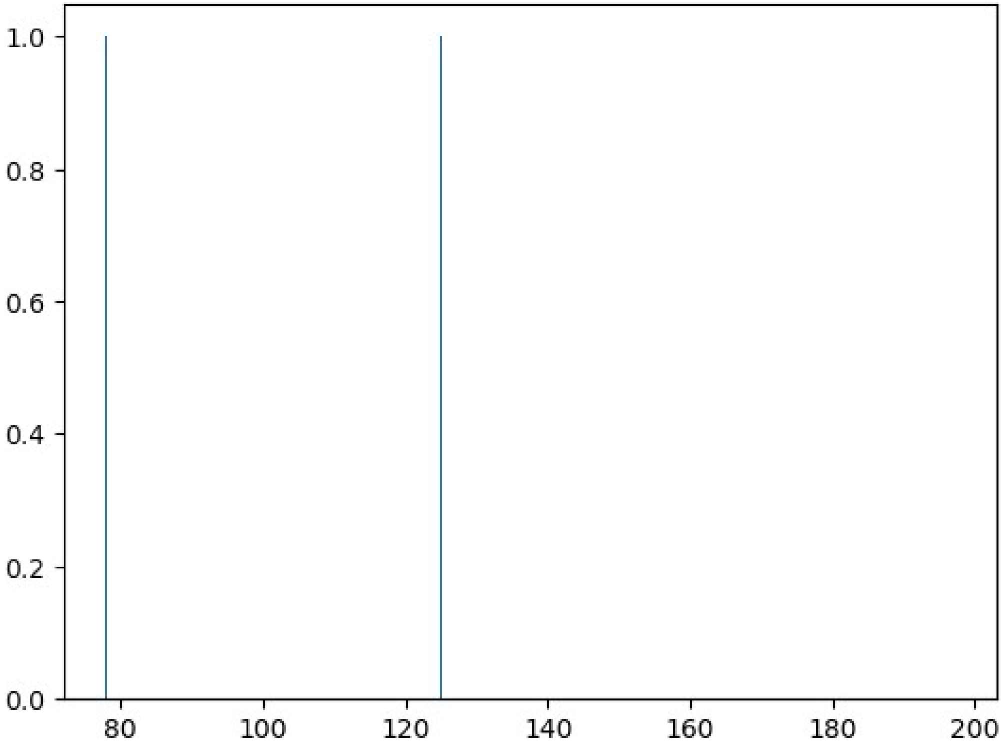
```
i=int(input("enter insullen"))
bm=float(input("enter bmi"))
d=float(input("enter dafunction"))
a=int(input("enter age"))
pr=clf.predict([[g,b,s,i,bm,d,a]])
if pr[0]==0:
    print("no")
else:
    print("yes")
```

```
yes
```

```
C:\ProgramData\anaconda3\Lib\site-packages\sklearn\base.py:493:  UserWarning:  X  do
es not have valid feature names, but LogisticRegression was fitted with feature n
ames
  warnings.warn(
```

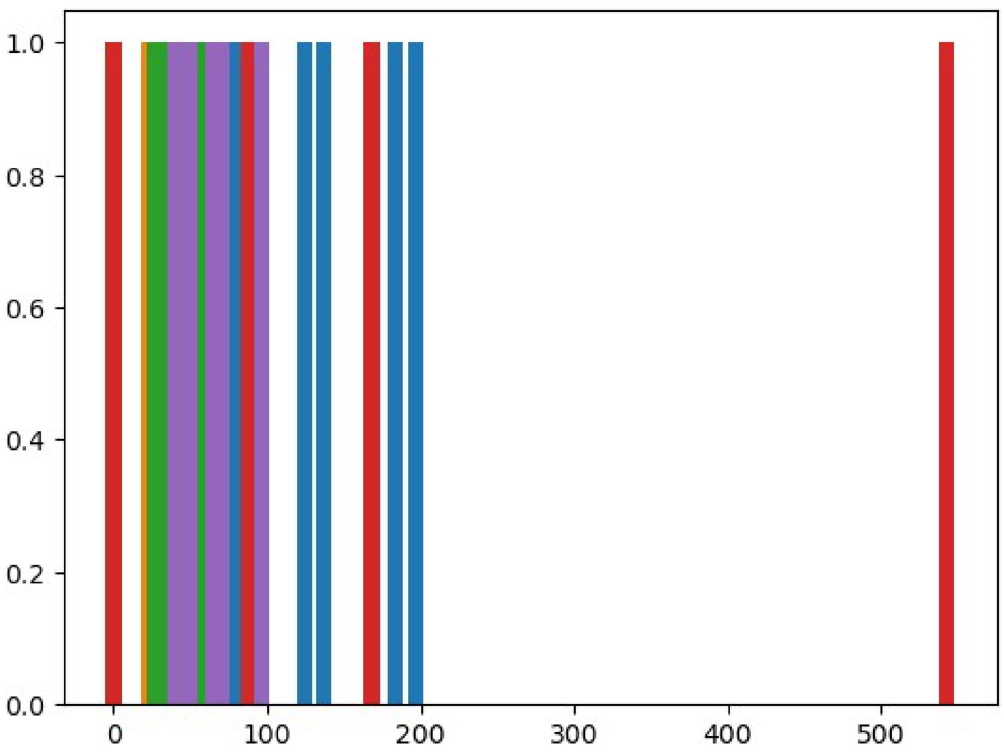
In [53]:

```
import matplotlib.pyplot as mp
x=df.Glucose[1:10]
y=df.Outcome[1:10]
mp.bar(x,y,width=0.1)
mp.show()
```

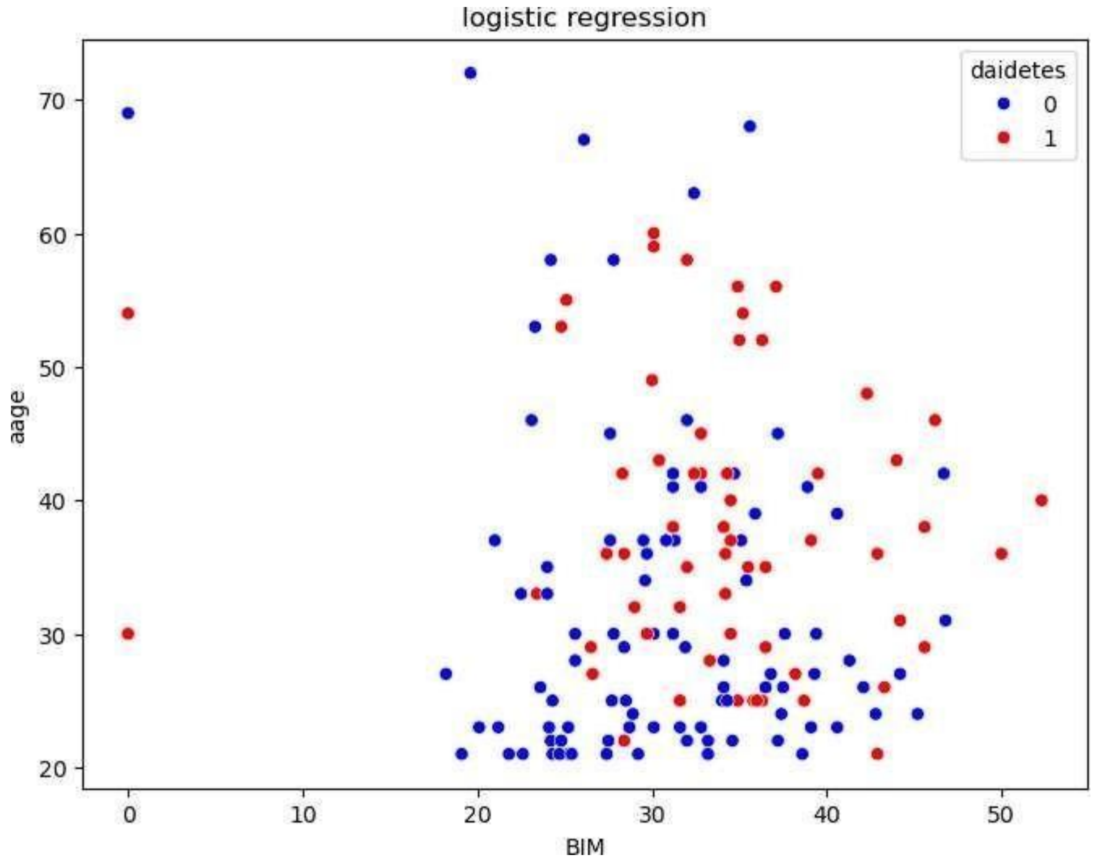


In [57]:

```
x = df[['Glucose', 'BMI', 'Age', 'Insulin', 'BloodPressure']].iloc[1:10]
y = df.Outcome[1:10]
for col in x.columns:
    mp.bar(x[col], y, width=10)

mp.show()
```



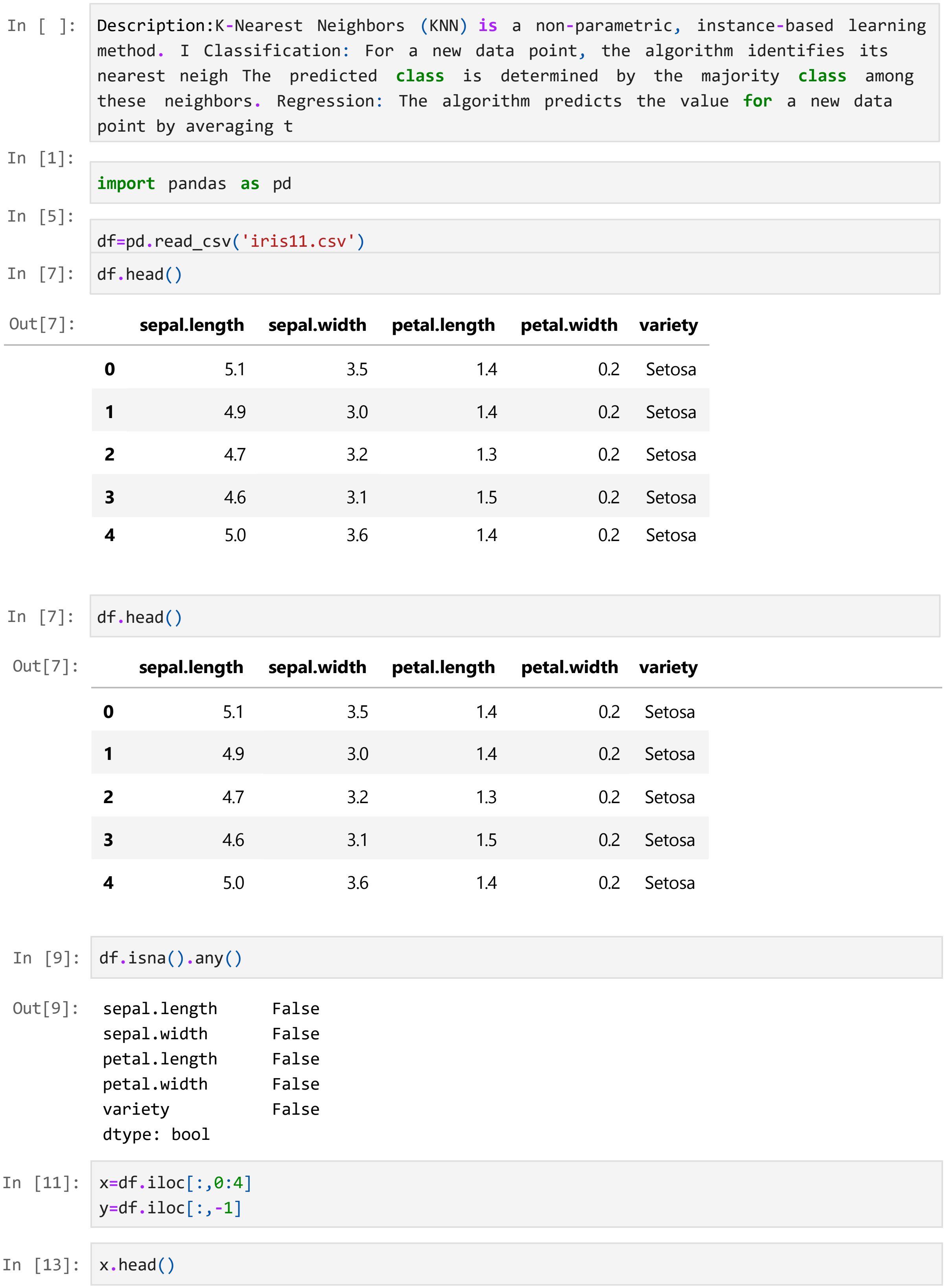
```
In [63]: from sklearn.metrics import accuracy_score,classification_report,confusion_matri
         accuracy=accuracy_score(y_test,clf.predict(x_test))
         print("accuracy:{:.2f}%".format(accuracy*100))

         accuracy:71.43%

In [69]: print("Confusion matrix")
         confusion_matrix(y_test,clf.predict(x_test))

         Confusion matrix

Out[69]: array([[80, 13],
                [31, 30]], dtype=int64)

In [71]: print("classification  report:\n",classification_report(y_test,clf.predict(x_test

         classification  report:
                       precision    recall  f1-score   support

                    0       0.72      0.86      0.78        93
                    1       0.70      0.49      0.58        61

             accuracy                           0.71       154
            macro avg       0.71      0.68      0.68       154
         weighted avg       0.71      0.71      0.70       154


In [79]: import matplo tlib.pyplot  as plt
         import seabor n as sns
         plt.figure(figsize=(8,6))
         sns.scatterplot(x=x_test['B MI'],y=x_test['Age'],h e=y_test['Outcome'],palette={0
         plt.xlabel("BIM")
         plt.ylabel("aa ge")
         plt.title("lo gistic regres sion")
         plt.legend(ti tle="daidete s",loc="up per right")
         plt.show()
```


logistic regression
daidetes
0
1
aage
70
60
50
40
30
20
BIM
0
10
20
30
40
50

```
In [ ]: )
```

Experiment:5

AIM: Implement the KNN algorithm for classification and demonstrate the process of finding out optimal —K value using Python Programming.



```
In [ ]: Description:K-Nearest Neighbors (KNN) is a non-parametric, instance-based learning
        method. I Classification: For a new data point, the algorithm identifies its
        nearest neigh The predicted class is determined by the majority class among
        these neighbors. Regression: The algorithm predicts the value for a new data
        point by averaging t
```

```
In [1]: import pandas as pd
```

```
In [5]: df=pd.read_csv('iris11.csv')
```

```
In [7]: df.head()
```

Out[7]:

	sepal.length	sepal.width	petal.length	petal.width	variety
0	5.1	3.5	1.4	0.2	Setosa
1	4.9	3.0	1.4	0.2	Setosa
2	4.7	3.2	1.3	0.2	Setosa
3	4.6	3.1	1.5	0.2	Setosa
4	5.0	3.6	1.4	0.2	Setosa

```
In [7]: df.head()
```

Out[7]:

	sepal.length	sepal.width	petal.length	petal.width	variety
0	5.1	3.5	1.4	0.2	Setosa
1	4.9	3.0	1.4	0.2	Setosa
2	4.7	3.2	1.3	0.2	Setosa
3	4.6	3.1	1.5	0.2	Setosa
4	5.0	3.6	1.4	0.2	Setosa

```
In [9]: df.isna().any()
```

```
Out[9]: sepal.length    False
        sepal.width     False
        petal.length    False
        petal.width     False
        variety         False
        dtype: bool
```

```
In [11]: x=df.iloc[:,0:4]
         y=df.iloc[:,-1]
```

```
In [13]: x.head()
```

Out[13]:

	sepal.length	sepal.width	petal.length	petal.width
0	5.1	3.5	1.4	0.2
1	4.9	3.0	1.4	0.2
2	4.7	3.2	1.3	0.2
3	4.6	3.1	1.5	0.2
4	5.0	3.6	1.4	0.2

In [15]:
```
y.head()
```

Out[15]:
```
0    Setosa
1    Setosa
2    Setosa
3    Setosa
4    Setosa
Name: variety, dtype: object
```

In [17]:
```
df.shape
```

Out[17]:
```
(150, 5)
```

In [27]:
```
from sklearn.neighbors import KNeighborsClassifier
knn=KNeighborsClassifier(n_neighbors=12)
```

In [29]:
```
knn.fit(x,y)
```

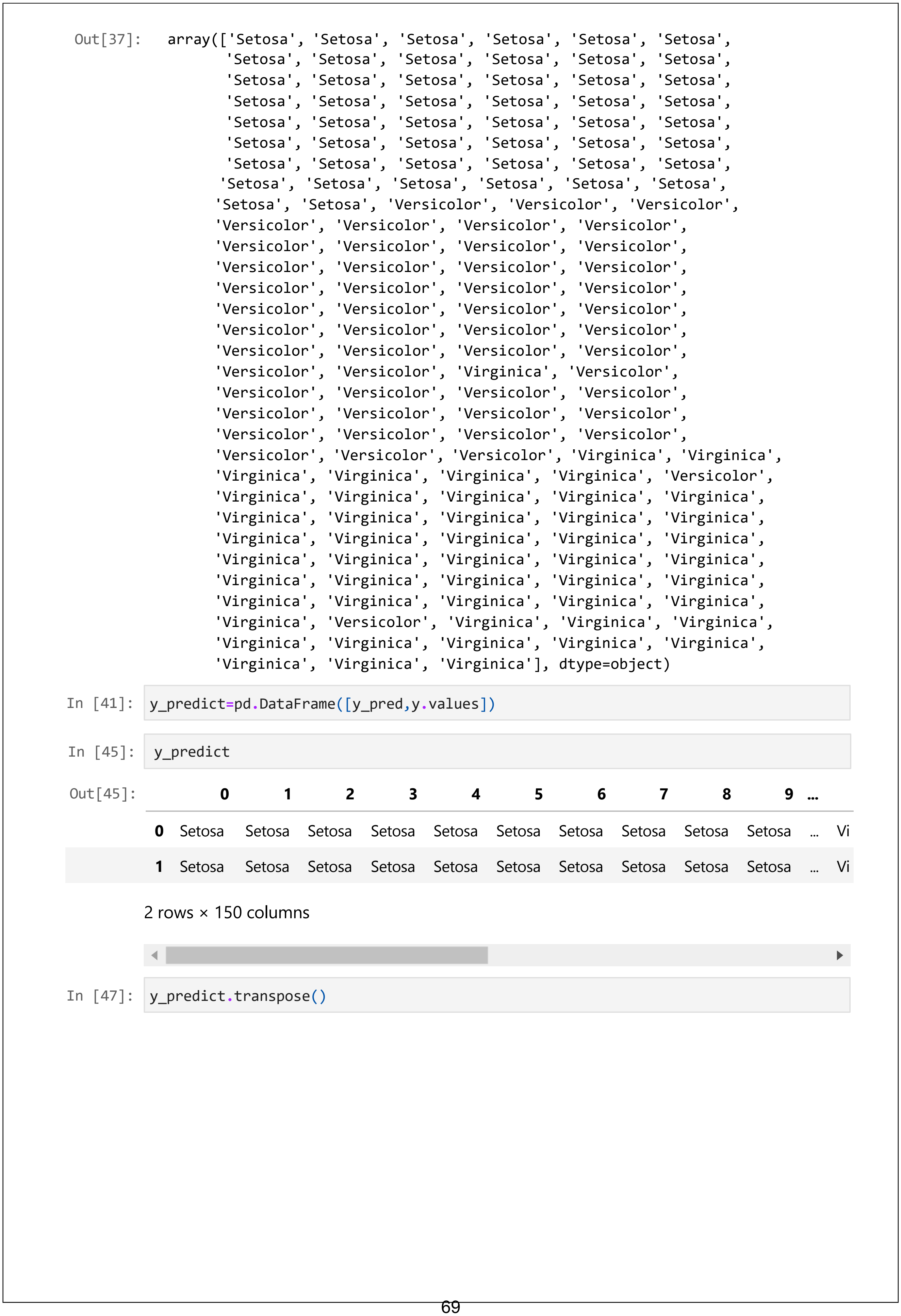
Out[29]:
```
▾ KNeighborsClassifier
KNeighborsClassifier(n_neighbors=12)
```

In [33]:
```
knn.predict(x)
```

```
Out[33]:    array(['Setosa', 'Setosa', 'Setosa', 'Setosa', 'Setosa', 'Setosa',
                   'Setosa', 'Setosa', 'Setosa', 'Setosa', 'Setosa', 'Setosa',
                   'Setosa', 'Setosa', 'Setosa', 'Setosa', 'Setosa', 'Setosa',
                   'Setosa', 'Setosa', 'Setosa', 'Setosa', 'Setosa', 'Setosa',
                   'Setosa', 'Setosa', 'Setosa', 'Setosa', 'Setosa', 'Setosa',
                   'Setosa', 'Setosa', 'Setosa', 'Setosa', 'Setosa', 'Setosa',
                   'Setosa', 'Setosa', 'Setosa', 'Setosa', 'Setosa', 'Setosa',
                  'Setosa', 'Setosa', 'Setosa', 'Setosa', 'Setosa', 'Setosa',
                 'Setosa', 'Setosa', 'Versicolor', 'Versicolor', 'Versicolor',
                 'Versicolor', 'Versicolor', 'Versicolor', 'Versicolor',
                 'Versicolor', 'Versicolor', 'Versicolor', 'Versicolor',
                 'Versicolor', 'Versicolor', 'Versicolor', 'Versicolor',
                 'Versicolor', 'Versicolor', 'Versicolor', 'Versicolor',
                 'Versicolor', 'Versicolor', 'Versicolor', 'Versicolor',
                 'Versicolor', 'Versicolor', 'Versicolor', 'Versicolor',
                 'Versicolor', 'Versicolor', 'Versicolor', 'Versicolor',
                 'Versicolor', 'Versicolor', 'Virginica', 'Versicolor',
                 'Versicolor', 'Versicolor', 'Versicolor', 'Versicolor',
                 'Versicolor', 'Versicolor', 'Versicolor', 'Versicolor',
                 'Versicolor', 'Versicolor', 'Versicolor', 'Versicolor',
                 'Versicolor', 'Versicolor', 'Versicolor', 'Virginica', 'Virginica',
                 'Virginica', 'Virginica', 'Virginica', 'Virginica', 'Versicolor',
                 'Virginica', 'Virginica', 'Virginica', 'Virginica', 'Virginica',
                 'Virginica', 'Virginica', 'Virginica', 'Virginica', 'Virginica',
                 'Virginica', 'Virginica', 'Virginica', 'Virginica', 'Virginica',
                 'Virginica', 'Virginica', 'Virginica', 'Virginica', 'Virginica',
                 'Virginica', 'Virginica', 'Virginica', 'Virginica', 'Virginica',
                 'Virginica', 'Virginica', 'Virginica', 'Virginica', 'Virginica',
                 'Virginica', 'Versicolor', 'Virginica', 'Virginica', 'Virginica',
                 'Virginica', 'Virginica', 'Virginica', 'Virginica', 'Virginica',
                 'Virginica', 'Virginica', 'Virginica'], dtype=object)
```

```
In [35]: y_pred=knn.predict(x)
```

```
In [37]: y_pred
```



```
Out[37]:  array(['Setosa', 'Setosa', 'Setosa', 'Setosa', 'Setosa', 'Setosa',
                 'Setosa', 'Setosa', 'Setosa', 'Setosa', 'Setosa', 'Setosa',
                 'Setosa', 'Setosa', 'Setosa', 'Setosa', 'Setosa', 'Setosa',
                 'Setosa', 'Setosa', 'Setosa', 'Setosa', 'Setosa', 'Setosa',
                 'Setosa', 'Setosa', 'Setosa', 'Setosa', 'Setosa', 'Setosa',
                 'Setosa', 'Setosa', 'Setosa', 'Setosa', 'Setosa', 'Setosa',
                 'Setosa', 'Setosa', 'Setosa', 'Setosa', 'Setosa', 'Setosa',
                 'Setosa', 'Setosa', 'Setosa', 'Setosa', 'Setosa', 'Setosa',
                 'Setosa', 'Setosa', 'Versicolor', 'Versicolor', 'Versicolor',
                 'Versicolor', 'Versicolor', 'Versicolor', 'Versicolor',
                 'Versicolor', 'Versicolor', 'Versicolor', 'Versicolor',
                 'Versicolor', 'Versicolor', 'Versicolor', 'Versicolor',
                 'Versicolor', 'Versicolor', 'Versicolor', 'Versicolor',
                 'Versicolor', 'Versicolor', 'Versicolor', 'Versicolor',
                 'Versicolor', 'Versicolor', 'Versicolor', 'Versicolor',
                 'Versicolor', 'Versicolor', 'Versicolor', 'Versicolor',
                 'Versicolor', 'Versicolor', 'Virginica', 'Versicolor',
                 'Versicolor', 'Versicolor', 'Versicolor', 'Versicolor',
                 'Versicolor', 'Versicolor', 'Versicolor', 'Versicolor',
                 'Versicolor', 'Versicolor', 'Versicolor', 'Versicolor',
                 'Versicolor', 'Versicolor', 'Versicolor', 'Virginica', 'Virginica',
                 'Virginica', 'Virginica', 'Virginica', 'Virginica', 'Versicolor',
                 'Virginica', 'Virginica', 'Virginica', 'Virginica', 'Virginica',
                 'Virginica', 'Virginica', 'Virginica', 'Virginica', 'Virginica',
                 'Virginica', 'Virginica', 'Virginica', 'Virginica', 'Virginica',
                 'Virginica', 'Virginica', 'Virginica', 'Virginica', 'Virginica',
                 'Virginica', 'Virginica', 'Virginica', 'Virginica', 'Virginica',
                 'Virginica', 'Virginica', 'Virginica', 'Virginica', 'Virginica',
                 'Virginica', 'Versicolor', 'Virginica', 'Virginica', 'Virginica',
                 'Virginica', 'Virginica', 'Virginica', 'Virginica', 'Virginica',
                 'Virginica', 'Virginica', 'Virginica'], dtype=object)
```

```
In [41]: y_predict=pd.DataFrame([y_pred,y.values])
```

```
In [45]: y_predict
```

Out[45]:

	0	1	2	3	4	5	6	7	8	9	...	
0	Setosa	Setosa	Setosa	Setosa	Setosa	Setosa	Setosa	Setosa	Setosa	Setosa	...	Vi
1	Setosa	Setosa	Setosa	Setosa	Setosa	Setosa	Setosa	Setosa	Setosa	Setosa	...	Vi

2 rows × 150 columns

```
In [47]: y_predict.transpose()
```

Out[47]:

	0	1
0	Setosa	Setosa
1	Setosa	Setosa
2	Setosa	Setosa
3	Setosa	Setosa
4	Setosa	Setosa
...	...	...
145	Virginica	Virginica
146	Virginica	Virginica
147	Virginica	Virginica
148	Virginica	Virginica
149	Virginica	Virginica

150 rows × 2 columns

```
In [53]: print(knn.score(x,y))
```

```
0.98
```

```
In [65]: knn.predict([[1,2,3,4]])
```

```
C:\ProgramData\anaconda3\Lib\site-packages\sklearn\base.py:493: UserWarning: X do
es not have valid feature names, but KNeighborsClassifier was fitted with feature
names
  warnings.warn(
```

```
Out[65]: array(['Versicolor'], dtype=object)
```

```
In [67]: from sklearn.model_selection import train_test_split
         x_train,x_test,y_train,y_test=train_test_split(x,y,test_size=0.2)
```

```
In [69]: knn.fit(x,y)
```

```
Out[69]: ▾ KNeighborsClassifier
         KNeighborsClassifier(n_neighbors=12)
```

```
In [71]: knn.score(x_test,y_test)
```

```
Out[71]: 1.0
```

```
In [73]: knn.predict_proba(x_test)
```

```
Out[73]:  array([[1.        , 0.        , 0.        ],
                 [0.        , 1.        , 0.        ],
                 [0.        , 0.        , 1.        ],
                 [1.        , 0.        , 0.        ],
                 [0.        , 0.91666667, 0.08333333],
                 [0.        , 0.16666667, 0.83333333],
                 [0.        , 0.        , 1.        ],
                 [1.        , 0.        , 0.        ],
                 [0.        , 0.08333333, 0.91666667],
                 [0.        , 0.        , 1.        ],
                 [0.        , 0.58333333, 0.41666667],
                 [1.        , 0.        , 0.        ],
                 [0.        , 0.        , 1.        ],
                 [1.        , 0.        , 0.        ],
                 [0.        , 1.        , 0.        ],
                 [0.        , 0.        , 1.        ],
                 [1.        , 0.        , 0.        ],
                 [0.        , 1.        , 0.        ],
                 [0.        , 1.        , 0.        ],
                 [0.        , 0.25      , 0.75      ],
                 [0.        , 0.66666667, 0.33333333],
                 [1.        , 0.        , 0.        ],
                 [1.        , 0.        , 0.        ],
                 [0.        , 1.        , 0.        ],
                 [0.        , 1.        , 0.        ],
                 [0.        , 0.        , 1.        ],
                 [1.        , 0.        , 0.        ],
                 [0.        , 0.08333333, 0.91666667],
                 [1.        , 0.        , 0.        ],
                 [0.        , 0.41666667, 0.58333333]])
```

```
In [81]:  yp=knn.predict(x_test)
          yp
```

```
Out[81]:  array(['Setosa', 'Versicolor', 'Virginica', 'Setosa', 'Versicolor',
                 'Virginica', 'Virginica', 'Setosa', 'Virginica', 'Virginica',
                 'Versicolor', 'Setosa', 'Virginica', 'Setosa', 'Versicolor',
                 'Virginica', 'Setosa', 'Versicolor', 'Versicolor', 'Virginica',
                 'Versicolor', 'Setosa', 'Setosa', 'Versicolor', 'Versicolor',
                 'Virginica', 'Setosa', 'Virginica', 'Setosa', 'Virginica'],
                dtype=object)
```

```
In [85]:  ypredict=pd.DataFrame([yp,y.values])
```

```
In [87]:  ypredict.transpose()
```

Out[87]:

	0	1
0	Setosa	Setosa
1	Versicolor	Setosa
2	Virginica	Setosa
3	Setosa	Setosa
4	Versicolor	Setosa
...	...	...
145	None	Virginica
146	None	Virginica
147	None	Virginica
148	None	Virginica
149	None	Virginica

150 rows × 2 columns

In [89]:

```
print(knn.score(x_test,y_test))
```

```
1.0
```

In [91]:

```
knn.predict([[1,2,3,4]])
```

```
C:\ProgramData\anaconda3\Lib\site-packages\sklearn\base.py:493: UserWarning: X do
es not have valid feature names, but KNeighborsClassifier was fitted with feature
names
  warnings.warn(
```

Out[91]:

```
array(['Versicolor'], dtype=object)
```

In [ ]:

Experiment-6

Aim: Construct an SVM classifier using python programming.

In [ ]:

```
Description: A support vector machine (SVM) is a supervised machine learning
algorithm that classifies data by finding an optimal line or hyperplane
that maximizes the distance between each class in an N-dimensional space.
```

In [1]:

```
import pandas as pd
df=pd.read_csv("Social_Network_Ads.csv")
```

In [3]:

```
df.head()
```

Out[3]:

	User ID	Gender	Age	EstimatedSalary	Purchased
0	15624510	Male	19	19000	0
1	15810944	Male	35	20000	0
2	15668575	Female	26	43000	0
3	15603246	Female	27	57000	0
4	15804002	Male	19	76000	0

In [5]:

```
x=df.iloc[:,[2,3]]#(:,2:4)
y=df.iloc[:,-1]
```

In [7]:

```
import numpy as np
x.head()
```

Out[7]:

	Age	EstimatedSalary
0	19	19000
1	35	20000
2	26	43000
3	27	57000
4	19	76000

In [9]:

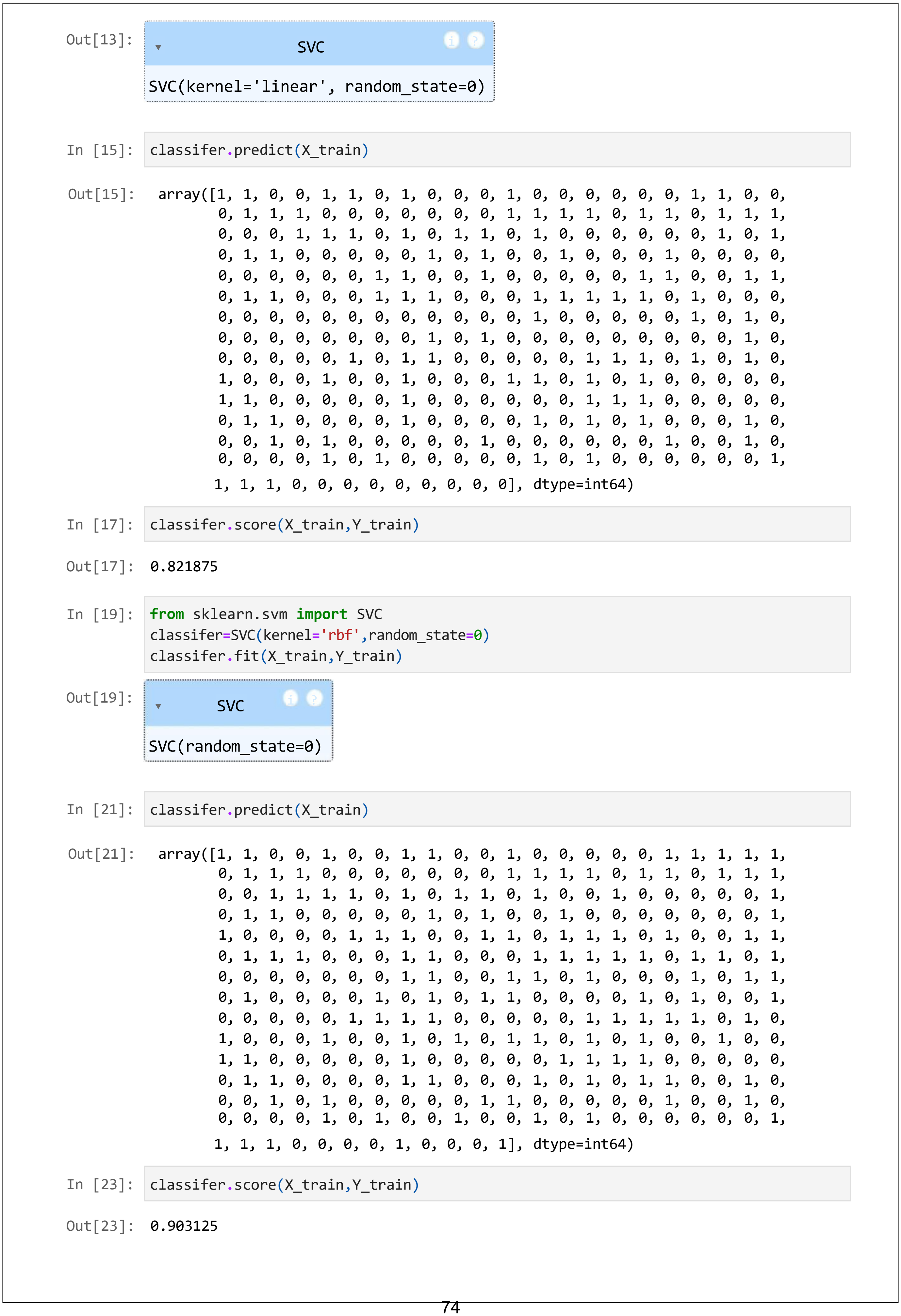
```
from sklearn.model_selection import train_test_split
X_train,X_test,Y_train,Y_test=train_test_split(x,y,
                       test_size=0.2,random_state=0)
```

In [11]:

```
#normalisation
from sklearn.preprocessing import StandardScaler
sc=StandardScaler()
X_train=sc.fit_transform(X_train)
X_test=sc.fit_transform(X_test)
```

In [13]:

```
from sklearn.svm import SVC
classifer=SVC(kernel='linear',random_state=0)
classifer.fit(X_train,Y_train)
```



```
Out[13]:  ▾ SVC
          SVC(kernel='linear', random_state=0)
```

```
In [15]:  classifer.predict(X_train)
```

```
Out[15]:  array([1, 1, 0, 0, 1, 1, 0, 1, 0, 0, 0, 1, 0, 0, 0, 0, 0, 0, 1, 1, 0, 0,
                 0, 1, 1, 1, 0, 0, 0, 0, 0, 0, 0, 1, 1, 1, 1, 0, 1, 1, 0, 1, 1, 1,
                 0, 0, 0, 1, 1, 1, 0, 1, 0, 1, 1, 0, 1, 0, 0, 0, 0, 0, 0, 1, 0, 1,
                 0, 1, 1, 0, 0, 0, 0, 0, 1, 0, 1, 0, 0, 1, 0, 0, 0, 1, 0, 0, 0, 0,
                 0, 0, 0, 0, 0, 0, 1, 1, 0, 0, 1, 0, 0, 0, 0, 0, 1, 1, 0, 0, 1, 1,
                 0, 1, 1, 0, 0, 0, 1, 1, 1, 0, 0, 0, 1, 1, 1, 1, 1, 0, 1, 0, 0, 0,
                 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1, 0, 0, 0, 0, 0, 1, 0, 1, 0,
                 0, 0, 0, 0, 0, 0, 0, 0, 1, 0, 1, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1, 0,
                 0, 0, 0, 0, 0, 1, 0, 1, 1, 0, 0, 0, 0, 0, 1, 1, 1, 0, 1, 0, 1, 0,
                 1, 0, 0, 0, 1, 0, 0, 1, 0, 0, 0, 1, 1, 0, 1, 0, 1, 0, 0, 0, 0, 0,
                 1, 1, 0, 0, 0, 0, 0, 1, 0, 0, 0, 0, 0, 0, 1, 1, 1, 0, 0, 0, 0, 0,
                 0, 1, 1, 0, 0, 0, 0, 1, 0, 0, 0, 0, 1, 0, 1, 0, 1, 0, 0, 0, 1, 0,
                 0, 0, 1, 0, 1, 0, 0, 0, 0, 0, 1, 0, 0, 0, 0, 0, 0, 1, 0, 0, 1, 0,
                 0, 0, 0, 0, 1, 0, 1, 0, 0, 0, 0, 0, 1, 0, 1, 0, 0, 0, 0, 0, 0, 1,
                1, 1, 1, 0, 0, 0, 0, 0, 0, 0, 0, 0], dtype=int64)
```

```
In [17]:  classifer.score(X_train,Y_train)
```

```
Out[17]:  0.821875
```

```
In [19]:  from sklearn.svm import SVC
          classifer=SVC(kernel='rbf',random_state=0)
          classifer.fit(X_train,Y_train)
```

```
Out[19]:  ▾ SVC
          SVC(random_state=0)
```

```
In [21]:  classifer.predict(X_train)
```

```
Out[21]:  array([1, 1, 0, 0, 1, 0, 0, 1, 1, 0, 0, 1, 0, 0, 0, 0, 0, 1, 1, 1, 1, 1,
                 0, 1, 1, 1, 0, 0, 0, 0, 0, 0, 0, 1, 1, 1, 1, 0, 1, 1, 0, 1, 1, 1,
                 0, 0, 1, 1, 1, 1, 0, 1, 0, 1, 1, 0, 1, 0, 0, 1, 0, 0, 0, 0, 0, 1,
                 0, 1, 1, 0, 0, 0, 0, 0, 1, 0, 1, 0, 0, 1, 0, 0, 0, 0, 0, 0, 0, 1,
                 1, 0, 0, 0, 0, 1, 1, 1, 0, 0, 1, 1, 0, 1, 1, 1, 0, 1, 0, 0, 1, 1,
                 0, 1, 1, 1, 0, 0, 0, 1, 1, 0, 0, 0, 1, 1, 1, 1, 1, 0, 1, 1, 0, 1,
                 0, 0, 0, 0, 0, 0, 0, 1, 1, 0, 0, 1, 1, 0, 1, 0, 0, 0, 1, 0, 1, 1,
                 0, 1, 0, 0, 0, 0, 1, 0, 1, 0, 1, 1, 0, 0, 0, 0, 1, 0, 1, 0, 0, 1,
                 0, 0, 0, 0, 0, 1, 1, 1, 1, 0, 0, 0, 0, 0, 1, 1, 1, 1, 1, 0, 1, 0,
                 1, 0, 0, 0, 1, 0, 0, 1, 0, 1, 0, 1, 1, 0, 1, 0, 1, 0, 0, 1, 0, 0,
                 1, 1, 0, 0, 0, 0, 0, 1, 0, 0, 0, 0, 0, 1, 1, 1, 1, 0, 0, 0, 0, 0,
                 0, 1, 1, 0, 0, 0, 0, 1, 1, 0, 0, 0, 1, 0, 1, 0, 1, 1, 0, 0, 1, 0,
                 0, 0, 1, 0, 1, 0, 0, 0, 0, 0, 1, 1, 0, 0, 0, 0, 0, 1, 0, 0, 1, 0,
                 0, 0, 0, 0, 1, 0, 1, 0, 0, 1, 0, 0, 1, 0, 1, 0, 0, 0, 0, 0, 0, 1,
                1, 1, 1, 0, 0, 0, 0, 1, 0, 0, 0, 1], dtype=int64)
```

```
In [23]:  classifer.score(X_train,Y_train)
```

```
Out[23]:  0.903125
```

```
In [29]: from sklearn.metrics import accuracy_score,classification_report
         from sklearn.metrics import confusion_matrix,roc_curve,auc
         accuracy=accuracy_score(Y_test,classifer.predict(X_test))
         print("Accuracy:{:.2f}%".format(accuracy*100))
```

```
Accuracy:93.75%
```

```
In [31]: cm=confusion_matrix(Y_test,classifer.predict(X_test))
         cm
```

```
Out[31]: array([[54,  4],
                [ 1, 21]], dtype=int64)
```

```
In [ ]: Output
```

```
In [33]: #output
         print("Classification Report:\n",classification_report
               (Y_test,classifer.predict(X_test)))
```

```
Classification  Report:
               precision    recall  f1-score   support

           0       0.98      0.93      0.96        58
           1       0.84      0.95      0.89        22

    accuracy                           0.94        80
   macro avg       0.91      0.94      0.92        80
weighted avg       0.94      0.94      0.94        80
```

```
In [ ]:
```

Experiment-7

AIM:Demonstrate the process of the Decision Tree construction for Classification

In [ ]:

```
Description:Decision trees are an approach used in supervised machine learning,
The approach is used mainly to solve classification problems,.
which is the use of a model to categorise or classify an object.
```

In [166…

```
import pandas as pd
from sklearn.tree import DecisionTreeClassifier
from sklearn.model_selection import train_test_split
from sklearn import metrics
```

In [168…

```
df=pd.read_csv(r'D:\22a81a05f9\diabetes.csv')
```

In [170…

```
df.head()
```

Out[170…

	Pregnancies	Glucose	BloodPressure	SkinThickness	Insulin	BMI	DiabetesPedigreeF
0	6	148	72	35	0	33.6	
1	1	85	66	29	0	26.6	
2	8	183	64	0	0	23.3	
3	1	89	66	23	94	28.1	
4	0	137	40	35	168	43.1	

In [172…

```
#data preprocessing
df.isnull().sum()
```

Out[172…

```
Pregnancies                 0
Glucose                     0
BloodPressure               0
SkinThickness               0
Insulin                     0
BMI                         0
DiabetesPedigreeFunction    0
Age                         0
Outcome                     0
dtype: int64
```

In [174…

```
df.isna().any()
```

Out[174…

```
Pregnancies                 False
Glucose                     False
BloodPressure               False
SkinThickness               False
Insulin                     False
BMI                         False
DiabetesPedigreeFunction    False
Age                         False
Outcome                     False
dtype: bool
```

In [176…

```
#feature extraction
features=['Pregnancies',          'Glucose','BloodPressure','SkinThickness','Insul
```

```
ind=df[features]
dep=df.Outcome
```

In [178…

```
#training the data
x_train,x_test,y_train,y_test=train_test_split(ind,dep,test_size=0.3,random_stat
```

In [180…

```
#implement the model
dt=DecisionTreeClassifier()
dt.fit(x_train,y_train)
```

Out[180…

```
▾ DecisionTree lassifier

DecisionTreeClassifier()
```

In [182…

```
#improve accuracy
dt=DecisionTreeClassifier(criterion='entropy',max_depth=3)
dt.fit(x_train,y_train)
```

Out[182…

```
▾              DecisionTreeClassifier

DecisionTreeClassifier(criterion='entropy',  max_depth=3)
```

In [184…

```
dt.predict(x_test)
```

Out[184…

```
array([0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1, 0, 1, 1, 0, 1, 0, 0, 0, 0, 0, 0,
       1, 0, 0, 1, 0, 1, 0, 1, 0, 0, 0, 1, 0, 1, 0, 0, 0, 0, 0, 0, 0, 1,
       0, 0, 1, 1, 0, 0, 0, 0, 1, 0, 0, 0, 1, 0, 0, 0, 1, 0, 1, 0, 0, 0,
       0, 0, 1, 1, 1, 1, 0, 0, 1, 0, 1, 1, 0, 1, 1, 0, 0, 1, 0, 1, 1, 0,
       1, 0, 0, 0, 0, 0, 1, 1, 0, 0, 1, 0, 0, 0, 1, 1, 0, 0, 1, 1, 0, 0,
       0, 0, 1, 0, 0, 0, 0, 1, 0, 1, 0, 1, 0, 0, 0, 0, 0, 0, 1, 0, 1, 0,
       1, 1, 0, 0, 0, 1, 0, 0, 1, 0, 0, 1, 1, 0, 0, 0, 0, 0, 0, 1, 0, 0,
       1, 1, 0, 0, 0, 0, 1, 1, 0, 0, 0, 0, 0, 1, 1, 1, 1, 1, 0, 0, 1, 0,
       0, 0, 0, 0, 0, 1, 0, 1, 0, 0, 0, 1, 1, 0, 0, 0, 0, 0, 1, 0, 0, 0,
       0, 1, 1, 1, 0, 0, 0, 1, 0, 0, 0, 1, 0, 1, 0, 0, 0, 1, 0, 0, 0, 1,
       0, 0, 0, 1, 0, 1, 0, 0, 0, 1, 0], dtype=int64)
```

In [186…

```
pred=dt.predict(x_test)
```

In [188…

```
print("classification accuracy is",metrics.accuracy_score(y_test,pred))
```

```
classification accuracy is 0.7705627705627706
```

In [190…

```
pip install pydotplus
```

```
Requirement already satisfied: pydotplus in c:\users\hp\anaconda3\lib\site-packag
es (2.0.2)
Requirement already satisfied: pyparsing>=2.0.1 in c:\users\hp\anaconda3\lib\site
-packages (from pydotplus) (3.1.2)
Note: you may need to restart the kernel to use updated packages.
```

In [193…

```
conda install python-graphviz
```

```
Channels:
 - defaults
Platform: win-64
Collecting package metadata (repodata.json): ...working... done
Solving environment: ...working... done

# All requested packages already installed.


Note: you may need to restart the kernel to use updated packages.
```

In [194…

```
import graphviz
print(graphviz.version())
```

```
(2, 50, 0)
```

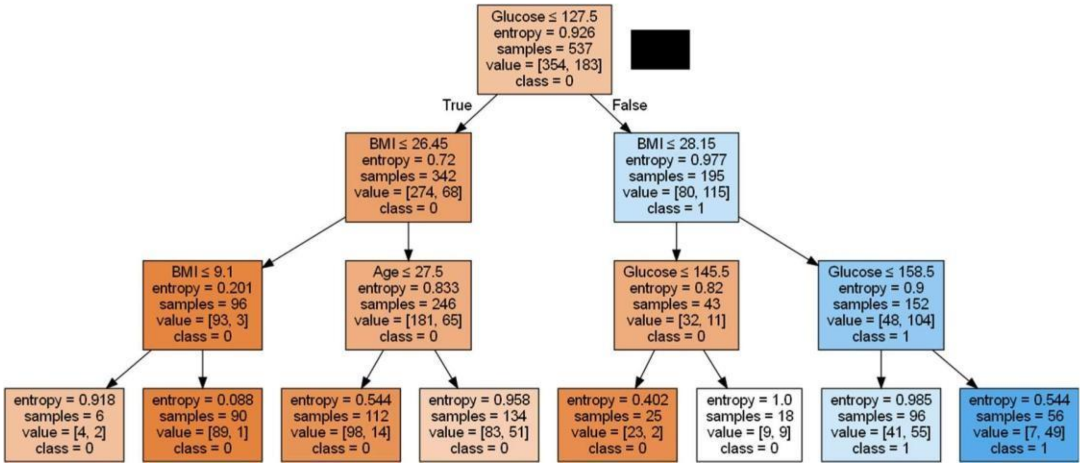
In [ ]:

```
#visualization
sfrom sklearn.tree import export_graphviz
from six import StringIO
from IPython.display import Image
import pydotplu
```

In [192…

```
dot_data=StringIO()
export_graphviz(dt,out_file=dot_data,filled=True,special_characters=True,feature
graph=pydotplus.graph_from_dot_data(dot_data.getvalue())
graph.write_png('diabetes.png')
Image(graph.create_png())
```

Out[192…



[redacted]

In [197…

```
from IPython.display import Image
print(Image)
```

```
<class 'IPython.core.display.Image'>
```

In [ ]:

Experiment-8

Aim: Implement an Ensemble Learner using Random Forest Algorithm using python programming.

Description:

- A Random Forest is a collection of decision trees that work together to make predictions.
- It takes different random parts of the dataset to train each tree and then it combines the results by averaging them.
- This approach helps improve the accuracy of predictions.
- Random Forest is based on ensemble learning.

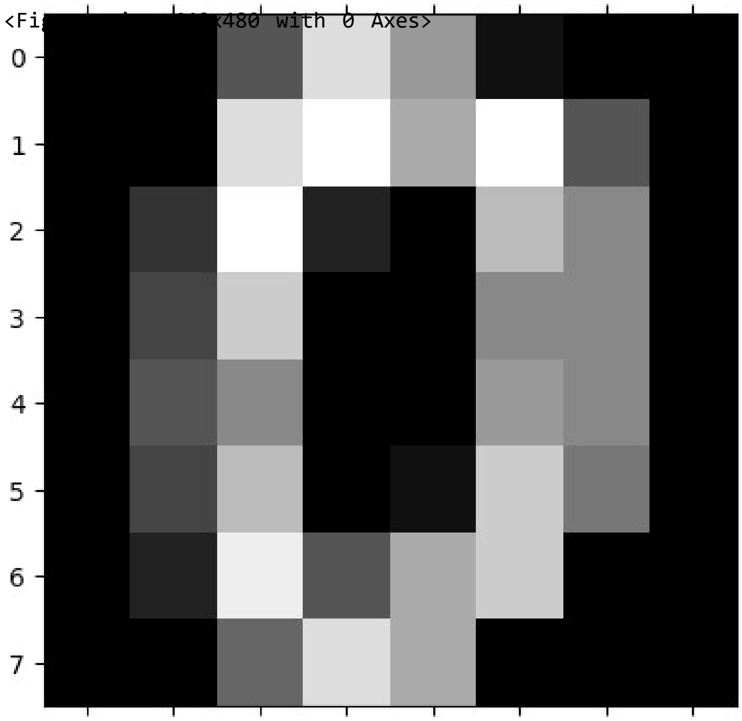
```
In [1]:  import pandas as pd
         from sklearn.datasets import load_digits
         digits=load_digits()
```

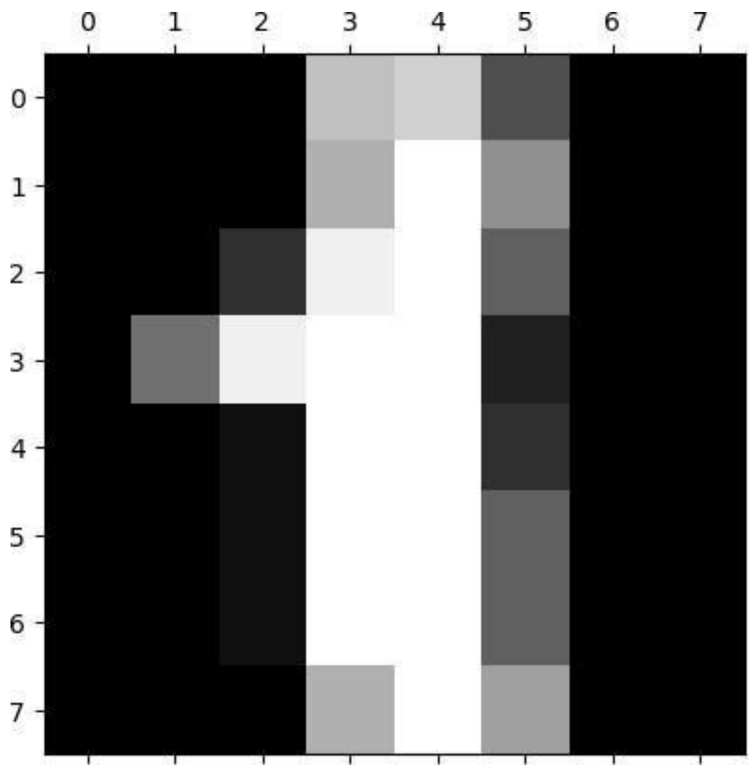
```
In [2]:  dir(digits)
```

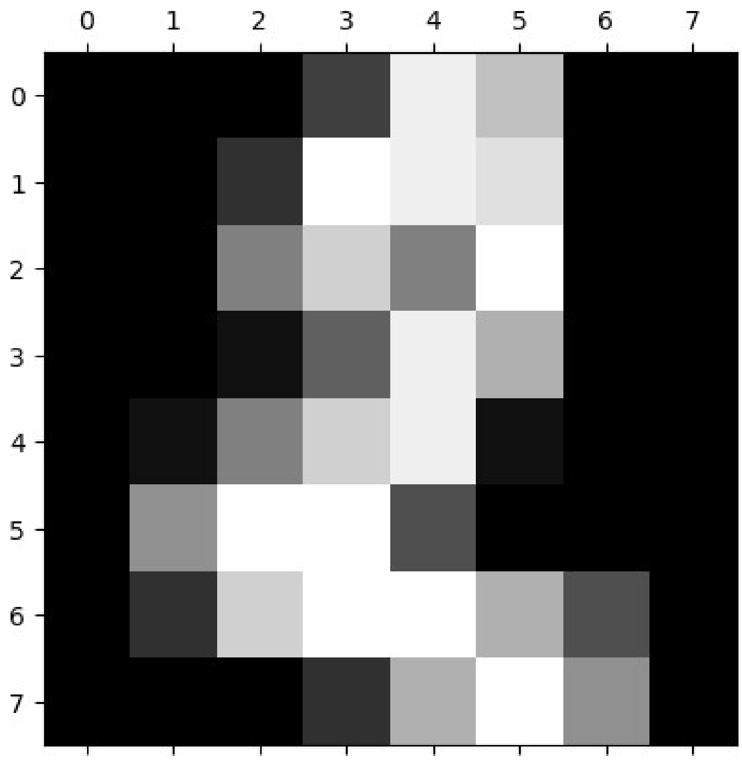
```
Out[2]:  ['DESCR', 'data', 'feature_names', 'frame', 'images', 'target', 'target_names']
```

```
In [15]:  #import matplotlib.pyplot as plt
          #plt.gray()
          for i in range(3):
              plt.matshow(digits.images[i])
```

```
<Figure size 480x480 with 0 Axes>
```







In [3]:

```
df=pd.DataFrame(digits.data)
digits.data
```

```
Out[3]: array([[ 0.,  0.,  5., ...,  0.,  0.,  0.],
               [ 0.,  0.,  0., ..., 10.,  0.,  0.],
               [ 0.,  0.,  0., ..., 16.,  9.,  0.],
               ...,
               [ 0.,  0.,  1., ...,  6.,  0.,  0.],
               [ 0.,  0.,  2., ..., 12.,  0.,  0.],
               [ 0.,  0., 10., ..., 12.,  1.,  0.]])
```

```
In [4]: df.head()
```

Out[4]:

	0	1	2	3	4	5	6	7	8	9	...	54	55	56	57	58	59	6
0	0.0	0.0	5.0	13.0	9.0	1.0	0.0	0.0	0.0	0.0	...	0.0	0.0	0.0	0.0	6.0	13.0	10.
1	0.0	0.0	0.0	12.0	13.0	5.0	0.0	0.0	0.0	0.0	...	0.0	0.0	0.0	0.0	0.0	11.0	16.
2	0.0	0.0	0.0	4.0	15.0	12.0	0.0	0.0	0.0	0.0	...	5.0	0.0	0.0	0.0	0.0	3.0	11.
3	0.0	0.0	7.0	15.0	13.0	1.0	0.0	0.0	0.0	8.0	...	9.0	0.0	0.0	0.0	7.0	13.0	13.
4	0.0	0.0	0.0	1.0	11.0	0.0	0.0	0.0	0.0	0.0	...	0.0	0.0	0.0	0.0	0.0	2.0	16.

5 rows × 64 columns

```
In [6]: df['target']=digits.target
```

```
In [7]: df.head()
```

Out[7]:

	0	1	2	3	4	5	6	7	8	9	...	55	56	57	58	59	60	6
0	0.0	0.0	5.0	13.0	9.0	1.0	0.0	0.0	0.0	0.0	...	0.0	0.0	0.0	6.0	13.0	10.0	0
1	0.0	0.0	0.0	12.0	13.0	5.0	0.0	0.0	0.0	0.0	...	0.0	0.0	0.0	0.0	11.0	16.0	10
2	0.0	0.0	0.0	4.0	15.0	12.0	0.0	0.0	0.0	0.0	...	0.0	0.0	0.0	0.0	3.0	11.0	16
3	0.0	0.0	7.0	15.0	13.0	1.0	0.0	0.0	0.0	8.0	...	0.0	0.0	0.0	7.0	13.0	13.0	9
4	0.0	0.0	0.0	1.0	11.0	0.0	0.0	0.0	0.0	0.0	...	0.0	0.0	0.0	0.0	2.0	16.0	4

5 rows × 65 columns

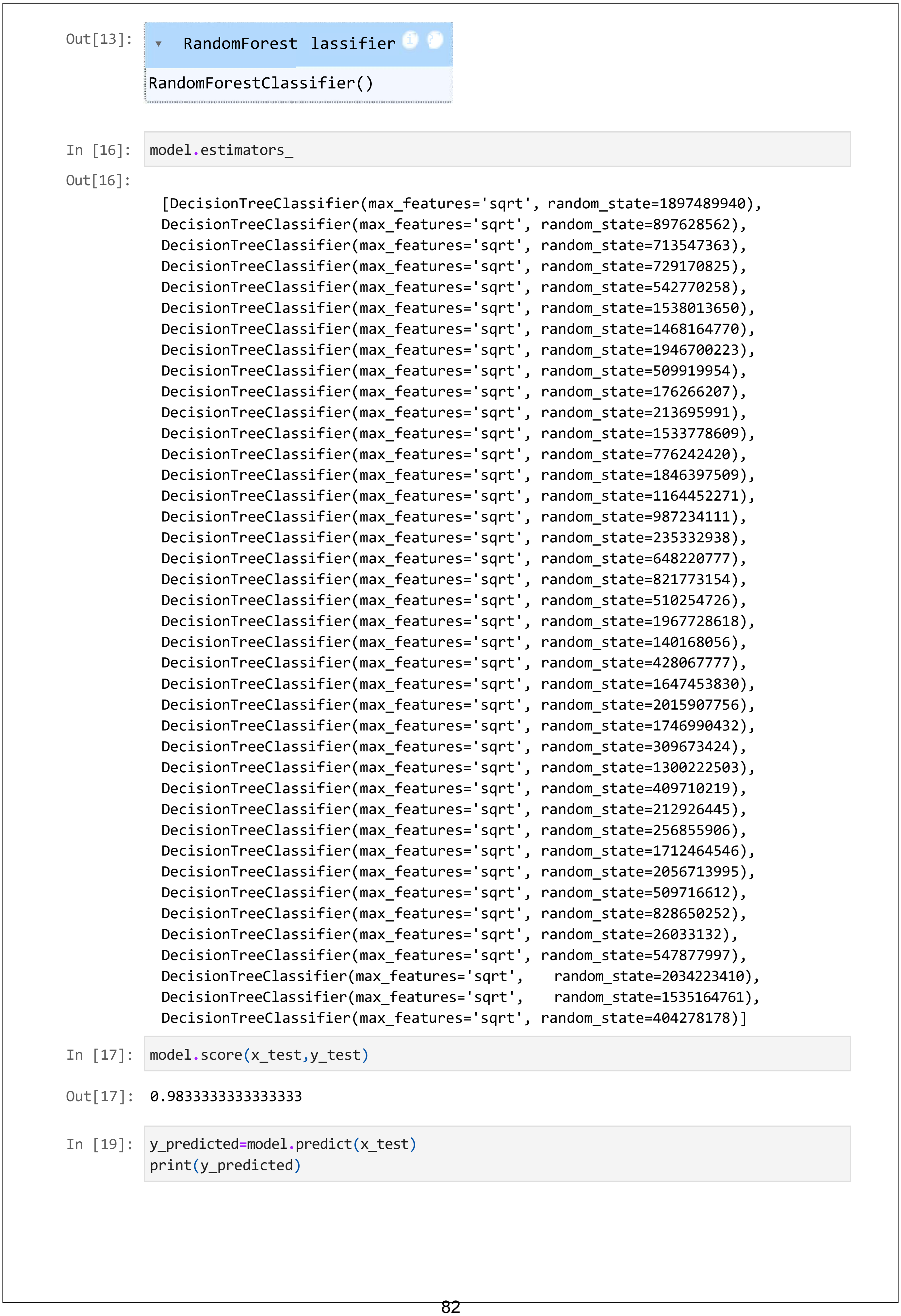
```
In [8]: ind=df.drop(['target'],axis=1)
        dep=df['target']
```

```
In [9]: from sklearn.model_selection import train_test_split
        x_train,x_test,y_train,y_test=train_test_split(ind,dep,test_size=0.3)
```

```
In [11]: from  sklearn.ensemble  import  RandomForestClassifier
```

```
In [12]: model=RandomForestClassifier()
```

```
In [13]: model.fit(x_train,y_train)
```



```
Out[13]:  ▾ RandomForest lassifier  i  ?
          RandomForestClassifier()
```

```
In [16]:  model.estimators_
```

```
Out[16]:
 [DecisionTreeClassifier(max_features='sqrt', random_state=1897489940),
 DecisionTreeClassifier(max_features='sqrt', random_state=897628562),
 DecisionTreeClassifier(max_features='sqrt', random_state=713547363),
 DecisionTreeClassifier(max_features='sqrt', random_state=729170825),
 DecisionTreeClassifier(max_features='sqrt', random_state=542770258),
 DecisionTreeClassifier(max_features='sqrt', random_state=1538013650),
 DecisionTreeClassifier(max_features='sqrt', random_state=1468164770),
 DecisionTreeClassifier(max_features='sqrt', random_state=1946700223),
 DecisionTreeClassifier(max_features='sqrt', random_state=509919954),
 DecisionTreeClassifier(max_features='sqrt', random_state=176266207),
 DecisionTreeClassifier(max_features='sqrt', random_state=213695991),
 DecisionTreeClassifier(max_features='sqrt', random_state=1533778609),
 DecisionTreeClassifier(max_features='sqrt', random_state=776242420),
 DecisionTreeClassifier(max_features='sqrt', random_state=1846397509),
 DecisionTreeClassifier(max_features='sqrt', random_state=1164452271),
 DecisionTreeClassifier(max_features='sqrt', random_state=987234111),
 DecisionTreeClassifier(max_features='sqrt', random_state=235332938),
 DecisionTreeClassifier(max_features='sqrt', random_state=648220777),
 DecisionTreeClassifier(max_features='sqrt', random_state=821773154),
 DecisionTreeClassifier(max_features='sqrt', random_state=510254726),
 DecisionTreeClassifier(max_features='sqrt', random_state=1967728618),
 DecisionTreeClassifier(max_features='sqrt', random_state=140168056),
 DecisionTreeClassifier(max_features='sqrt', random_state=428067777),
 DecisionTreeClassifier(max_features='sqrt', random_state=1647453830),
 DecisionTreeClassifier(max_features='sqrt', random_state=2015907756),
 DecisionTreeClassifier(max_features='sqrt', random_state=1746990432),
 DecisionTreeClassifier(max_features='sqrt', random_state=309673424),
 DecisionTreeClassifier(max_features='sqrt', random_state=1300222503),
 DecisionTreeClassifier(max_features='sqrt', random_state=409710219),
 DecisionTreeClassifier(max_features='sqrt', random_state=212926445),
 DecisionTreeClassifier(max_features='sqrt', random_state=256855906),
 DecisionTreeClassifier(max_features='sqrt', random_state=1712464546),
 DecisionTreeClassifier(max_features='sqrt', random_state=2056713995),
 DecisionTreeClassifier(max_features='sqrt', random_state=509716612),
 DecisionTreeClassifier(max_features='sqrt', random_state=828650252),
 DecisionTreeClassifier(max_features='sqrt', random_state=26033132),
 DecisionTreeClassifier(max_features='sqrt', random_state=547877997),
 DecisionTreeClassifier(max_features='sqrt',   random_state=2034223410),
 DecisionTreeClassifier(max_features='sqrt',   random_state=1535164761),
 DecisionTreeClassifier(max_features='sqrt', random_state=404278178)]
```

```
In [17]:  model.score(x_test,y_test)
```

```
Out[17]:  0.9833333333333333
```

```
In [19]:  y_predicted=model.predict(x_test)
          print(y_predicted)
```

```
[1 7 2 5 7 4 9 5 0 4 8 3 9 2 6 9 9 8 8 5 3 2 0 2 7 1 2 3 1 5 4 1 5 0 1 9 7
 2 8 5 9 7 6 0 9 0 5 1 5 4 2 3 9 1 7 1 6 7 7 9 2 1 7 2 5 0 8 9 5 1 6 9 4 8
 8 2 1 8 6 7 5 0 9 4 8 9 9 7 2 4 7 0 1 5 1 6 8 1 9 6 8 4 6 3 5 3 6 0 4 7 9
 8 5 7 9 6 7 7 6 0 8 7 3 8 8 5 6 4 1 5 1 9 7 0 0 9 0 5 1 4 8 8 1 3 6 9 9 7
 7 1 1 1 8 1 2 8 4 6 5 6 6 2 4 4 3 5 5 6 9 2 1 8 2 4 6 0 7 4 2 3 5 3 2 1 8
 8 7 0 9 0 1 8 5 2 6 8 5 5 8 5 6 0 4 3 9 4 5 4 6 3 3 3 1 3 0 9 4 7 0 3 6 8
 1 5 3 2 9 2 9 4 1 5 3 8 8 1 0 5 6 5 5 4 5 0 7 0 9 2 3 0 7 2 1 9 0 4 0 1 4
 8 2 8 2 8 6 5 9 3 7 2 7 3 2 0 2 6 1 3 7 1 0 0 4 3 3 4 6 1 0 1 0 1 7 9 7 9
 3 3 7 4 3 9 5 9 9 1 0 6 8 7 0 7 8 0 4 4 9 6 0 3 1 9 2 1 9 5 9 8 7 0 3 2 9
 1 5 7 0 9 9 9 5 6 2 2 1 9 1 0 0 5 6 0 2 4 3 3 4 1 4 4 4 5 9 6 2 0 8 7 5 3
 3 9 1 5 6 5 4 0 8 8 5 7 5 4 7 1 6 2 4 9 3 4 7 2 1 2 4 4 6 2 6 2 0 9 5 9 1
 8 7 7 6 1 6 7 5 2 1 5 5 3 1 2 6 4 3 1 0 4 2 1 3 5 8 9 5 2 6 1 3 4 7 5 2 1
 2 4 9 9 8 5 4 0 2 4 0 4 2 9 6 9 1 7 5 3 3 2 6 8 2 6 4 1 1 3 5 9 7 8 7 8 5
 1 7 1 8 6 9 3 8 0 9 6 8 5 4 0 0 3 2 7 2 3 7 4 5 3 6 5 8 8 6 8 7 0 0 4 5 0
 3 8 6 3 5 8 9 3 7 2 4 0 9 3 7 8 6 1 0 4 6 7]
```

In [20]:

```python
from sklearn.metrics import confusion_matrix
cm=confusion_matrix(y_test,y_predicted)
print(cm)
```

```
[[53  0  0  0  1  0  0  0  0  0]
 [ 0 59  0  0  0  0  0  0  0  0]
 [ 0  0 51  0  0  0  0  0  0  0]
 [ 0  0  0 49  0  0  0  0  0  1]
 [ 0  0  0  0 52  0  0  1  0  0]
 [ 0  0  0  0  0 59  0  0  0  1]
 [ 0  0  0  0  0  0 49  0  0  0]
 [ 0  0  0  0  0  0  0 51  0  0]
 [ 0  1  0  0  0  0  0  0 51  0]
 [ 0  0  0  1  0  1  0  1  1 57]]
```

In [21]:

```python
print(x_train.columns)
```

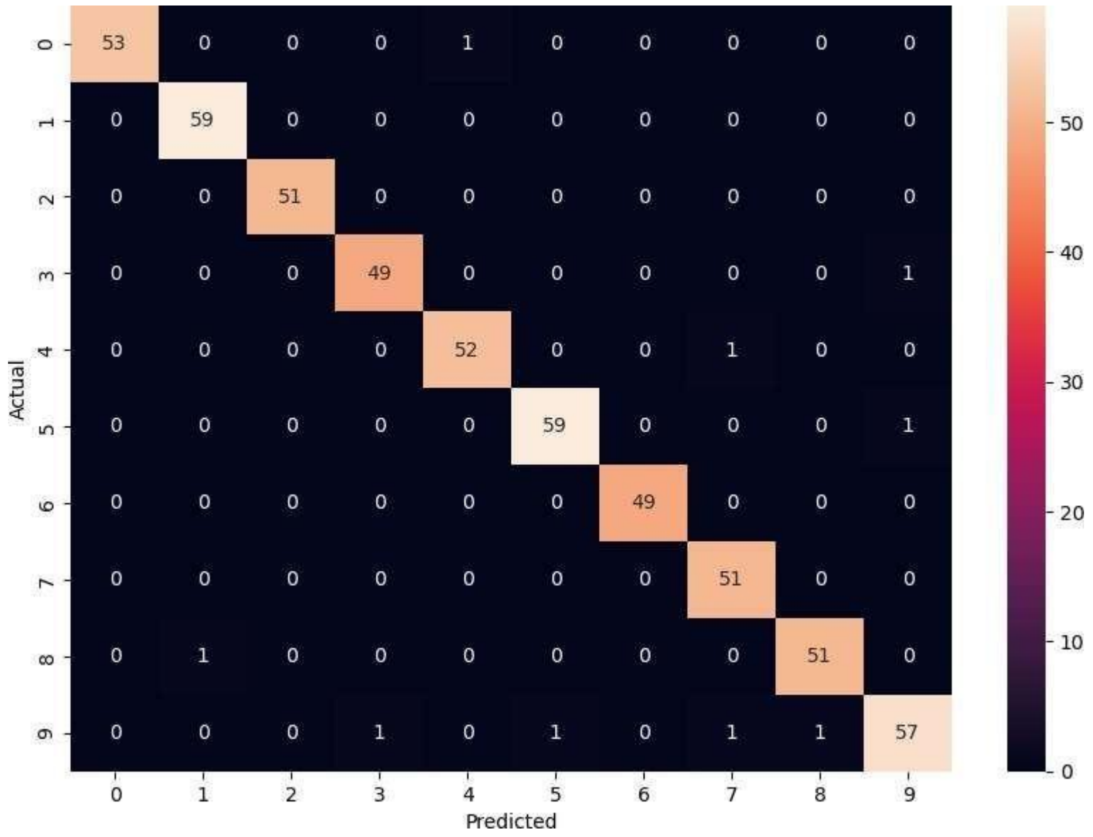
```
Index([ 0,  1,  2,  3,  4,  5,  6,  7,  8,  9, 10, 11, 12, 13, 14, 15, 16, 17,
       18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35,
       36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53,
       54, 55, 56, 57, 58, 59, 60, 61, 62, 63],
      dtype='object')
```

In [24]:

```python
import matplotlib.pyplot as plt
import seaborn as sns
plt.figure(figsize=(10,7))
sns.heatmap(cm,annot=True)
plt.xlabel('Predicted')
plt.ylabel('Actual')
```

Out[24]:

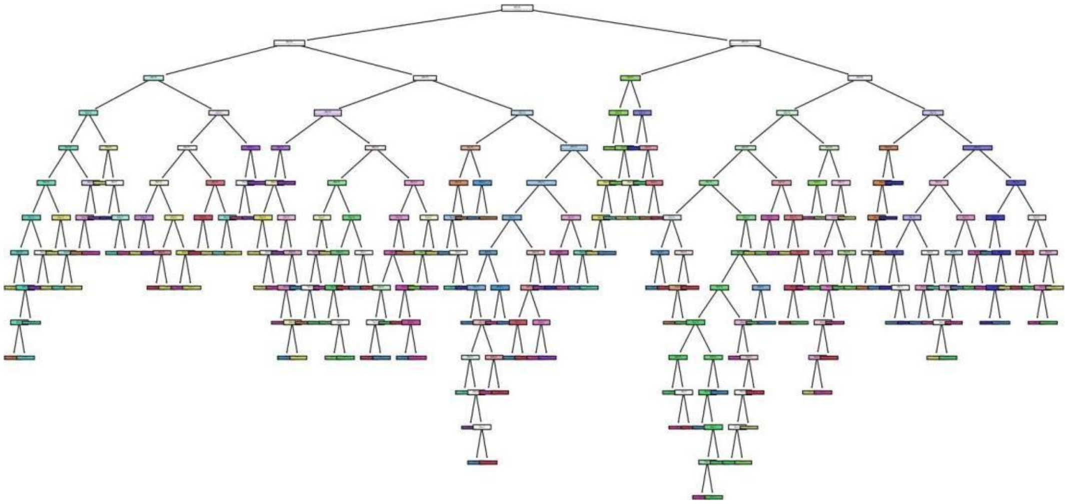
```
Text(95.72222222222221, 0.5, 'Actual')
```

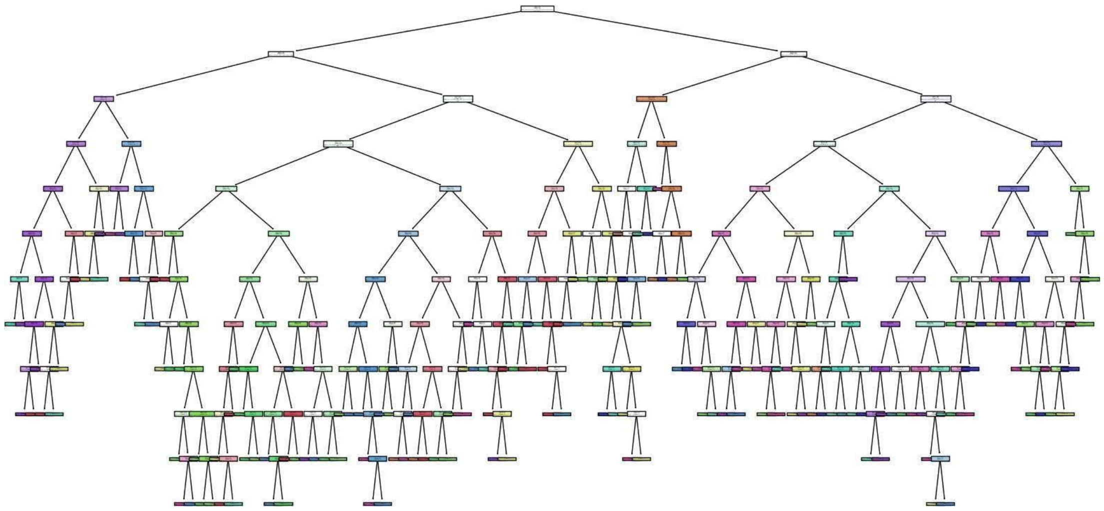


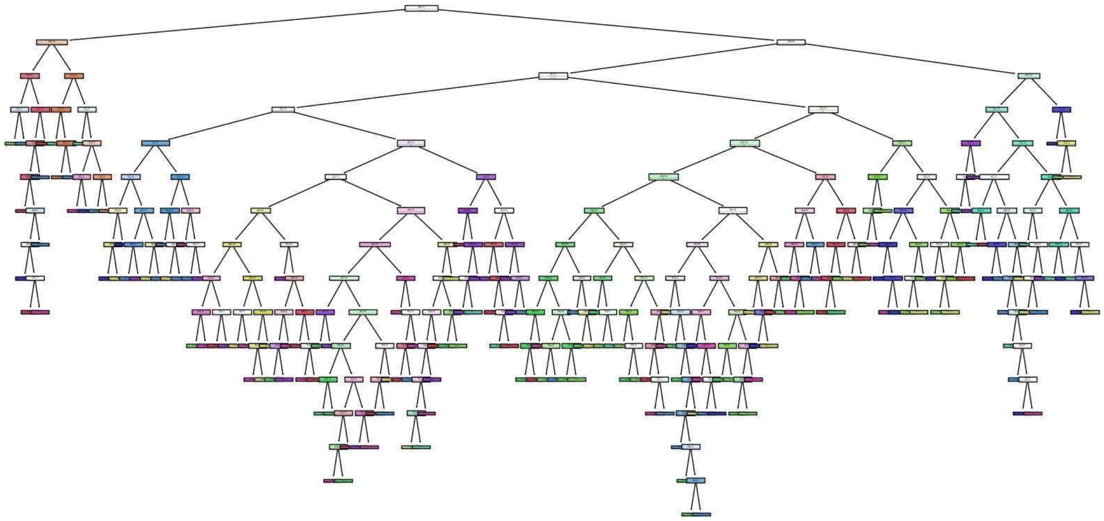
```
In [25]: #Visualisation
         from sklearn.tree import export_graphviz
         from six import StringIO
         from IPython.display import Image
```

```
In [26]: from sklearn.tree import plot_tree
```

```
In [27]: for i in range(3):
             treeplot=model.estimators_[i]
             plt.figure(figsize=(20,10))
             plot_tree(treeplot,filled=True)
             plt.show()
```







```
In [ ]:
```

Experiment-9

AIM: To implement an ensemble learner using AdaBoostAlgorithm using Python programming.

In [ ]:

```
Description: AdaBoostClassifier stands for Adaptive Boosting Classifier.
             It is an ensemble learning method — meaning it builds a strong
             classifier by combining many weak classifiers (like decision trees).
```

In [2]:

```
#import libraries
import pandas as pd
from sklearn.model_selection import train_test_split
from sklearn.metrics import accuracy_score
```

In [6]:

```
#import dataset
df=pd.read_csv(r'D:\22A81A05G0(ML)\diabetes.csv')
df.head()
```

Out[6]:

	Pregnancies	Glucose	BloodPressure	SkinThickness	Insulin	BMI	DiabetesPedigreeFunc
0	6	148	72	35	0	33.6	0
1	1	85	66	29	0	26.6	0
2	8	183	64	0	0	23.3	0
3	1	89	66	23	94	28.1	0
4	0	137	40	35	168	43.1	2

In [8]:

```
#data preprocessing
df.isnull().sum()
```

Out[8]:

```
Pregnancies                 0
Glucose                     0
BloodPressure               0
SkinThickness               0
Insulin                     0
BMI                         0
DiabetesPedigreeFunction    0
Age                         0
Outcome                     0
dtype: int64
```

```
In [10]: df.isna().any()
```

```
Out[10]: Pregnancies                 False
         Glucose                     False
         BloodPressure               False
         SkinThickness               False
         Insulin                     False
         BMI                         False
         DiabetesPedigreeFunction    False
         Age                         False
         Outcome                     False
         dtype: bool
```

```
In [12]: #feature extraction
         ind=df.drop(['Outcome'],axis=1)
         dep=df['Outcome']
```

```
In [14]: #training the data
         x_train,x_test,y_train,y_test=train_test_split(ind,dep,test_size=0.2)
```

```
In [16]: #import AdaBoodtClassifier
         from sklearn.ensemble import AdaBoostClassifier
```

```
In [22]: #model fitting
         ada=AdaBoostClassifier(n_estimators=100,learning_rate=1)
         model=ada.fit(x_train,y_train)
```

```
In [24]: #model prediction
         model.predict(x_test)
```

```
Out[24]:  array([0, 0, 0, 0, 1, 0, 0, 0, 1, 0, 0, 1, 0, 1, 0, 0, 0, 0, 0, 0, 0, 0,
                 0, 0, 0, 1, 1, 1, 0, 0, 1, 0, 0, 1, 1, 0, 1, 0, 0, 1, 0, 1, 1, 1,
                 0, 0, 1, 0, 0, 0, 1, 0, 1, 1, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1, 0,
                 0, 0, 0, 1, 0, 1, 1, 0, 0, 1, 0, 0, 0, 1, 0, 1, 1, 0, 0, 0, 1, 0,
                 0, 1, 1, 0, 0, 1, 0, 0, 0, 0, 1, 0, 0, 0, 1, 1, 0, 1, 1, 1, 0, 0,
                 0, 0, 0, 1, 1, 1, 0, 1, 1, 1, 0, 1, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1,
                 0, 1, 0, 0, 1, 0, 0, 0, 0, 1, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1, 1, 0],
                dtype=int64)
```

```
In [26]: #Accuracy score
         print(accuracy_score(y_test,model.predict(x_test))*100)
```

```
69.48051948051948
```

```
In [32]: #implementing svm with adaboost
         from sklearn.svm import SVC
         svc=SVC(probability=True,kernel='linear')
         abc=AdaBoostClassifier(n_estimators=50,estimator=svc,learning_rate=1)
         model=abc.fit(x_train,y_train)
         print(model.predict(x_test))
```

```
[0 0 0 0 1 0 0 0 0 0 0 0 0 1 0 1 0 0 0 0 0 0 0 1 0 1 1 1 0 0 1 0 0 1 0 0 1
 0 0 1 0 0 1 1 0 0 1 1 0 0 1 0 1 1 0 0 0 0 0 0 0 1 0 0 1 1 0 0 0 0 0 1 0 0
 0 1 0 0 0 1 0 0 1 0 0 0 0 0 0 1 1 0 0 1 0 0 0 0 1 0 0 0 0 1 0 1 1 1 0 0 0
 0 0 0 0 0 0 0 0 0 0 0 1 0 0 0 0 0 0 0 0 1 0 0 1 0 1 0 0 0 0 1 0 0 0 0 0 0
 0 0 0 1 1 0]
```

```
In [ ]: OUTPUT:
```

```
In [34]: print(accuracy_score(y_test,model.predict(x_test))*100)
```

```
73.37662337662337
```

```
In [ ]:
```

Experiment-10

AIM:Demonstrate the working of Multi-layer perceptron with MLPClassifier() using Python programming.

In [ ]:

```
Description: A Multi-Layer Perceptron (MLP) is a type of neural network that con
of multiple layers of neurons. It is a supervised learning algorithm used
for classification and regression tasks. The MLPClassifier() is part of
the sklearn.neural_network module in Python Scikit-learn library and is
used for classification tasks.
```

In [1]:

```
import pandas as pd
```

In [3]:

```
df=pd.read_csv('iris.csv')
```

In [5]:

```
df.head()
```

Out[5]:

	sep al_length	sepal_width	petal_length	petal_width	species
0	5.1	3.5	1.4	0.2	setosa
1	4.9	3.0	1.4	0.2	setosa
2	4.7	3.2	1.3	0.2	setosa
3	4.6	3.1	1.5	0.2	setosa
4	5.0	3.6	1.4	0.2	setosa

In [7]:

```
df.isnull().sum()
```

Out[7]:

```
sepal_length     0
sepal_width      0
petal_length     0
petal_width      0
species          0
dtype: int64
```

In [9]:

```
df.isna().any()
```

Out[9]:

```
sepal_length     False
sepal_width      False
petal_length     False
petal_width      False
species          False
dtype: bool
```

In [13]:

```
x=df.drop(['species'],axis=1)
y=df['species']
```

In [15]:

```
from sklearn.model_selection import train_test_split
x_train,x_test,y_train,y_test=train_test_split(x,y,test_size=0.2,random_state=42
```

In [17]:

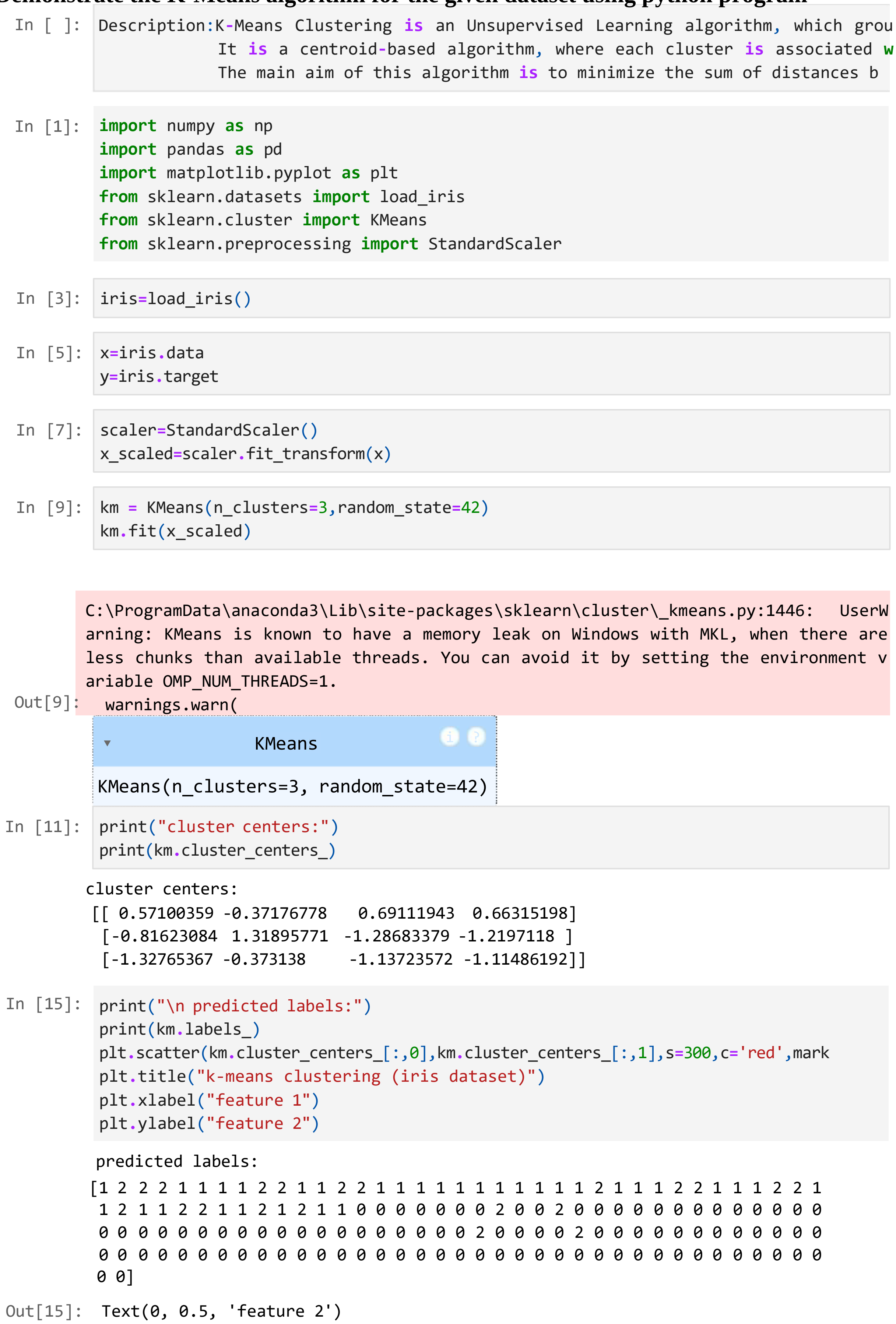
```
from sklearn.neural_network import MLPClassifier
```

```
In [19]: mlp=MLPClassifier(hidden_layer_sizes=(100,),max_iter=1000,random_state=42)

In [21]: mlp.fit(x_train,y_train)

Out[21]: ▾ MLPClassifier
         MLPClassifier(max_iter=1000, random_state=42)

In [23]: y_pred=mlp.predict(x_test)
         y_pred

Out[23]: array(['versicolor', 'setosa', 'virginica', 'versicolor', 'versicolor',
                'setosa', 'versicolor', 'virginica', 'versicolor', 'versicolor',
                'virginica', 'setosa', 'setosa', 'setosa', 'setosa', 'versicolor',
                'virginica', 'versicolor', 'versicolor', 'virginica', 'setosa',
                'virginica', 'setosa', 'virginica', 'virginica', 'virginica',
                'virginica', 'virginica', 'setosa', 'setosa'], dtype='<U10')

In [25]: from sklearn.metrics import accuracy_score
         accuracy=accuracy_score(y_test,y_pred)

In [ ]: #OUTPUT:

In [27]: print(f"Neural Network weights:{mlp.coefs_}")
```

```
Neural  Network  weights:[array([[-8.33064203e-08,  2.64530294e-01,  2.39491291e-0
1,
            6.60616023e-02,  -1.77318496e-01,  -3.90935072e-02,
               -6.08578520e-03, 1.50144522e-01, 3.11578070e-01,
            3.02201155e-05,  -9.12177664e-03,   2.02655404e-01,
            2.10372968e-01,  -5.14193482e-02,  -1.09917550e-01,
             -8.45916027e-04, -1.69678398e-05, 2.32425848e-03,
            1.69035716e-02,  -6.57244987e-02,   9.01234575e-02,
           -7.02452058e-02,  -2.99295755e-05,  -2.11751417e-07,
            6.82856853e-12,   1.07871918e-01,   -3.17160098e-01,
            5.50409231e-02,   8.63637149e-03,   -6.94567121e-03,
            7.89375012e-02,  -3.75472085e-02,   5.13308896e-02,
            2.14704205e-01,   4.83802558e-01,   2.09645651e-01,
           -1.66584123e-05,   2.31989890e-01,   1.24555332e-01,
           -5.72890937e-02,  -2.45885725e-01,   3.24801825e-02,
               -7.91452351e-03, 1.84369295e-01, 2.59767438e-01,
            1.03281201e-01,   1.44109458e-01,   -3.88407562e-03,
            7.50551555e-02,  -8.20089328e-04,   2.20941852e-01,
            1.68166080e-01,   1.67221137e-01,   1.71212978e-01,
            1.58067465e-01,   2.21095010e-01,   -4.17099114e-03,
           -2.17826207e-01,  -7.04030516e-03,  -5.35127151e-06,
           -8.97235046e-09,   -9.19505769e-02,   1.42854394e-01,
           -2.06841302e-02,  -1.34052102e-01,  -3.14956209e-02,
             -1.89814640e-03, 1.37521722e-01, -4.99044721e-03,
            2.33663749e-01,   1.80211487e-01,   -3.47744370e-02,
               -1.05610089e-02, 1.82029635e-01, 1.89951807e-01,
            8.97794754e-02,   8.11836319e-02,   -1.63030424e-02,
           -4.63399658e-02,   -2.83335976e-03,   1.36948798e-01,
           -1.33141338e-02,  -1.10961921e-01,  -2.02508303e-02,
               -2.05699583e-02, 2.63577630e-01, 1.53148498e-01,
            4.31610004e-02,   1.63246148e-01,   -8.98928129e-02,
               -2.67764223e-03, 2.25049169e-01, 8.71078875e-02,
            1.94489172e-01,   3.08360750e-01,   -2.22014711e-02,
            3.84682401e-02,   1.00829961e-01,   -1.23011061e-01,
          7.29248301e-02],
           [-8.16442464e-03, 1.98078234e-01, 2.25112445e-01,
           6.66103604e-02,   1.83537754e-01,   -2.37077169e-02,
           8.02412482e-10,  -1.59481285e-02,   4.46465221e-01,
          -4.84066458e-03, -3.32586654e-05, -3.01929004e-01,
           3.55206979e-01,   3.14390799e-02,   2.43652552e-02,
           2.32799203e-03,   6.35750722e-04,   -1.59908696e-01,
           3.34977513e-01,  -4.92626741e-02,   2.98673265e-01,
           1.43282691e-02,  -8.21040809e-06,  -3.08875112e-03,
           -2.86078447e-04, 3.99339577e-02, -9.24388957e-02,
           3.27090757e-01,  -2.71819023e-01,  -7.63105384e-14,
          -1.51640107e-01,   -2.79910811e-02,   1.89471101e-01,
            -2.08560950e-01,  4.59384207e-01,  1.09821145e-01,
           5.75379134e-13,   4.79489992e-01,    2.56612521e-02,
           1.97696237e-01,    1.71565286e-02,   -2.01615458e-01,
           4.31808620e-14,  -2.28434814e-01,    4.93158163e-01,
          -2.49102740e-01,    3.43299615e-01,   -1.78167729e-01,
          -2.23997694e-01,  -5.28546656e-05,    1.05589592e-01,
           -8.02951889e-03,  -3.11088781e-01,  -2.95090776e-02,
           3.64484930e-01,  -3.60680437e-01,    4.57948290e-06,
          -1.03270714e-01,  -2.16476746e-04,    6.89990180e-05,
          -1.82046911e-07,  -7.57862370e-03,    1.13382575e-01,
          -1.11680970e-02,  -2.25590600e-01,    1.34831832e-01,
           -7.00697898e-06, -3.19476017e-01, -7.39163039e-03,
           1.76353433e-01,    2.52087476e-01,   -7.96644113e-02,
          -2.36546186e-14,  -7.82337907e-02,  -1.71143400e-02,
```

Experiment-11

Aim:Demonstrate the K-Means algorithm for the given dataset using python program



```
In [ ]:  Description:K-Means Clustering is an Unsupervised Learning algorithm, which grou
                     It is a centroid-based algorithm, where each cluster is associated w
                     The main aim of this algorithm is to minimize the sum of distances b
```

```
In [1]:  import numpy as np
         import pandas as pd
         import matplotlib.pyplot as plt
         from sklearn.datasets import load_iris
         from sklearn.cluster import KMeans
         from sklearn.preprocessing import StandardScaler
```

```
In [3]:  iris=load_iris()
```

```
In [5]:  x=iris.data
         y=iris.target
```

```
In [7]:  scaler=StandardScaler()
         x_scaled=scaler.fit_transform(x)
```

```
In [9]:  km = KMeans(n_clusters=3,random_state=42)
         km.fit(x_scaled)
```

```
C:\ProgramData\anaconda3\Lib\site-packages\sklearn\cluster\_kmeans.py:1446:  UserW
arning: KMeans is known to have a memory leak on Windows with MKL, when there are
less chunks than available threads. You can avoid it by setting the environment v
ariable OMP_NUM_THREADS=1.
Out[9]:  warnings.warn(
```

```
KMeans(n_clusters=3, random_state=42)
```

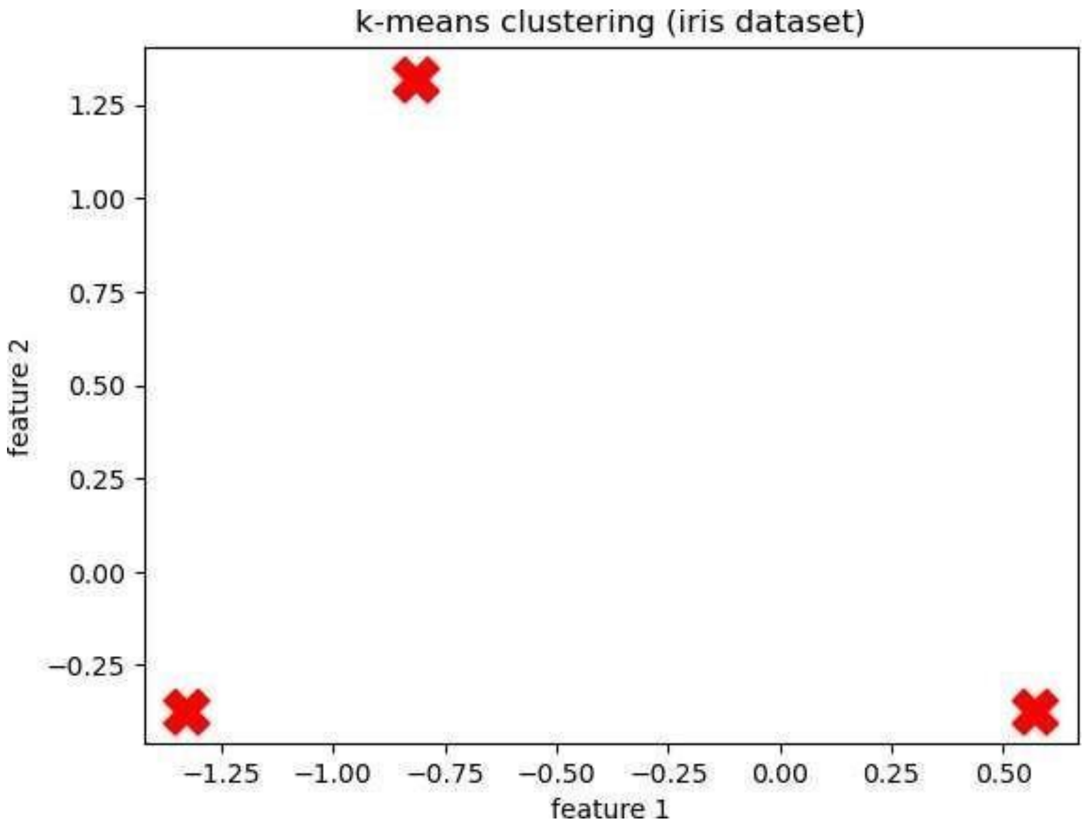
```
In [11]: print("cluster centers:")
         print(km.cluster_centers_)
```

```
cluster centers:
[[ 0.57100359 -0.37176778   0.69111943  0.66315198]
 [-0.81623084  1.31895771  -1.28683379 -1.2197118 ]
 [-1.32765367 -0.373138     -1.13723572 -1.11486192]]
```

```
In [15]: print("\n predicted labels:")
         print(km.labels_)
         plt.scatter(km.cluster_centers_[:,0],km.cluster_centers_[:,1],s=300,c='red',mark
         plt.title("k-means clustering (iris dataset)")
         plt.xlabel("feature 1")
         plt.ylabel("feature 2")
```

```
 predicted labels:
[1 2 2 2 1 1 1 1 2 2 1 1 2 2 1 1 1 1 1 1 1 1 1 1 1 2 1 1 1 2 2 1 1 1 2 2 1
 1 2 1 1 2 2 1 1 2 1 2 1 1 0 0 0 0 0 0 2 0 0 2 0 0 0 0 0 0 0 0 0 0 0 0 0 0
 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 2 0 0 0 0 2 0 0 0 0 0 0 0 0 0 0 0 0
 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
 0 0]
```

```
Out[15]: Text(0, 0.5, 'feature 2')
```



In [ ]:

```
OUTPUT:
```

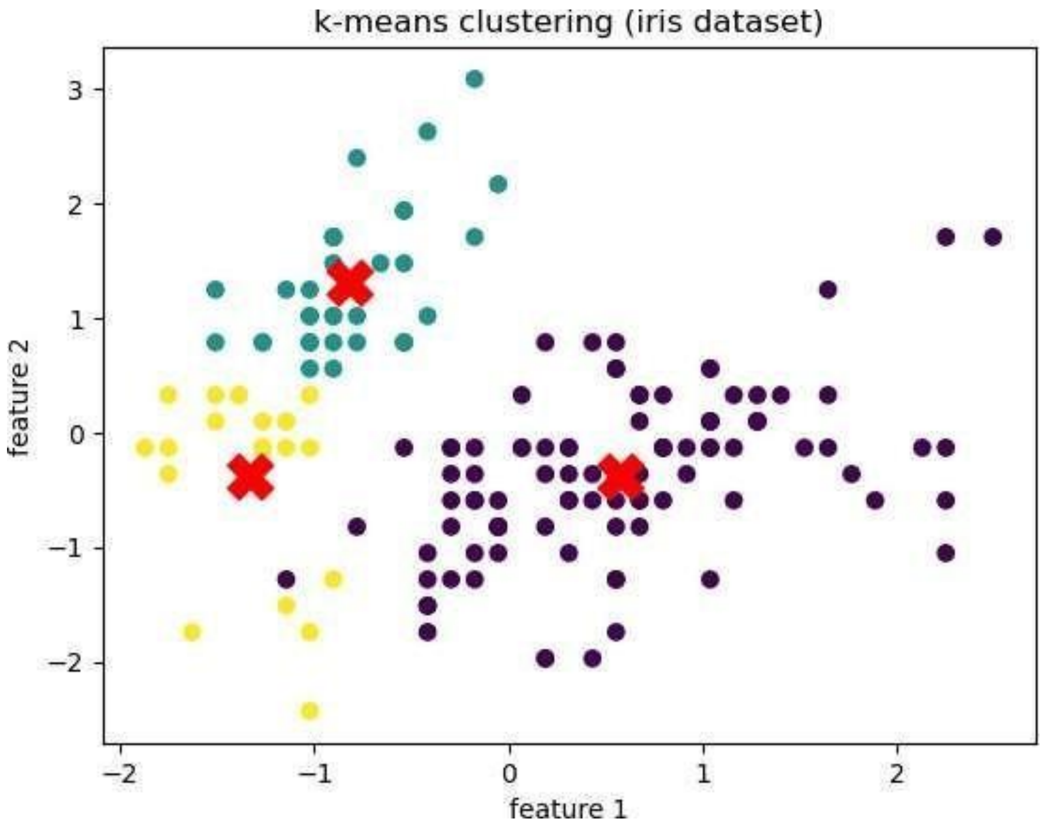
In [17]:

```
print("\n predicted labels:")
print(km.labels_)
plt.scatter(x_scaled[:,0],x_scaled[:,1],c=km.labels_,cmap='viridis')
plt.scatter(km.cluster_centers_[:,0],km.cluster_centers_[:,1],s=300,c='red',mark
plt.title("k-means  clustering (iris  dataset)")
plt.xlabel("feature  1")
plt.ylabel("feature  2")
```

```
 predicted  labels:
[1 2 2 2 1 1 1 1 2 2 1 1 2 2 1 1 1 1 1 1 1 1 1 1 1 2 1 1 1 2 2 1 1 1 2 2 1
 1 2 1 1 2 2 1 1 2 1 2 1 1 0 0 0 0 0 0 0 2 0 0 2 0 0 0 0 0 0 0 0 0 0 0 0 0
 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 2 0 0 0 0 2 0 0 0 0 0 0 0 0 0 0 0 0
 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
 0 0]
```

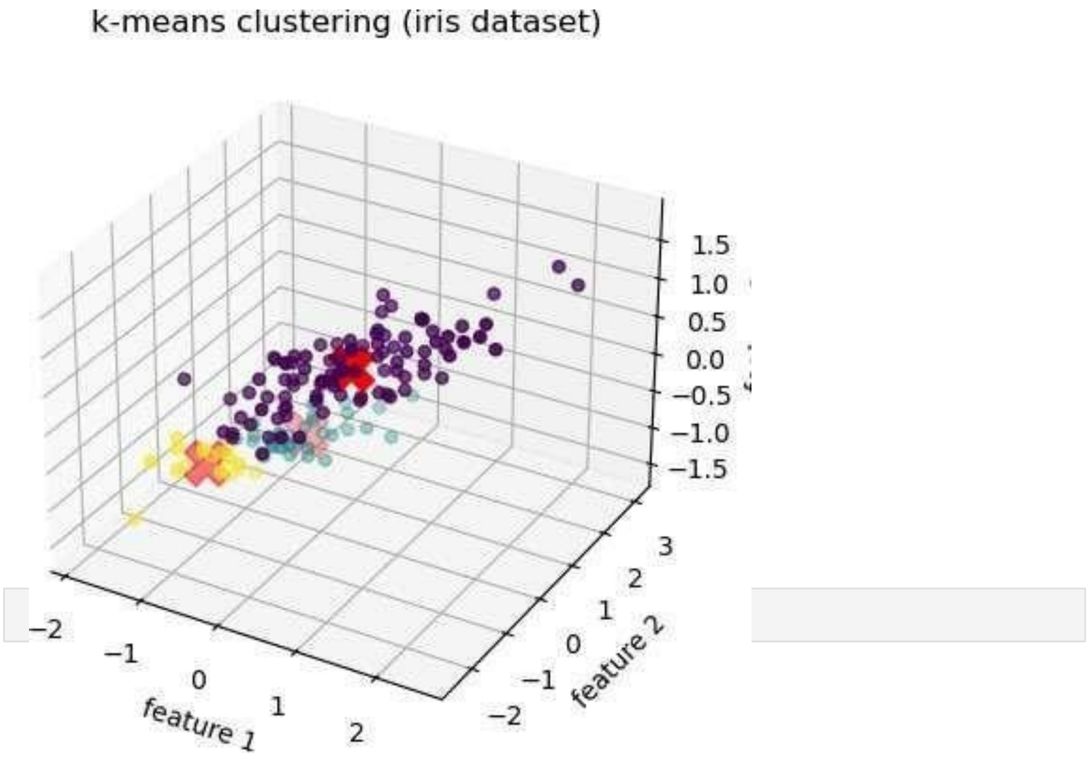
Out[17]:

```
Text(0, 0.5, 'feature 2')
```



```
In [31]:  fig=plt.figure()
          pl=fig.add_subplot(projection='3d')
          pl.scatter(x_scaled[:,0],x_scaled[:,1],x_scaled[:,2],c=km.labels_,cmap='viridis'
          pl.scatter(km.cluster_centers_[:,0],km.cluster_centers_[:,1],km.cluster_centers_
          pl.set_title("k-means  clustering  (iris  dataset)")
          pl.set_xlabel("feature   1")
          pl.set_ylabel("feature   2")
          pl.set_zlabel("feature   3")
```

```
Out[31]:  Text(0.5,  0,  'feature  3')
```


k-means clustering (iris dataset)
1.5
1.0
0.5
0.0
−0.5
−1.0
−1.5
−2
−1
0
1
2
feature 1
3
2
1
0
−1
−2
feature 2