INDEX

Practical No. 1

Aim: Implement Bayes Theorem using Python.

Code:

1. Past data reveals that 10% of the patients entering a particular clinic have liver disease. Also 5% of the patients are alcoholic. Among the patients diagnosed with liver disease 7% are also alcoholic. Find out the probability that the patients have liver disease if they are alcoholic.

```
a = float(input("Enter the percentage of patients having Liver disease : "))
b = float(input("Enter the percentage of patients that are Alcoholic : "))
b_given_a = float(input("Enter the percentage of patients who are alcoholic if they have liver disease : "))
prob = (b_given_a*a)/b

print("There are %.2f %% chances that the paients have liver disease if they are alcoholic."%(prob))
```

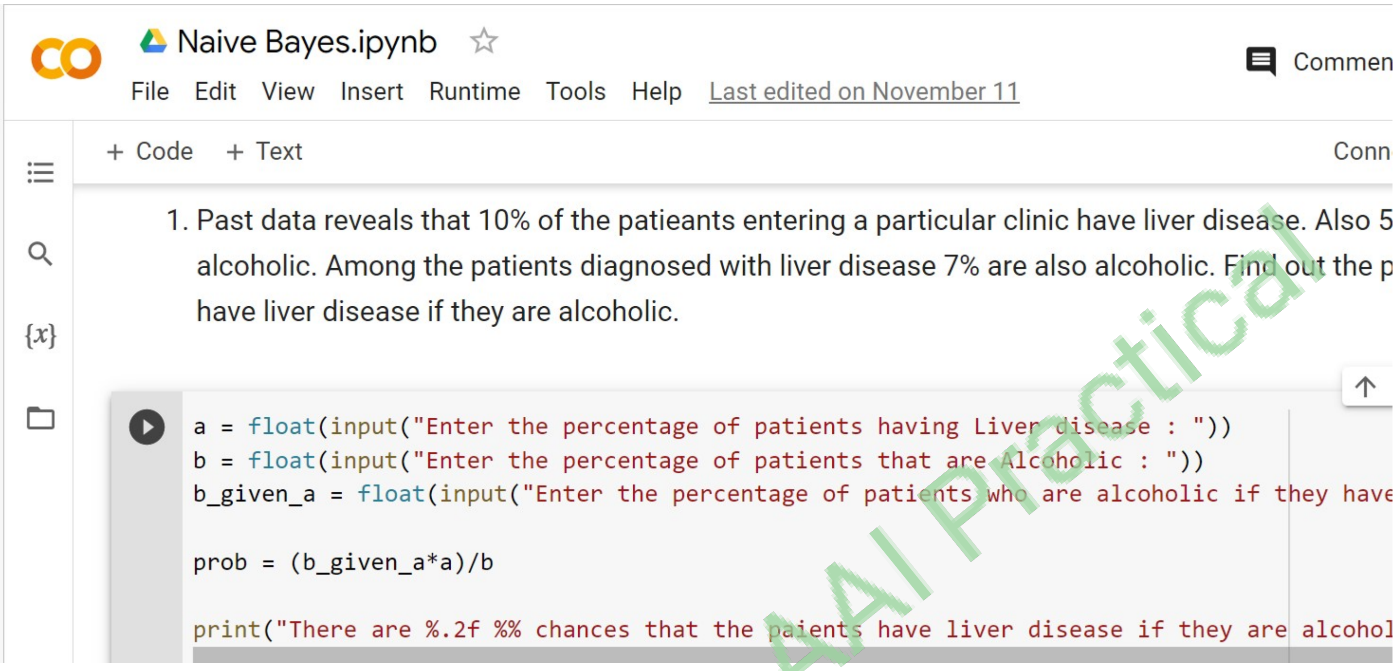
2. Given that in a particular sample space, 1% of the patients have a certain genetic defect. 90% of the test for the gene detect the defect i.e., they are true positives. 9.6% of the test are false positives. If a person gets a positive test result, what are the chances that are actually have the genetic defect?

```
a = float(input("Enter the percentage of patients having genetic defects : "))
b_given_a = float(input("Enter the percentage of positive test results if the patients have the genetic effect : "))
b_given_not_a = float(input("Enter the percentage of positive test results if the patients do not have the genetic effect : "))

prob_not_a = 1 - (a/100)
prob_not_a = prob_not_a*100
prob_a_given_b = (b_given_a*a)/(b_given_a*a + b_given_not_a*prob_not_a)

print("There are %.3f%% chances that the patient has genetic defect if they have a positive test result."%(prob_a_given_b))
```

Output: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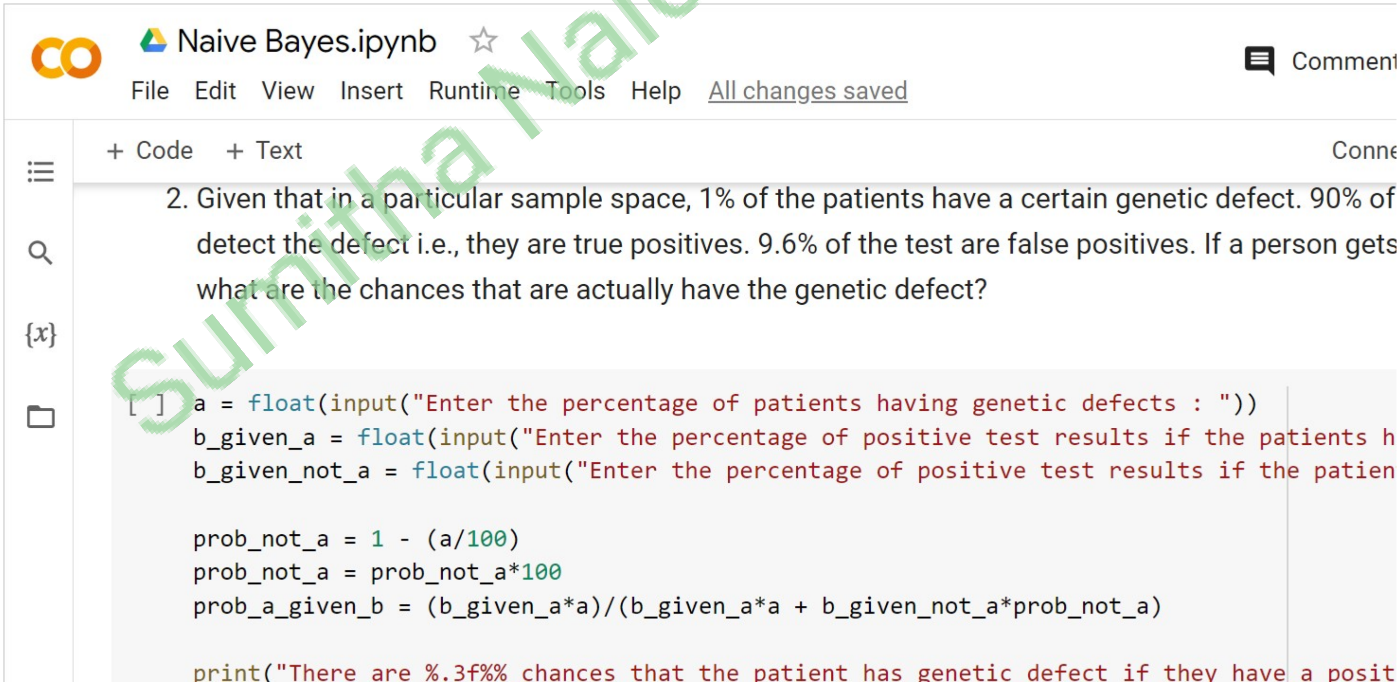
1. Past data reveals that 10% of the patieants entering a particular clinic have liver disease. Also 5 alcoholic. Among the patients diagnosed with liver disease 7% are also alcoholic. Find out the p have liver disease if they are alcoholic.

```
a = float(input("Enter the percentage of patients having Liver disease : "))
b = float(input("Enter the percentage of patients that are Alcoholic : "))
b_given_a = float(input("Enter the percentage of patients who are alcoholic if they have

prob = (b_given_a*a)/b

print("There are %.2f %% chances that the paients have liver disease if they are alcohol
```



2. Given that in a particular sample space, 1% of the patients have a certain genetic defect. 90% of detect the defect i.e., they are true positives. 9.6% of the test are false positives. If a person gets what are the chances that are actually have the genetic defect?

```
[ ] a = float(input("Enter the percentage of patients having genetic defects : "))
    b_given_a = float(input("Enter the percentage of positive test results if the patients h
    b_given_not_a = float(input("Enter the percentage of positive test results if the patien

    prob_not_a = 1 - (a/100)
    prob_not_a = prob_not_a*100
    prob_a_given_b = (b_given_a*a)/(b_given_a*a + b_given_not_a*prob_not_a)

    print("There are %.3f%% chances that the patient has genetic defect if they have a posit
```

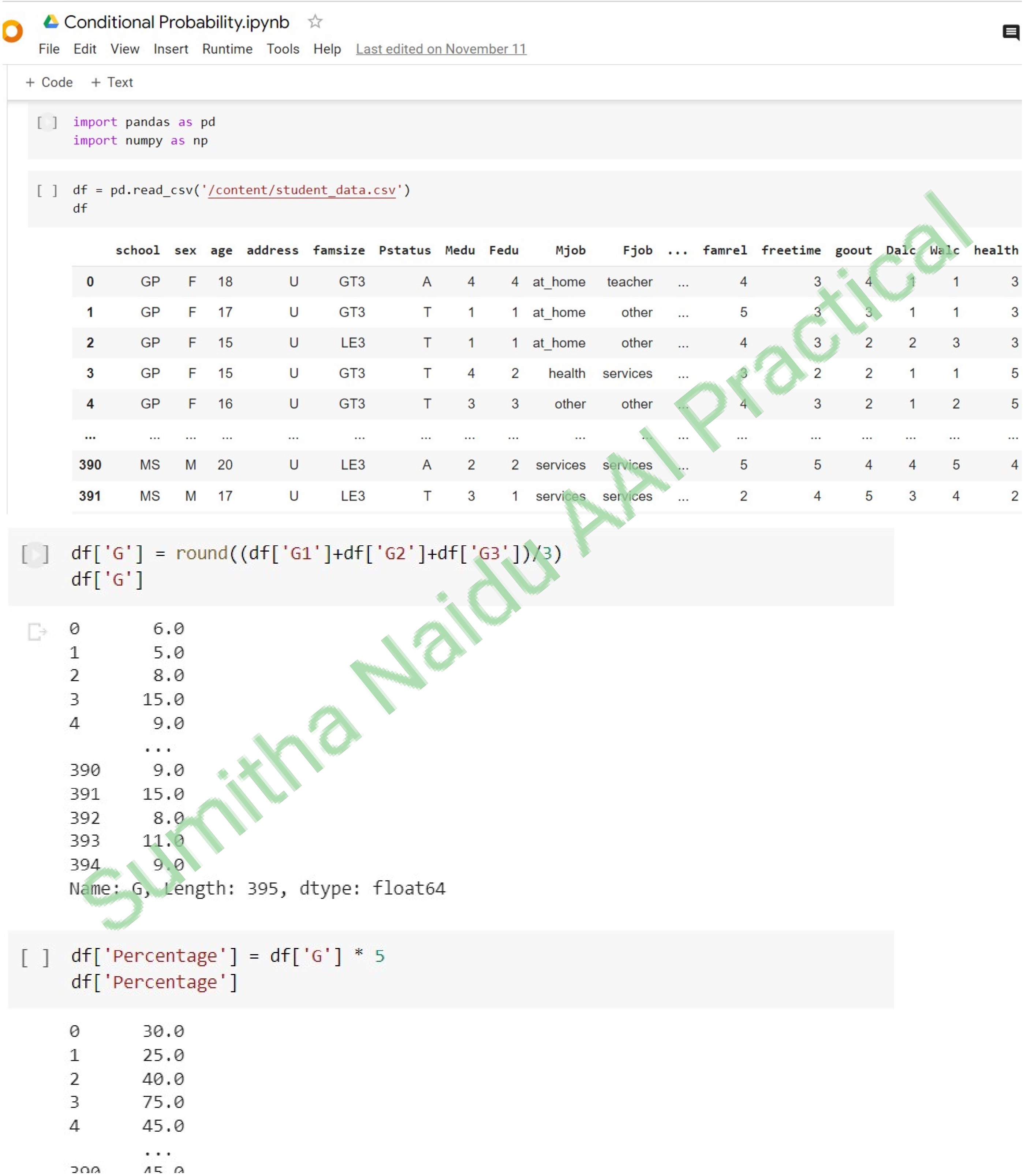
Practical No. 2

Aim: Implement Conditional Probability and Joint Probability using Python.

Code:

```
#Conditional Probability

import pandas as pd
import numpy as np

df = pd.read_csv('/content/student_data.csv')
df['G'] = round((df['G1']+df['G2']+df['G3'])/3)
df['Percentage'] = df['G'] * 5
df['O_grade'] = np.where(df['Percentage'] >= 80, 1, 0)
df['high_absentees'] = np.where(df['absences'] >= 10,1,0)
df['count'] = 1
df = df[['O_grade', 'high_absentees', 'count']]
ptable = pd.pivot_table(df, values='count', index = 'high_absentees', columns='O_grade', aggfunc=
np.size, fill_value = 0)

total = 283+29+78+5
prob_a = (29+5)/total
prob_b = (78+5)/total
prob_a_intersect_b = 5/total
prob_a, prob_b, prob_a_intersect_b
prob_a_given_b = prob_a_intersect_b / prob_b

print("Probability of Students getting atleast 80% grade given they have missed 10 lectures or more
 is ", round(prob_a_given_b,2))

#Joint Probability

color = input('Enter the card colour : ')
number = input('Enter the card number : ')
prob_color = 26/52
prob_num = 4/52
print('Probability of drawing a ',color, 'card is ',round(prob_color,2))
print('Probability of drawing a card with number ',number, ' is ',prob_num)
prob_color_and_num = round(prob_color*prob_num, 2)
print('Probability of drawing ',color,' card with the number ',number,' from a normal deck of 52 playi
ng cards is ',prob_color_and_num)
```

Output:



Conditional Probability.ipynb ☆
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```
[ ] import pandas as pd
    import numpy as np
```

```
[ ] df = pd.read_csv('/content/student_data.csv')
    df
```

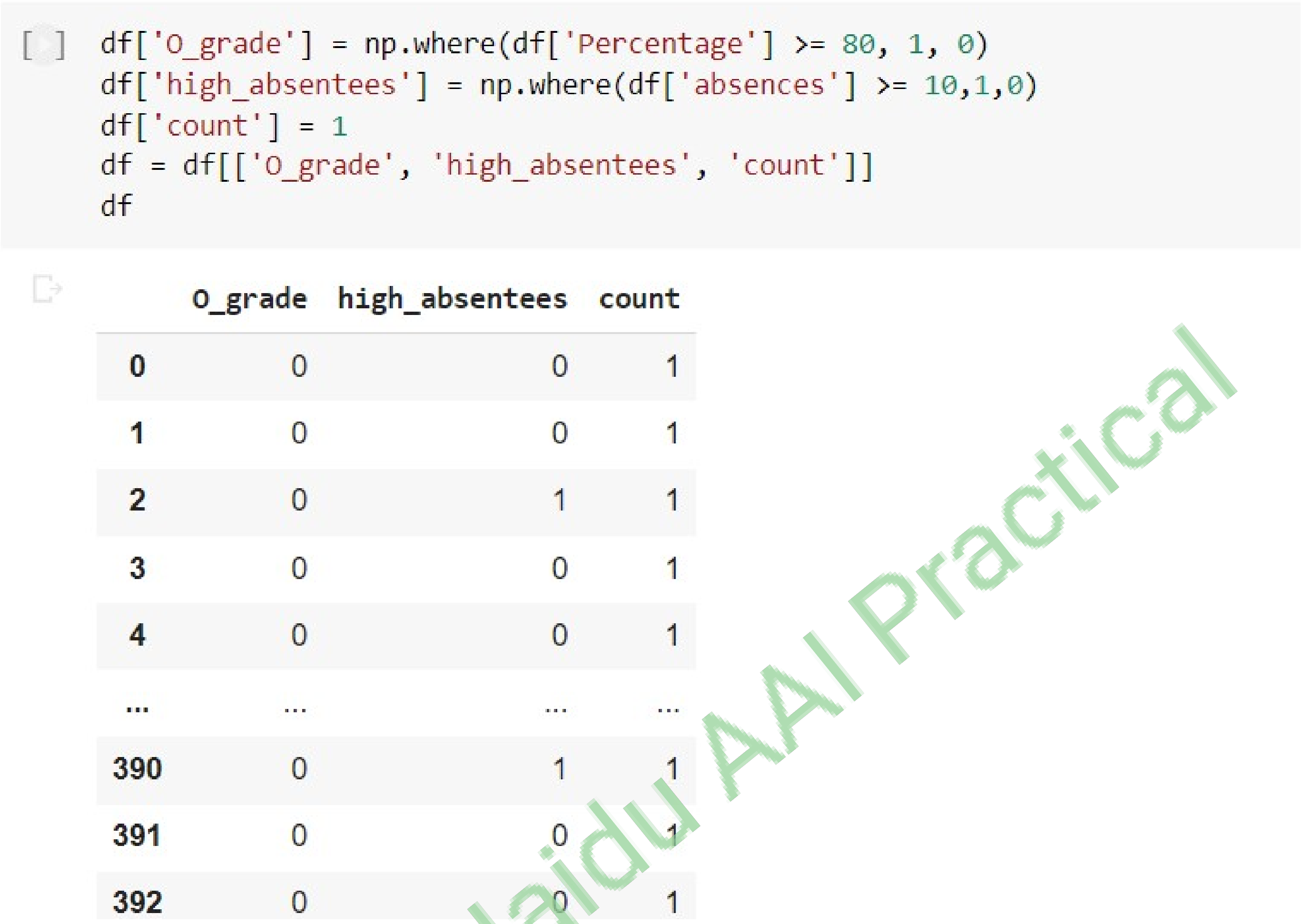
	school	sex	age	address	famsize	Pstatus	Medu	Fedu	Mjob	Fjob	...	famrel	freetime	goout	Dalc	Walc	health
0	GP	F	18	U	GT3	A	4	4	at_home	teacher	...	4	3	4	1	1	3
1	GP	F	17	U	GT3	T	1	1	at_home	other	...	5	3	3	1	1	3
2	GP	F	15	U	LE3	T	1	1	at_home	other	...	4	3	2	2	3	3
3	GP	F	15	U	GT3	T	4	2	health	services	...	3	2	2	1	1	5
4	GP	F	16	U	GT3	T	3	3	other	other	...	4	3	2	1	2	5
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
390	MS	M	20	U	LE3	A	2	2	services	services	...	5	5	4	4	5	4
391	MS	M	17	U	LE3	T	3	1	services	services	...	2	4	5	3	4	2

```
[ ] df['G'] = round((df['G1']+df['G2']+df['G3'])/3)
    df['G']
```

```
0       6.0
1       5.0
2       8.0
3      15.0
4       9.0
       ...
390     9.0
391    15.0
392     8.0
393    11.0
394     9.0
Name: G, Length: 395, dtype: float64
```

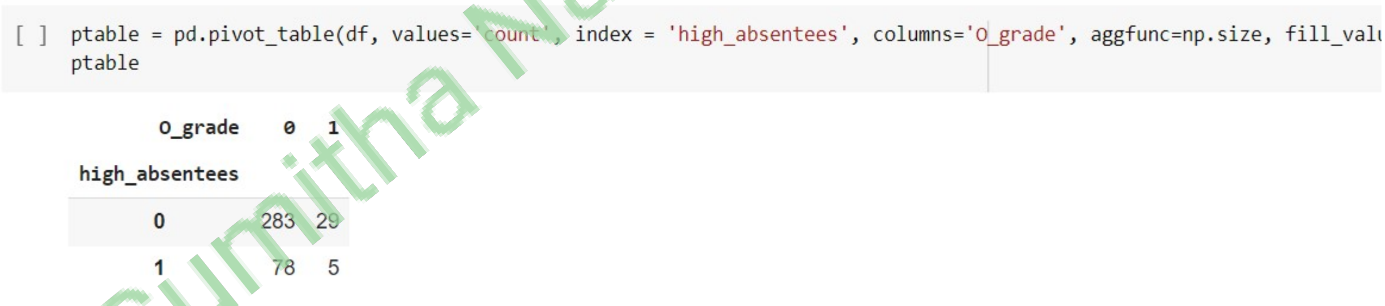
```
[ ] df['Percentage'] = df['G'] * 5
    df['Percentage']
```

```
0      30.0
1      25.0
2      40.0
3      75.0
4      45.0
       ...
390    45.0
```



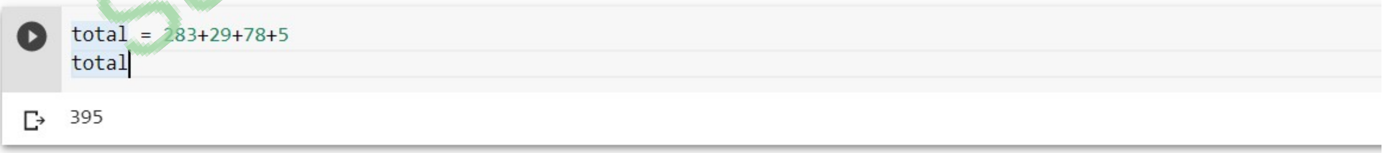
```
[ ] df['O_grade'] = np.where(df['Percentage'] >= 80, 1, 0)
    df['high_absentees'] = np.where(df['absences'] >= 10,1,0)
    df['count'] = 1
    df = df[['O_grade', 'high_absentees', 'count']]
    df
```

```
         O_grade  high_absentees  count
    0          0               0      1
    1          0               0      1
    2          0               1      1
    3          0               0      1
    4          0               0      1
  ...        ...             ...    ...
  390          0               1      1
  391          0               0      1
  392          0               0      1
```



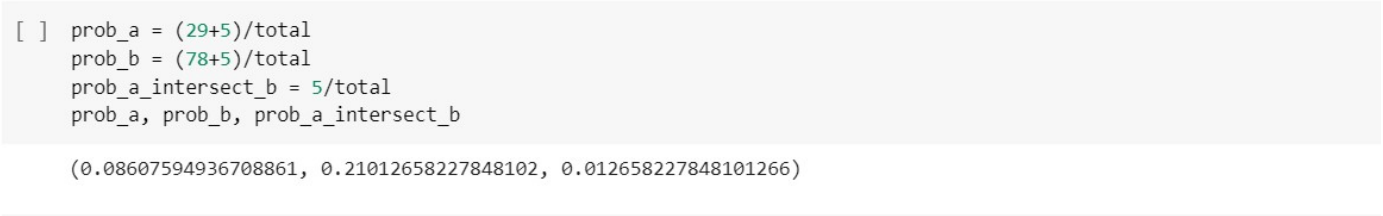
```
[ ] ptable = pd.pivot_table(df, values='count', index = 'high_absentees', columns='O_grade', aggfunc=np.size, fill_valu
    ptable
```

```
           O_grade    0   1
  high_absentees
                0   283  29
                1    78   5
```



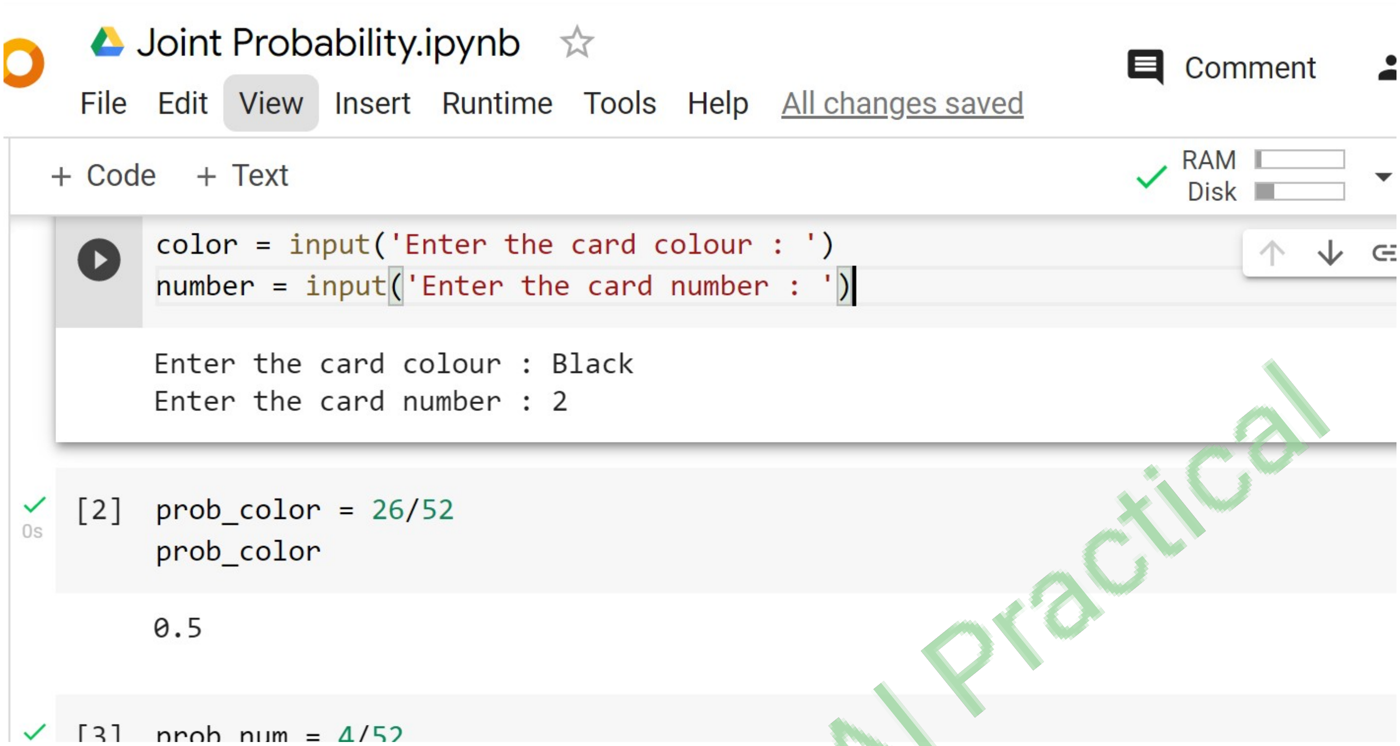
```
total = 283+29+78+5
total
```

```
395
```



```
[ ] prob_a = (29+5)/total
    prob_b = (78+5)/total
    prob_a_intersect_b = 5/total
    prob_a, prob_b, prob_a_intersect_b
```

```
(0.08607594936708861, 0.21012658227848102, 0.012658227848101266)
```



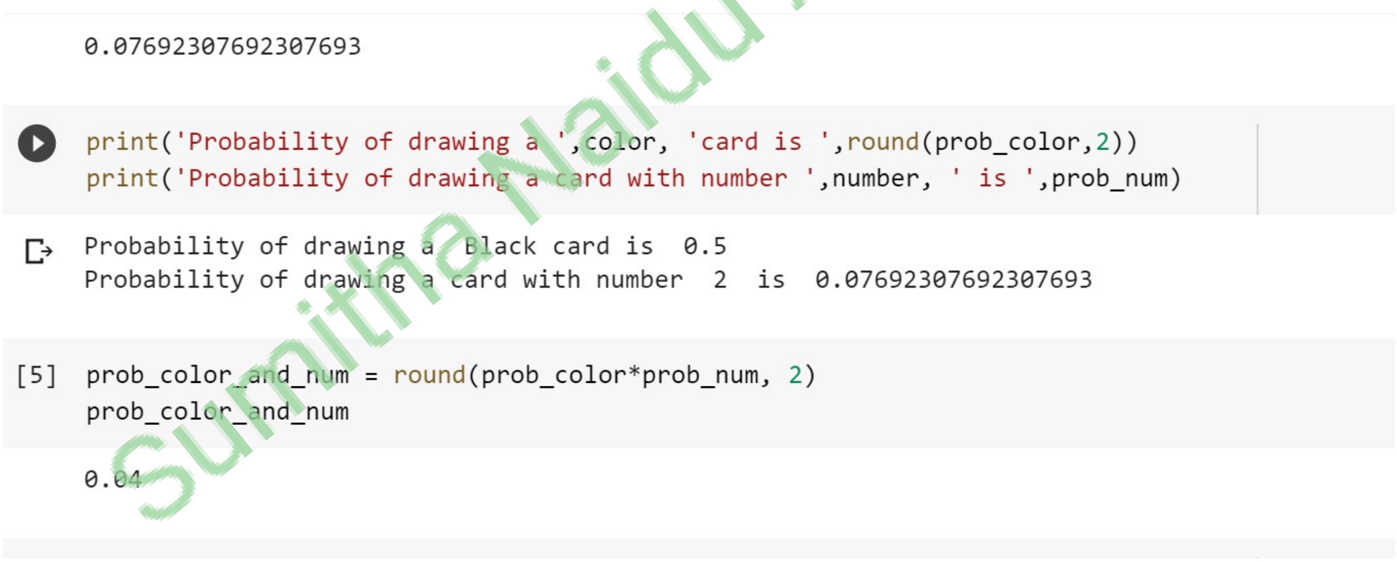
```
color = input('Enter the card colour : ')
number = input('Enter the card number : ')
```

```
Enter the card colour : Black
Enter the card number : 2
```

```
[2] prob_color = 26/52
    prob_color
```

```
0.5
```

```
[3] prob_num = 4/52
```



```
0.07692307692307693
```

```
print('Probability of drawing a ',color, 'card is ',round(prob_color,2))
print('Probability of drawing a card with number ',number, ' is ',prob_num)
```

```
Probability of drawing a  Black card is  0.5
Probability of drawing a card with number  2  is  0.07692307692307693
```

```
[5] prob_color_and_num = round(prob_color*prob_num, 2)
    prob_color_and_num
```

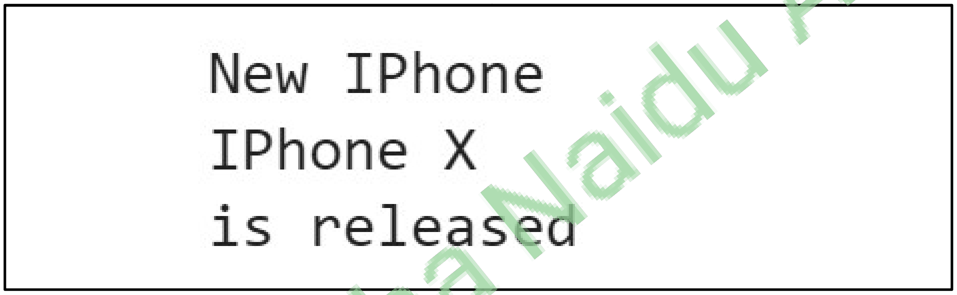
```
0.04
```

Practical No. 3

Aim: Write a program to implement Rule based system.

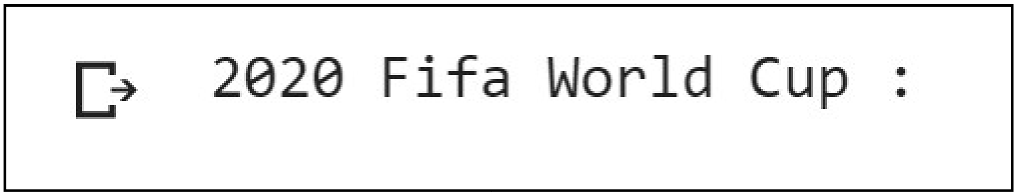
Code with Output:

```
import spacy
from spacy.matcher import Matcher

nlp=spacy.load('en_core_web_sm')
matcher=Matcher(nlp.vocab)

doc = nlp("New IPhone X is released")
pattern=[{'ORTH':'New'}, {'ORTH':'IPhone'}]
matcher.add('Iphone_pattern',[pattern])
matches = matcher(doc)

for match_id, start, end in matches:
  matched_span = doc[start:end]
  print(matched_span.text)
```



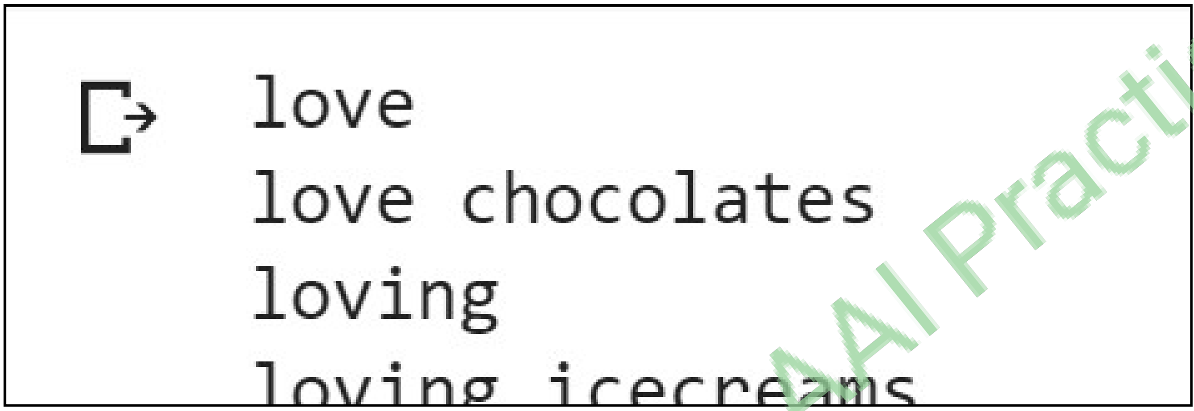
```
New IPhone
IPhone X
is released
```

```
doc = nlp("2020 Fifa World Cup : India Wins")
pattern=[{'IS_DIGIT':True}, {'LOWER':'fifa'}, {'LOWER':'world'}, {'LOWER':'cup'}, {'IS_PUNCT':True}]
matcher.add('FIFA_PATTERN',[pattern])

matches = matcher(doc)

for match_id, start, end in matches:
  matched_span = doc[start:end]
  print(matched_span.text,"\n")
```



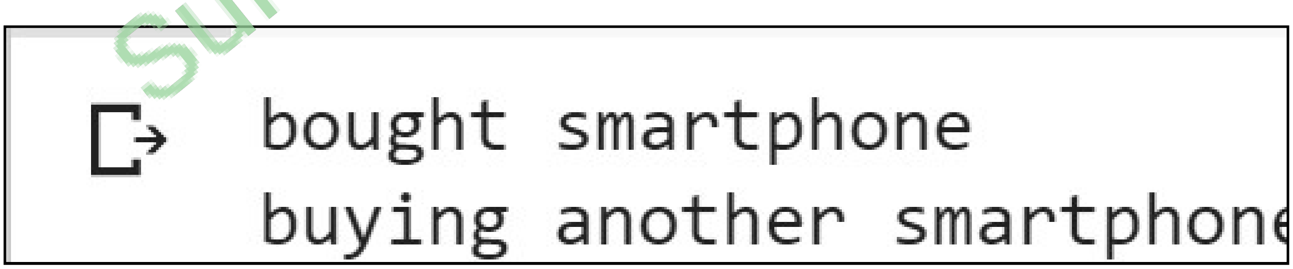
```
2020 Fifa World Cup :
```

```
doc = nlp("I love chocolates but now I loving icecreams more")
pattern=[{'LEMMA':'love'}, {'POS':'NOUN'}]
matcher.add('EAT_PATTERN',[pattern])

matches = matcher(doc)

for match_id, start, end in matches:
  matched_span = doc[start:end]
  print(matched_span.text)
```



```
love
love chocolates
loving
loving icecreams
```

```
doc = nlp("I bought smartphone now I am buying another smartphone")
pattern=[{'LEMMA':'buy'}, {'POS':'DET', "OP":'?'}, {'POS':'NOUN'}]
matcher.add('EA_PATTERN',[pattern])

matches = matcher(doc)

for match_id, start, end in matches:
  matched_span = doc[start:end]
  print(matched_span.text)
```



```
bought smartphone
buying another smartphone
```

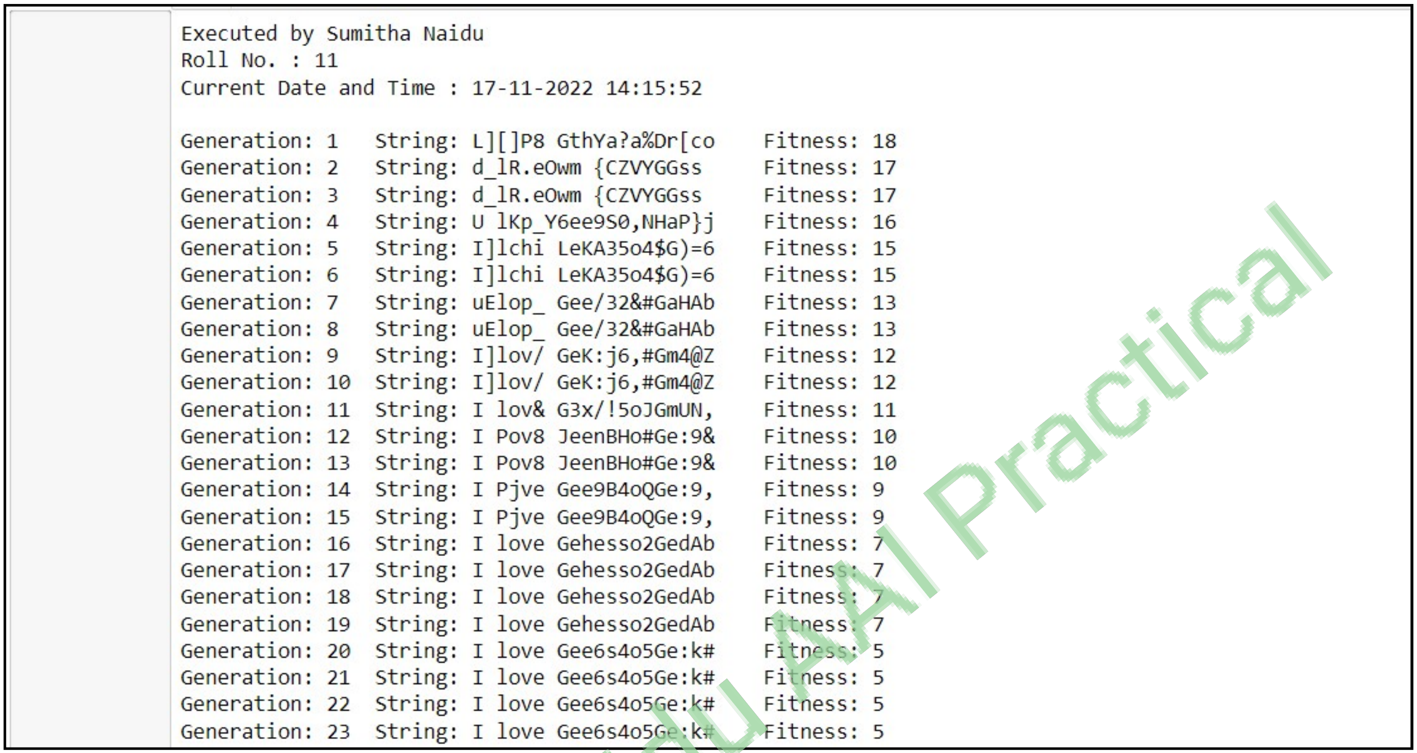
Practical No. 4

Aim: Simulate Genetic Algorithm with suitable example using Python.

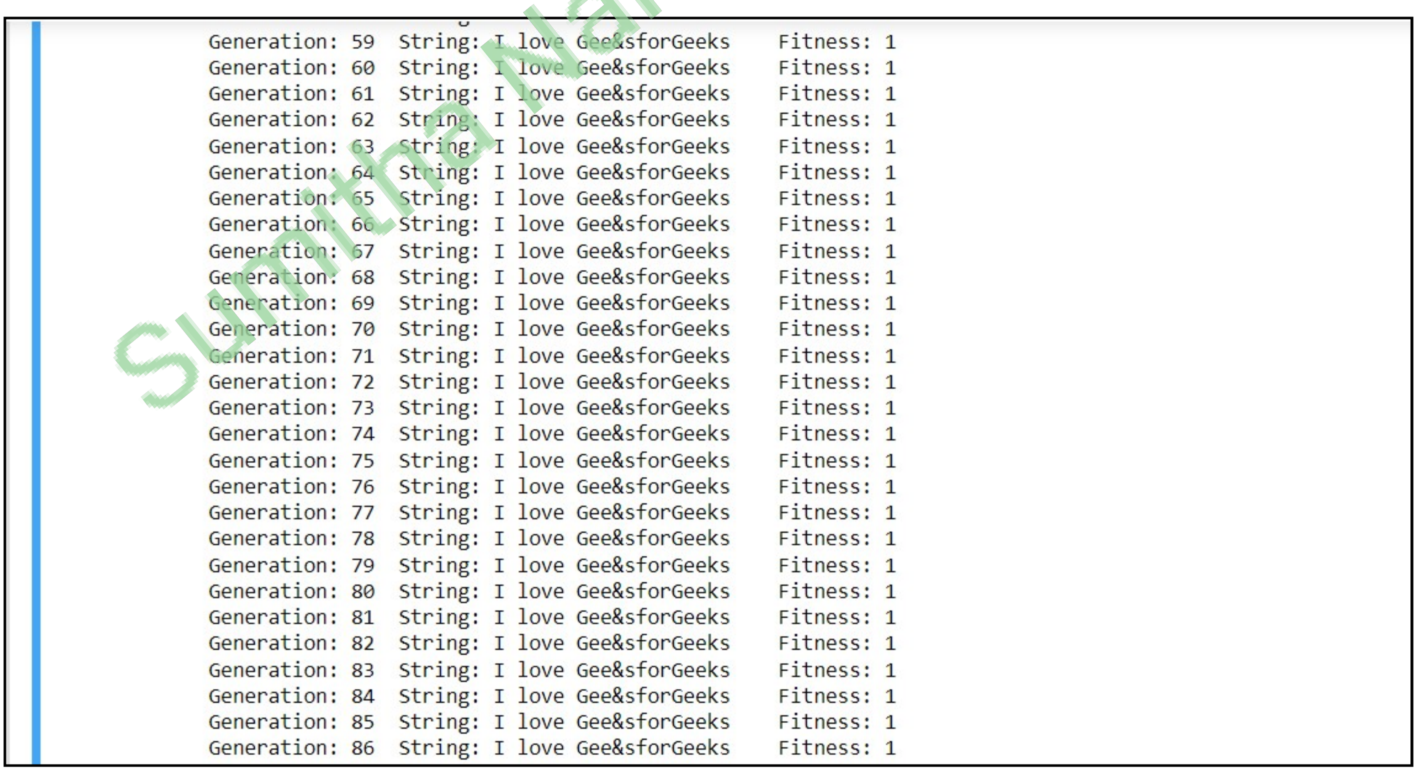
Code:

```
import datetime as dt
import random

# Number of individuals in each generation
POPULATION_SIZE = 100
# Valid genes
GENES = '''abcdefghijklmnopqrstuvwxyzABCDEFGHIJKLMNOPQRSTUVWXYZ 1234567890, .-
;:_!"#%&/()=?@${[]}'''
# Target string to be generated
TARGET = "I love GeeksforGeeks"

class Individual(object):
    def __init__(self, chromosome):
        self.chromosome = chromosome
        self.fitness = self.cal_fitness()
    @classmethod
    def mutated_genes(self):
        global GENES
        gene = random.choice(GENES)
        return gene
    @classmethod
    def create_gnome(self):
        global TARGET
        gnome_len = len(TARGET)
        return [self.mutated_genes() for _ in range(gnome_len)]
    def mate(self, par2):
        child_chromosome = []
        for gp1, gp2 in zip(self.chromosome, par2.chromosome):
            prob = random.random()
            if prob < 0.45:
                child_chromosome.append(gp1)
            elif prob < 0.90:
                child_chromosome.append(gp2)
            else:
                child_chromosome.append(self.mutated_genes())
        return Individual(child_chromosome)
    def cal_fitness(self):
        global TARGET
        fitness = 0
        for gs, gt in zip(self.chromosome, TARGET):
            if gs != gt: fitness+= 1
        return fitness

# Driver code
def main():
    global POPULATION_SIZE
    #current generation
    generation = 1
    found = False
    population = []
    # create initial population
    for _ in range(POPULATION_SIZE):
        gnome = Individual.create_gnome()
        population.append(Individual(gnome))

    while not found:
        population = sorted(population, key = lambda x:x.fitness)
        if population[0].fitness <= 0:
            found = True
            break
        new_generation = []
        s = int((10*POPULATION_SIZE)/100)
        new_generation.extend(population[:s])
        s = int((90*POPULATION_SIZE)/100)
        for _ in range(s):
            parent1 = random.choice(population[:50])
            parent2 = random.choice(population[:50])
            child = parent1.mate(parent2)
            new_generation.append(child)
        population = new_generation
        print("Generation: {}\tString: {}\tFitness:
{}".format(generation,"".join(population[0].chromosome), population[0].fitness))
        generation += 1
    print("Generation: {}\tString: {}\tFitness: {}".format(generation, "".join(population[0].chromosome),
population[0].fitness))

if __name__ == '__main__':
    main()
```

Output:



```
Executed by Sumitha Naidu
Roll No. : 11
Current Date and Time : 17-11-2022 14:15:52

Generation: 1   String: L][]P8 GthYa?a%Dr[co    Fitness: 18
Generation: 2   String: d_lR.eOwm {CZVYGGss     Fitness: 17
Generation: 3   String: d_lR.eOwm {CZVYGGss     Fitness: 17
Generation: 4   String: U lKp_Y6ee9S0,NHaP}j    Fitness: 16
Generation: 5   String: I]lchi LeKA35o4$G)=6    Fitness: 15
Generation: 6   String: I]lchi LeKA35o4$G)=6    Fitness: 15
Generation: 7   String: uElop_ Gee/32&#GaHAb    Fitness: 13
Generation: 8   String: uElop_ Gee/32&#GaHAb    Fitness: 13
Generation: 9   String: I]lov/ GeK:j6,#Gm4@Z    Fitness: 12
Generation: 10  String: I]lov/ GeK:j6,#Gm4@Z    Fitness: 12
Generation: 11  String: I lov& G3x/!5oJGmUN,    Fitness: 11
Generation: 12  String: I Pov8 JeenBHo#Ge:9&    Fitness: 10
Generation: 13  String: I Pov8 JeenBHo#Ge:9&    Fitness: 10
Generation: 14  String: I Pjve Gee9B4oQGe:9,    Fitness: 9
Generation: 15  String: I Pjve Gee9B4oQGe:9,    Fitness: 9
Generation: 16  String: I love Gehesso2GedAb    Fitness: 7
Generation: 17  String: I love Gehesso2GedAb    Fitness: 7
Generation: 18  String: I love Gehesso2GedAb    Fitness: 7
Generation: 19  String: I love Gehesso2GedAb    Fitness: 7
Generation: 20  String: I love Gee6s4o5Ge:k#    Fitness: 5
Generation: 21  String: I love Gee6s4o5Ge:k#    Fitness: 5
Generation: 22  String: I love Gee6s4o5Ge:k#    Fitness: 5
Generation: 23  String: I love Gee6s4o5Ge:k#    Fitness: 5
```



```
Generation: 59  String: I love Gee&sforGeeks    Fitness: 1
Generation: 60  String: I love Gee&sforGeeks    Fitness: 1
Generation: 61  String: I love Gee&sforGeeks    Fitness: 1
Generation: 62  String: I love Gee&sforGeeks    Fitness: 1
Generation: 63  String: I love Gee&sforGeeks    Fitness: 1
Generation: 64  String: I love Gee&sforGeeks    Fitness: 1
Generation: 65  String: I love Gee&sforGeeks    Fitness: 1
Generation: 66  String: I love Gee&sforGeeks    Fitness: 1
Generation: 67  String: I love Gee&sforGeeks    Fitness: 1
Generation: 68  String: I love Gee&sforGeeks    Fitness: 1
Generation: 69  String: I love Gee&sforGeeks    Fitness: 1
Generation: 70  String: I love Gee&sforGeeks    Fitness: 1
Generation: 71  String: I love Gee&sforGeeks    Fitness: 1
Generation: 72  String: I love Gee&sforGeeks    Fitness: 1
Generation: 73  String: I love Gee&sforGeeks    Fitness: 1
Generation: 74  String: I love Gee&sforGeeks    Fitness: 1
Generation: 75  String: I love Gee&sforGeeks    Fitness: 1
Generation: 76  String: I love Gee&sforGeeks    Fitness: 1
Generation: 77  String: I love Gee&sforGeeks    Fitness: 1
Generation: 78  String: I love Gee&sforGeeks    Fitness: 1
Generation: 79  String: I love Gee&sforGeeks    Fitness: 1
Generation: 80  String: I love Gee&sforGeeks    Fitness: 1
Generation: 81  String: I love Gee&sforGeeks    Fitness: 1
Generation: 82  String: I love Gee&sforGeeks    Fitness: 1
Generation: 83  String: I love Gee&sforGeeks    Fitness: 1
Generation: 84  String: I love Gee&sforGeeks    Fitness: 1
Generation: 85  String: I love Gee&sforGeeks    Fitness: 1
Generation: 86  String: I love Gee&sforGeeks    Fitness: 1
```

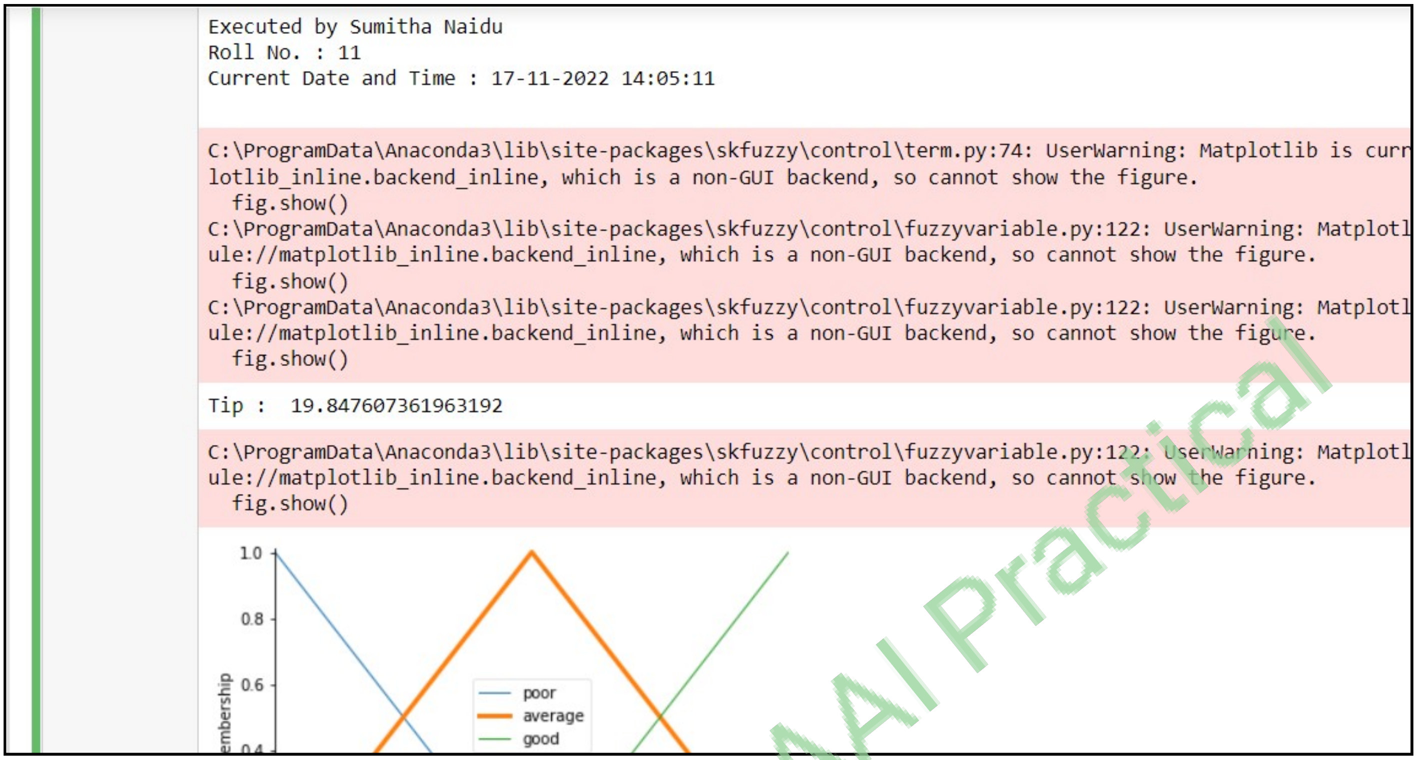
Practical No. 5

Aim: Design a Fuzzy based application using Python.

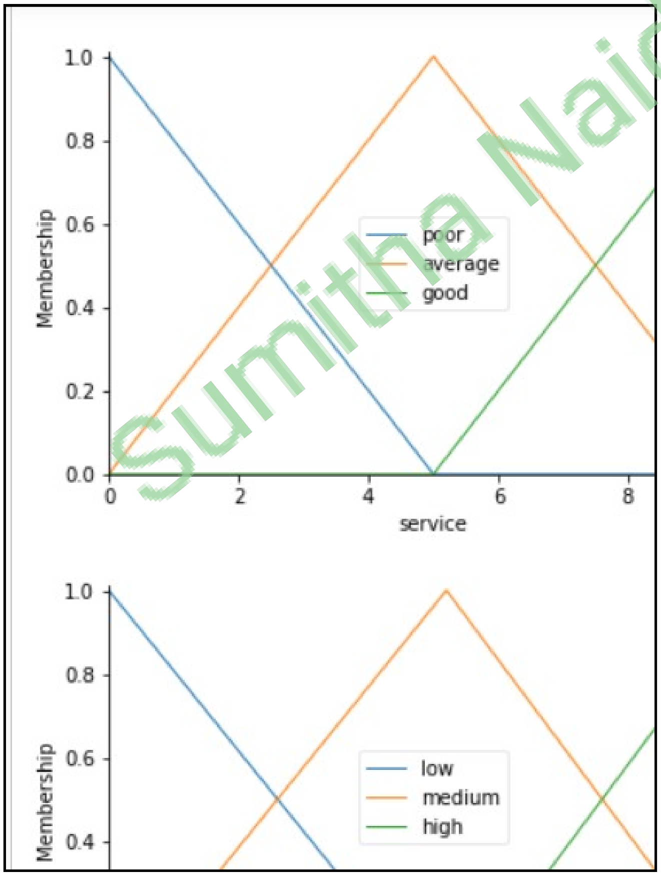
Code:

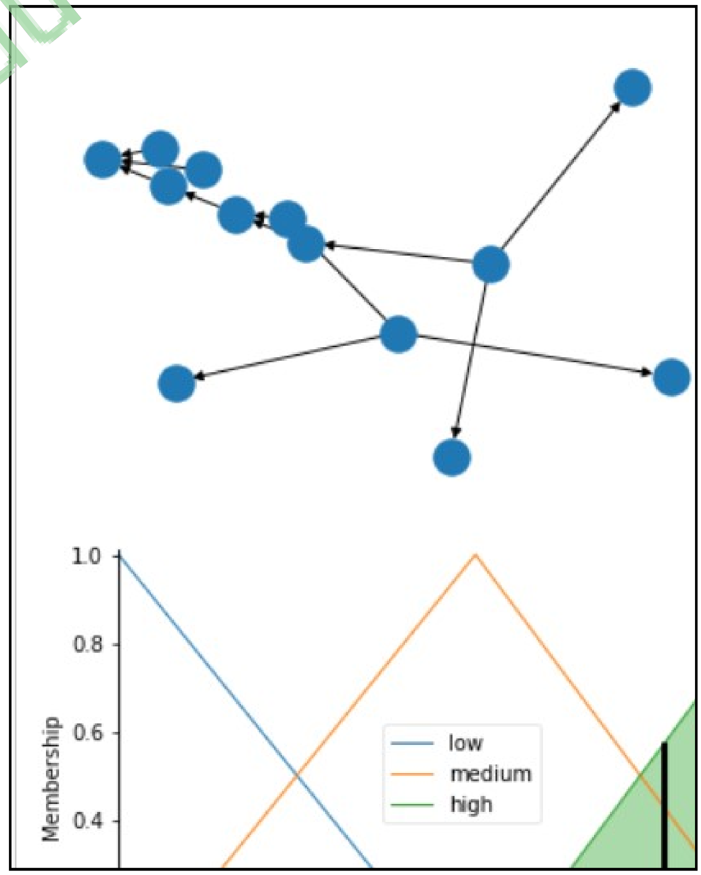
```
import numpy as np
import skfuzzy as fuzz
from skfuzzy import control as ctrl

# New Antecedent/Consequent objects hold universe variables and membership functions
quality = ctrl.Antecedent(np.arange(0, 11, 1), 'quality')
service = ctrl.Antecedent(np.arange(0, 11, 1), 'service')
tip = ctrl.Consequent(np.arange(0, 26, 1), 'tip')

# Auto-membership function population is possible with .automf(3, 5, or 7)
quality.automf(3)
service.automf(3)

# Custom membership functions can be built interactively with a familiar, Pythonic API
tip['low'] = fuzz.trimf(tip.universe, [0, 0, 13])
tip['medium'] = fuzz.trimf(tip.universe, [0, 13, 25])
tip['high'] = fuzz.trimf(tip.universe, [13, 25, 25])

# You can see how these look with .view()
quality['average'].view()
service.view()
tip.view()
rule1 = ctrl.Rule(quality['poor'] | service['poor'], tip['low'])
rule2 = ctrl.Rule(service['average'], tip['medium'])
rule3 = ctrl.Rule(service['good'] | quality['good'], tip['high'])
rule1.view()

tipping_ctrl = ctrl.ControlSystem([rule1, rule2, rule3])
tipping = ctrl.ControlSystemSimulation(tipping_ctrl)
# Pass inputs to the ControlSystem using Antecedent labels with Pythonic API
# Note: if you like passing many inputs all at once, use .inputs(dict_of_data)
tipping.input['quality'] = 6.5
tipping.input['service'] = 9.8
# Crunch the numbers
tipping.compute()
print (tipping.output['tip'])
tip.view(sim=tipping)
```

Output:



```
Executed by Sumitha Naidu
Roll No. : 11
Current Date and Time : 17-11-2022 14:05:11

C:\ProgramData\Anaconda3\lib\site-packages\skfuzzy\control\term.py:74: UserWarning: Matplotlib is curr
lotlib_inline.backend_inline, which is a non-GUI backend, so cannot show the figure.
  fig.show()
C:\ProgramData\Anaconda3\lib\site-packages\skfuzzy\control\fuzzyvariable.py:122: UserWarning: Matplotl
ule://matplotlib_inline.backend_inline, which is a non-GUI backend, so cannot show the figure.
  fig.show()
C:\ProgramData\Anaconda3\lib\site-packages\skfuzzy\control\fuzzyvariable.py:122: UserWarning: Matplotl
ule://matplotlib_inline.backend_inline, which is a non-GUI backend, so cannot show the figure.
  fig.show()

Tip :  19.847607361963192

C:\ProgramData\Anaconda3\lib\site-packages\skfuzzy\control\fuzzyvariable.py:122: UserWarning: Matplotl
ule://matplotlib_inline.backend_inline, which is a non-GUI backend, so cannot show the figure.
  fig.show()
```





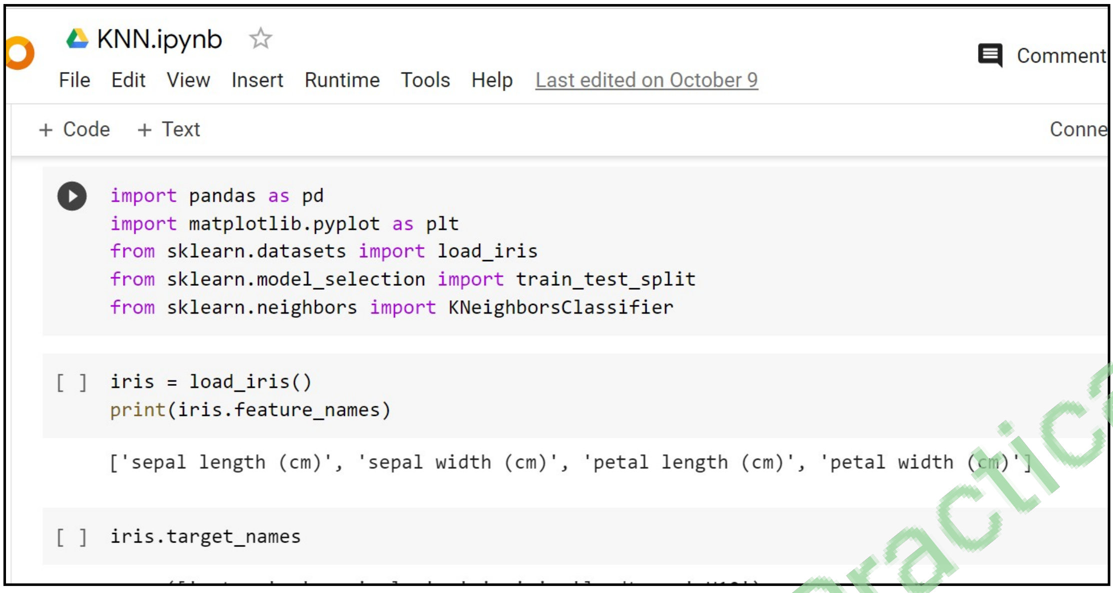
Practical No. 6

Aim: Write an application to implement supervised and unsupervised learning model.

Code:

```
import pandas as pd
import matplotlib.pyplot as plt
from sklearn.datasets import load_iris
from sklearn.model_selection import train_test_split
from sklearn.neighbors import KNeighborsClassifier

iris = load_iris()
print(iris.feature_names)
iris.target_names
df = pd.DataFrame(iris.data,columns=iris.feature_names)
df['target'] = iris.target
df['flower_name'] =df.target.apply(lambda x: iris.target_names[x])
print(df)

df0 = df[:50]
df1 = df[50:100]
df2 = df[100:]

plt.xlabel('Sepal Length')
plt.ylabel('Sepal Width')
plt.scatter(df0['sepal length (cm)'], df0['sepal width (cm)'],color="green",marker='+')
plt.scatter(df1['sepal length (cm)'], df1['sepal width (cm)'],color="blue",marker='.')

plt.xlabel('Petal Length')
plt.ylabel('Petal Width')
plt.scatter(df0['petal length (cm)'], df0['petal width (cm)'],color="green",s=100,marker='+')
plt.scatter(df1['petal length (cm)'], df1['petal width (cm)'],color="blue",marker='.')

X = df.drop(['target','flower_name'], axis='columns')
y = df.target
X_train, X_test, y_train, y_test = train_test_split(X,y, test_size=0.2)

knn = KNeighborsClassifier(n_neighbors=10)
knn.fit(X_train, y_train)
knn.score(X_test, y_test)
```

Output:


KNN.ipynb
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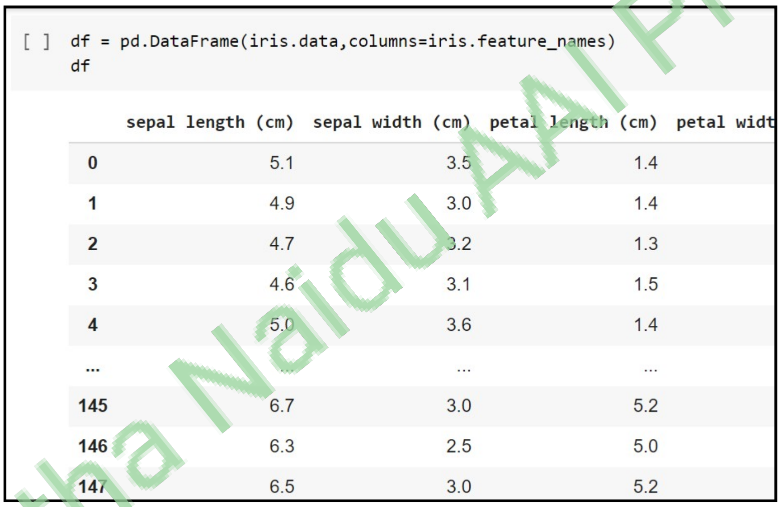
```
import pandas as pd
import matplotlib.pyplot as plt
from sklearn.datasets import load_iris
from sklearn.model_selection import train_test_split
from sklearn.neighbors import KNeighborsClassifier
```

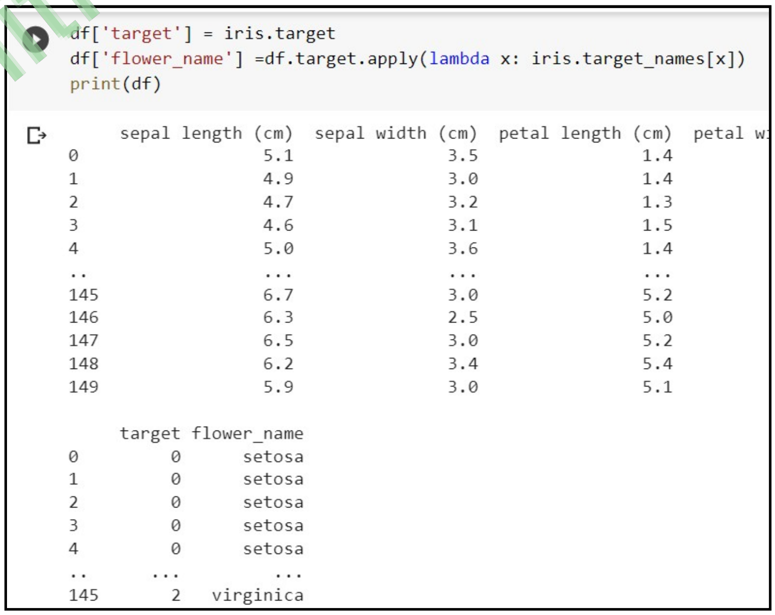
```
[ ] iris = load_iris()
    print(iris.feature_names)

    ['sepal length (cm)', 'sepal width (cm)', 'petal length (cm)', 'petal width (cm)']
```

```
[ ] iris.target_names
```



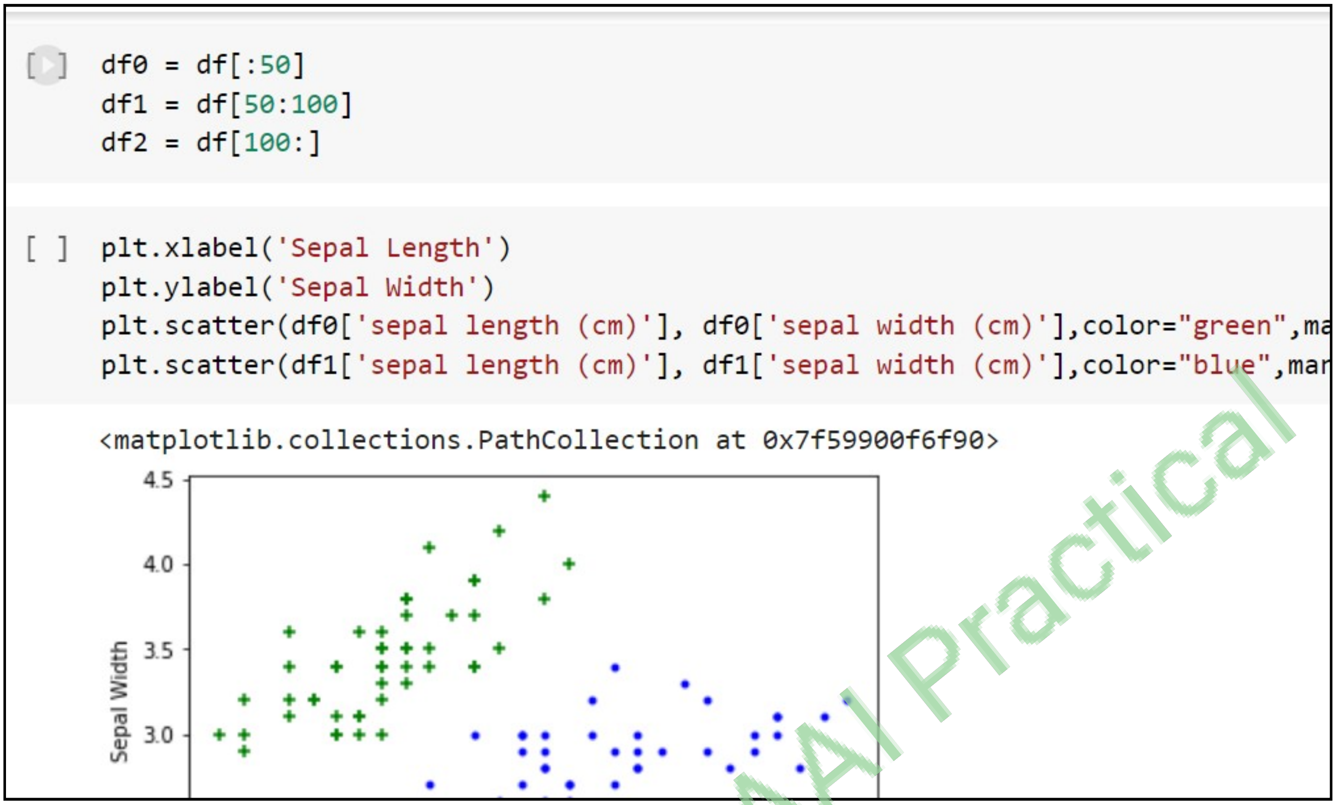
```
[ ] df = pd.DataFrame(iris.data,columns=iris.feature_names)
    df
```

	sepal length (cm)	sepal width (cm)	petal length (cm)	petal widt
0	5.1	3.5	1.4	
1	4.9	3.0	1.4	
2	4.7	3.2	1.3	
3	4.6	3.1	1.5	
4	5.0	3.6	1.4	
...	...	...	...	
145	6.7	3.0	5.2	
146	6.3	2.5	5.0	
147	6.5	3.0	5.2	



```
df['target'] = iris.target
df['flower_name'] =df.target.apply(lambda x: iris.target_names[x])
print(df)
```

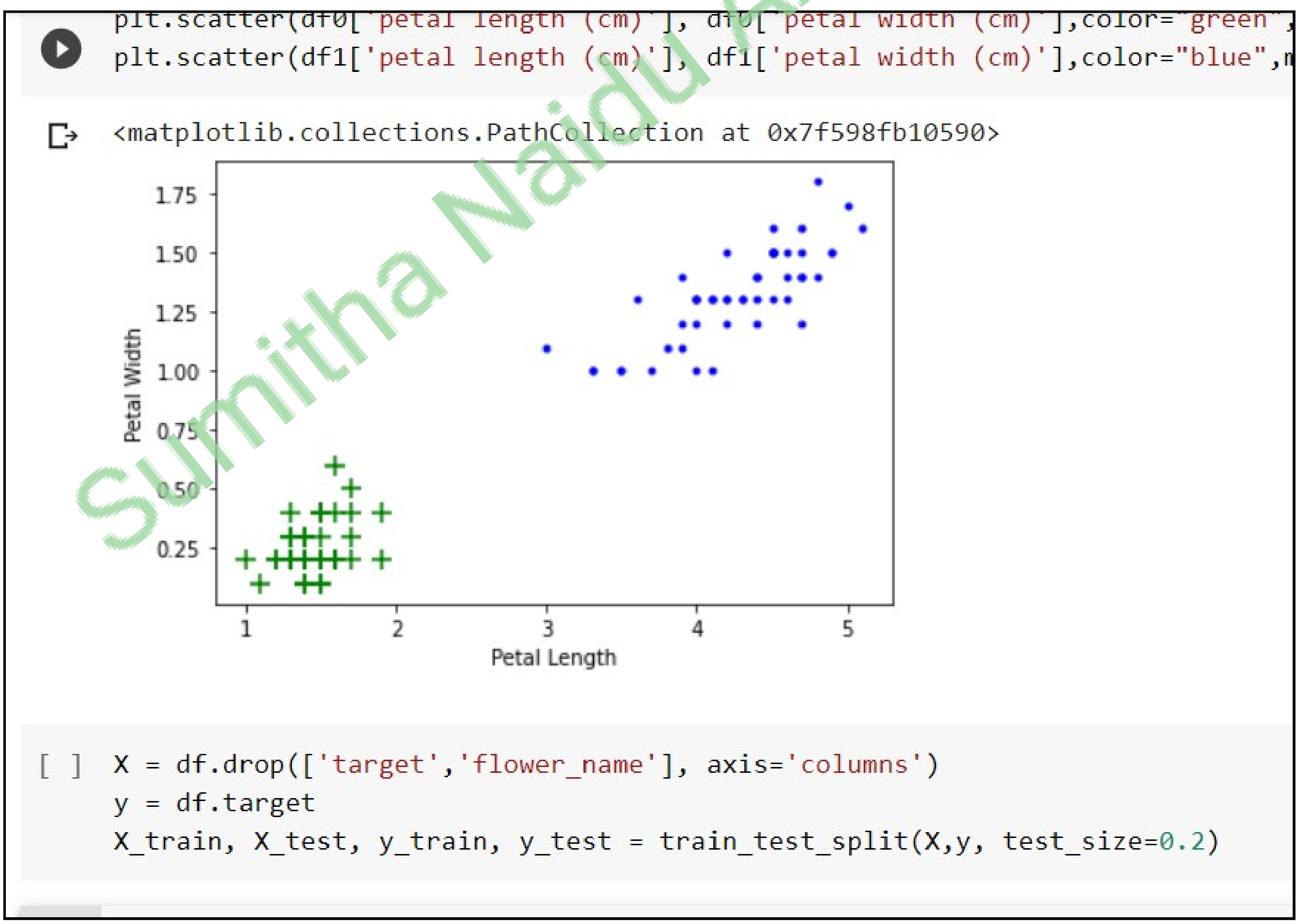
```
     sepal length (cm)  sepal width (cm)  petal length (cm)  petal wi
0                  5.1               3.5                1.4
1                  4.9               3.0                1.4
2                  4.7               3.2                1.3
3                  4.6               3.1                1.5
4                  5.0               3.6                1.4
..                 ...               ...                ...
145                6.7               3.0                5.2
146                6.3               2.5                5.0
147                6.5               3.0                5.2
148                6.2               3.4                5.4
149                5.9               3.0                5.1

     target flower_name
0         0      setosa
1         0      setosa
2         0      setosa
3         0      setosa
4         0      setosa
..      ...         ...
145       2   virginica
```



```
df0 = df[:50]
df1 = df[50:100]
df2 = df[100:]
```

```
plt.xlabel('Sepal Length')
plt.ylabel('Sepal Width')
plt.scatter(df0['sepal length (cm)'], df0['sepal width (cm)'],color="green",ma
plt.scatter(df1['sepal length (cm)'], df1['sepal width (cm)'],color="blue",mar
```

```
<matplotlib.collections.PathCollection at 0x7f59900f6f90>
```



```
plt.scatter(df0['petal length (cm)'], df0['petal width (cm)'],color="green",
plt.scatter(df1['petal length (cm)'], df1['petal width (cm)'],color="blue",m
```

```
<matplotlib.collections.PathCollection at 0x7f598fb10590>
```

```
X = df.drop(['target','flower_name'], axis='columns')
y = df.target
X_train, X_test, y_train, y_test = train_test_split(X,y, test_size=0.2)
```

Practical No. 7

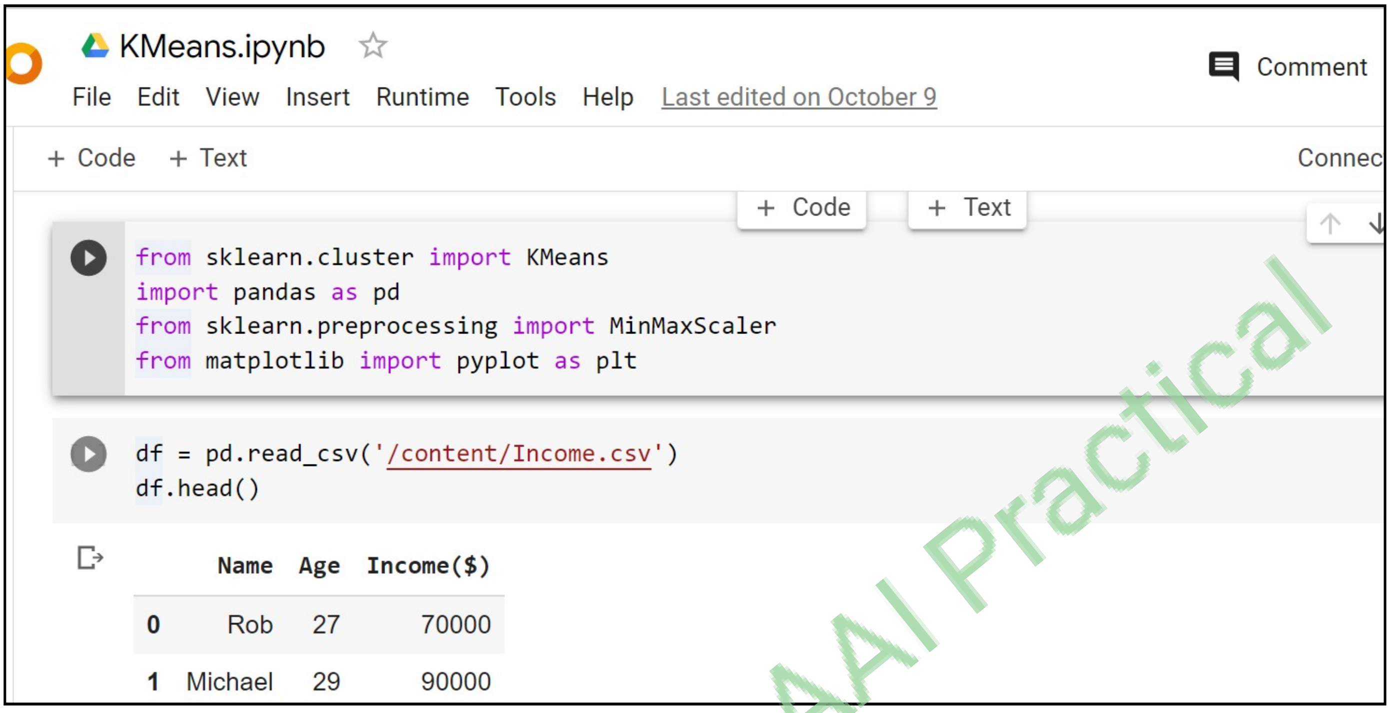
Aim: Write an application to implement clustering algorithm (K Means).

Code:

```
from sklearn.cluster import KMeans
import pandas as pd
from sklearn.preprocessing import MinMaxScaler
from matplotlib import pyplot as plt
df = pd.read_csv('/content/Income.csv')
df.head()
plt.scatter(df['Age'],df['Income($)'])
plt.xlabel('Age')
plt.ylabel('Income($)')
km = KMeans(n_clusters=3)
predicted = km.fit_predict(df[['Age',  'Income($)']])
df['cluster'] = predicted
df.head()
df1 = df[df.cluster == 0]
df2 = df[df.cluster == 1]
df3 = df[df.cluster == 2]
plt.scatter(km.cluster_centers_[:,0],km.cluster_centers_[:,1], color='purple', marker='*', label='Centroid')
plt.xlabel('Age')
plt.ylabel('Income($)')
plt.legend()
scaler = MinMaxScaler()

scaler.fit(df[['Income($)']])
df['Income($)'] = scaler.transform(df[['Income($)']])

scaler.fit(df[['Age']])
df['Age'] = scaler.transform(df[['Age']])

df.head()
plt.scatter(df['Age'],df['Income($)'])
plt.xlabel('Age')
plt.ylabel('Income($)')
km = KMeans(n_clusters=3)
predicted = km.fit_predict(df[['Age',  'Income($)']])
df['cluster'] = predicted
df.head()
```

```
df1 = df[df.cluster == 0]
df2 = df[df.cluster == 1]
df3 = df[df.cluster == 2]
plt.scatter(df1['Age'], df1['Income($)'], color='green')
plt.scatter(df2['Age'], df2['Income($)'], color='red')
plt.scatter(df3['Age'], df3['Income($)'], color='blue')
plt.scatter(km.cluster_centers_[:,0],km.cluster_centers_[:,1], color='purple', marker='*', label='Centroid')
plt.xlabel('Age')
plt.ylabel('Income($)')
plt.legend()
plt.scatter(df['Age'],df['Income($)'])
plt.xlabel('Age')
plt.ylabel('Income($)')
#Elbow Plot (For checking)
sse = []
k_range = range(1,10)
for k in k_range:
  km = KMeans(n_clusters=k)
  km.fit(df[['Age', 'Income($)']])
  sse.append(km.inertia_) # Calculating the distance between centroids and the nearest point

plt.xlabel('K')
plt.ylabel('Sum of Squared error')
plt.plot(k_range,sse)
```

Output:


KMeans.ipynb
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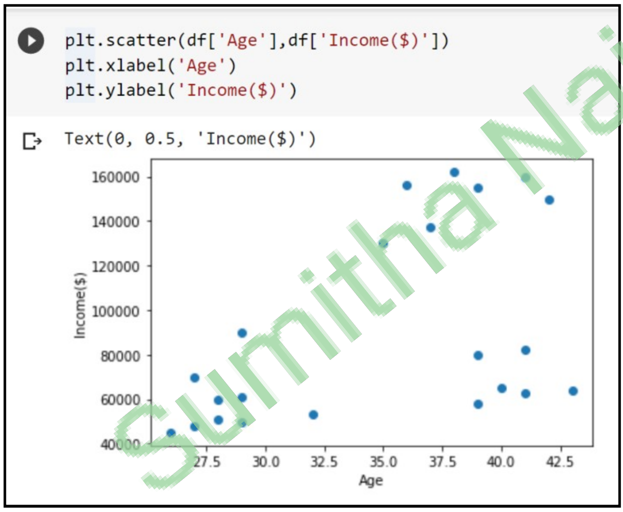
+ Code + Text

```
from sklearn.cluster import KMeans
import pandas as pd
from sklearn.preprocessing import MinMaxScaler
from matplotlib import pyplot as plt
```

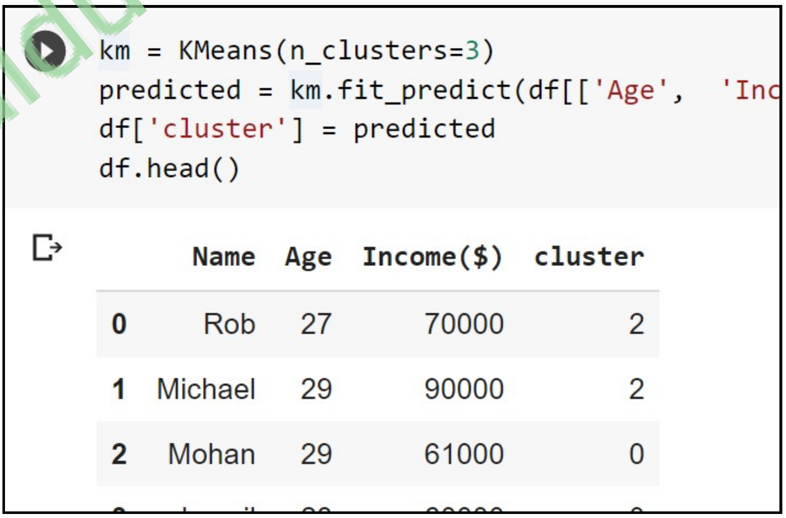
```
df = pd.read_csv('/content/Income.csv')
df.head()
```

	Name	Age	Income($)
0	Rob	27	70000
1	Michael	29	90000



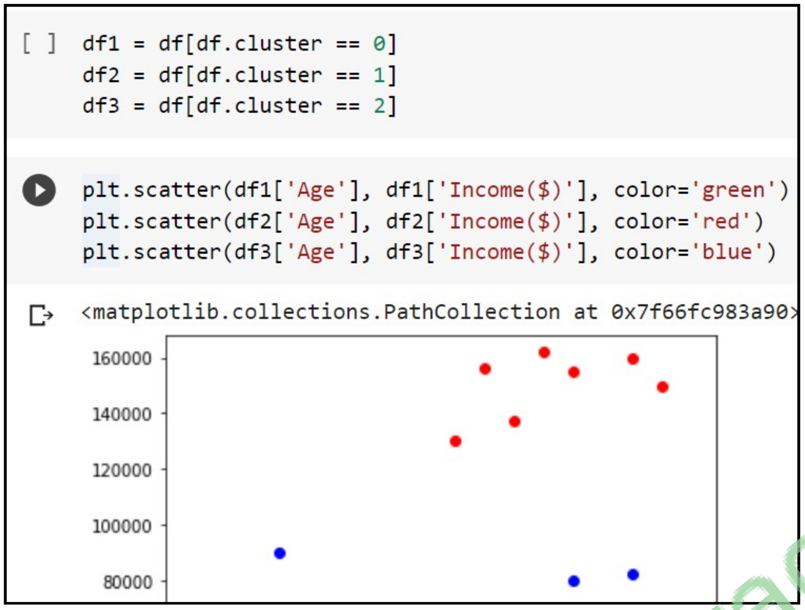
```
plt.scatter(df['Age'],df['Income($)'])
plt.xlabel('Age')
plt.ylabel('Income($)')
```

```
Text(0, 0.5, 'Income($)')
```



```
km = KMeans(n_clusters=3)
predicted = km.fit_predict(df[['Age',  'Inc
df['cluster'] = predicted
df.head()
```

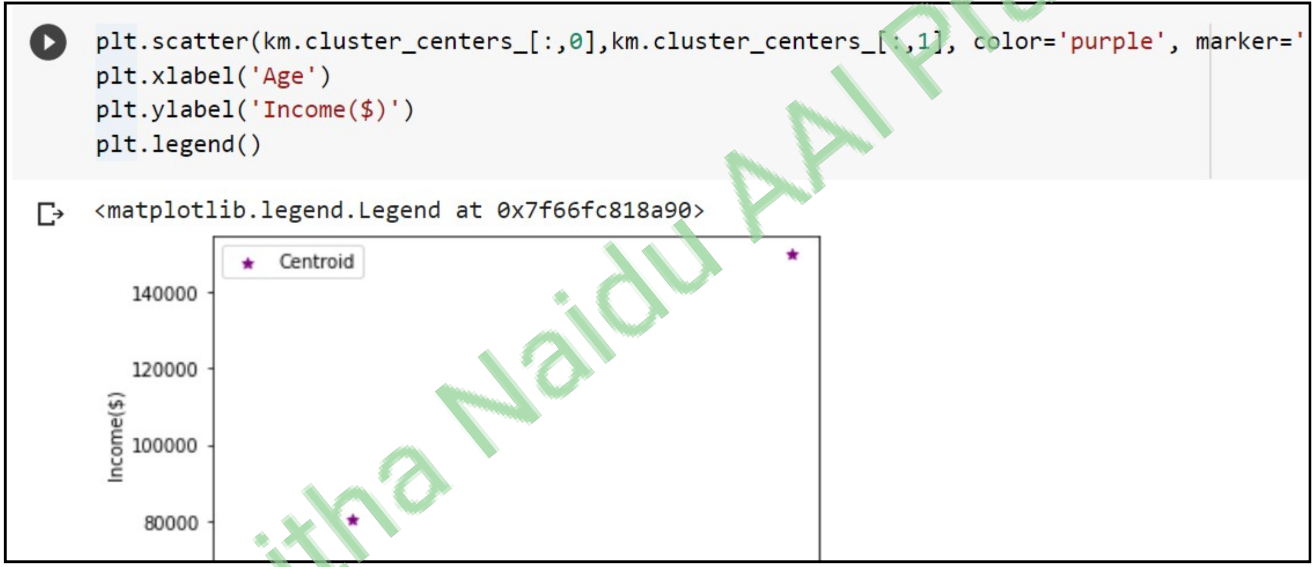
	Name	Age	Income($)	cluster
0	Rob	27	70000	2
1	Michael	29	90000	2
2	Mohan	29	61000	0



```
[ ] df1 = df[df.cluster == 0]
    df2 = df[df.cluster == 1]
    df3 = df[df.cluster == 2]
```

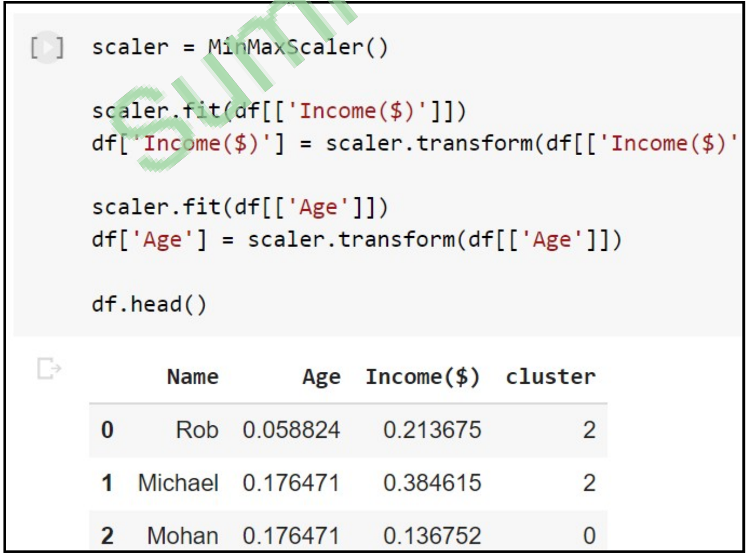
```
plt.scatter(df1['Age'], df1['Income($)'], color='green')
plt.scatter(df2['Age'], df2['Income($)'], color='red')
plt.scatter(df3['Age'], df3['Income($)'], color='blue')
```

```
<matplotlib.collections.PathCollection at 0x7f66fc983a90>
```



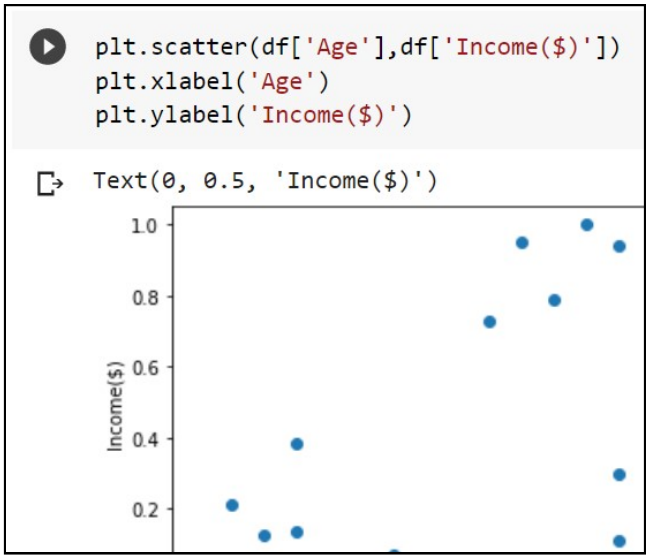
```
plt.scatter(km.cluster_centers_[:,0],km.cluster_centers_[:,1], color='purple', marker='
plt.xlabel('Age')
plt.ylabel('Income($)')
plt.legend()
```

```
<matplotlib.legend.Legend at 0x7f66fc818a90>
```



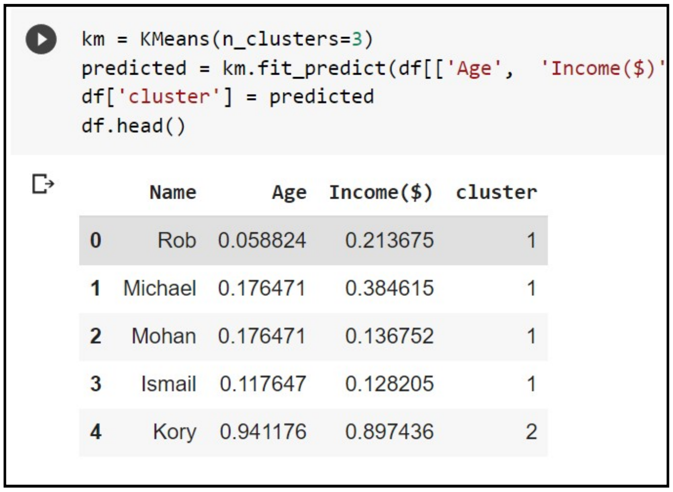
```
[ ] scaler = MinMaxScaler()

    scaler.fit(df[['Income($)']])
    df['Income($)'] = scaler.transform(df[['Income($)'

    scaler.fit(df[['Age']])
    df['Age'] = scaler.transform(df[['Age']])

    df.head()
```

	Name	Age	Income($)	cluster
0	Rob	0.058824	0.213675	2
1	Michael	0.176471	0.384615	2
2	Mohan	0.176471	0.136752	0



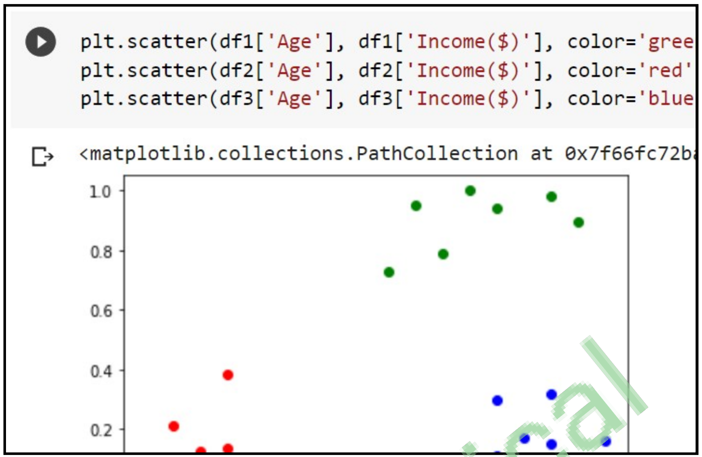
```
plt.scatter(df['Age'],df['Income($)'])
plt.xlabel('Age')
plt.ylabel('Income($)')
```

```
Text(0, 0.5, 'Income($)')
```



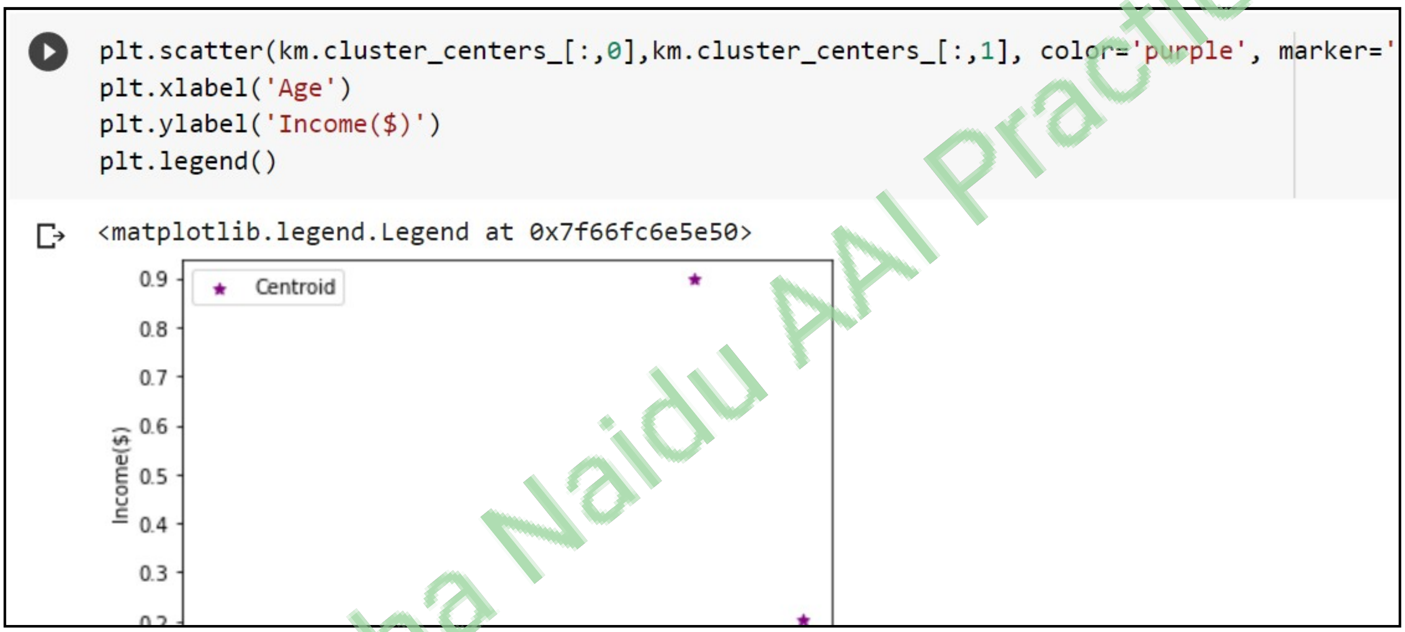
```
km = KMeans(n_clusters=3)
predicted = km.fit_predict(df[['Age',  'Income($)'
df['cluster'] = predicted
df.head()
```

	Name	Age	Income($)	cluster
0	Rob	0.058824	0.213675	1
1	Michael	0.176471	0.384615	1
2	Mohan	0.176471	0.136752	1
3	Ismail	0.117647	0.128205	1
4	Kory	0.941176	0.897436	2



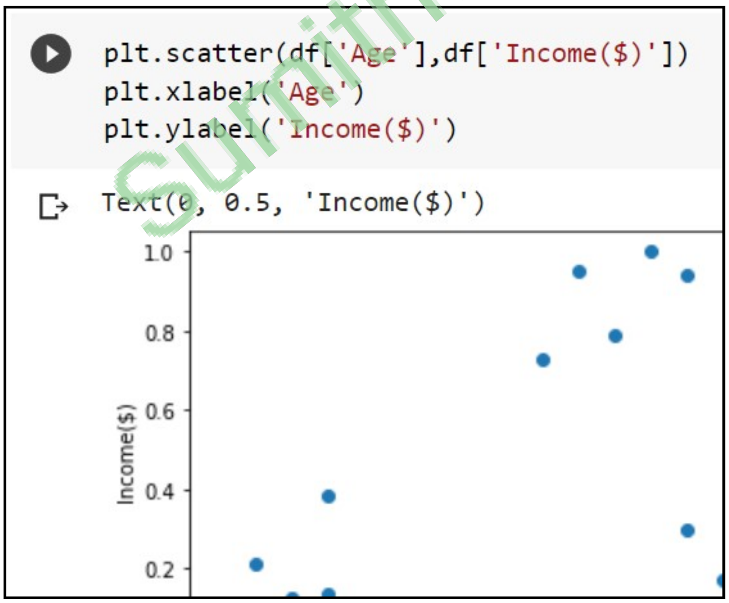
```
plt.scatter(df1['Age'], df1['Income($)'], color='gree
plt.scatter(df2['Age'], df2['Income($)'], color='red'
plt.scatter(df3['Age'], df3['Income($)'], color='blue
```

```
<matplotlib.collections.PathCollection at 0x7f66fc72b
```



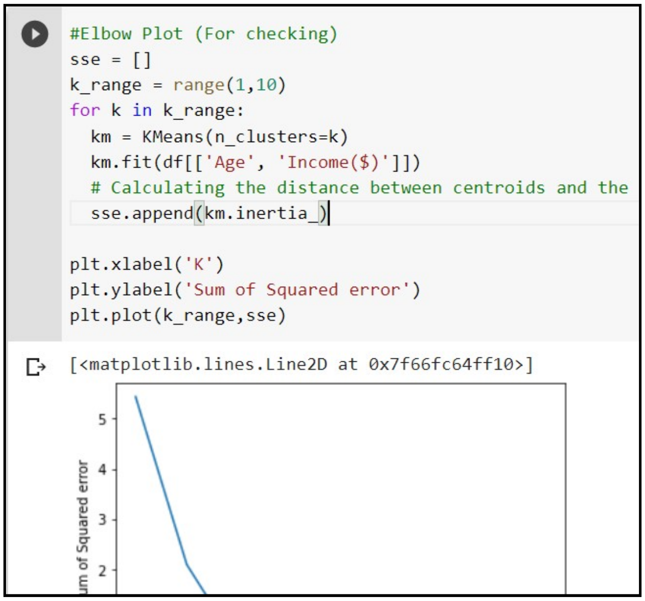
```
plt.scatter(km.cluster_centers_[:,0],km.cluster_centers_[:,1], color='purple', marker='
plt.xlabel('Age')
plt.ylabel('Income($)')
plt.legend()
```

```
<matplotlib.legend.Legend at 0x7f66fc6e5e50>
```



```
plt.scatter(df['Age'],df['Income($)'])
plt.xlabel('Age')
plt.ylabel('Income($)')
```

```
Text(0, 0.5, 'Income($)')
```



```
#Elbow Plot (For checking)
sse = []
k_range = range(1,10)
for k in k_range:
  km = KMeans(n_clusters=k)
  km.fit(df[['Age', 'Income($)']])
  # Calculating the distance between centroids and the
  sse.append(km.inertia_)

plt.xlabel('K')
plt.ylabel('Sum of Squared error')
plt.plot(k_range,sse)
```

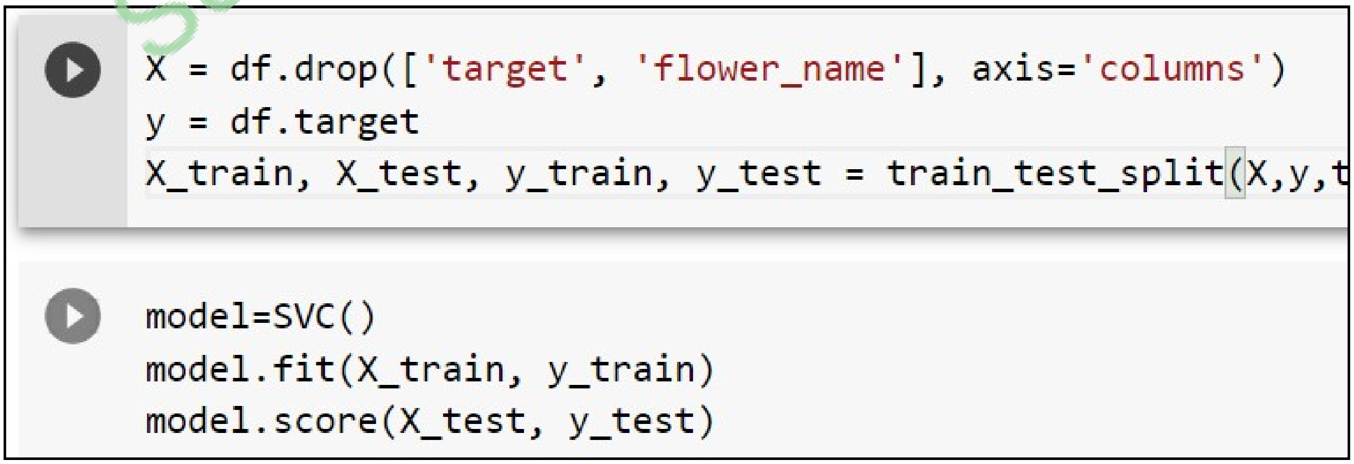
```
[<matplotlib.lines.Line2D at 0x7f66fc64ff10>]
```

Practical No. 8

Aim: Write an application to implement support vector machine algorithm.

Code:

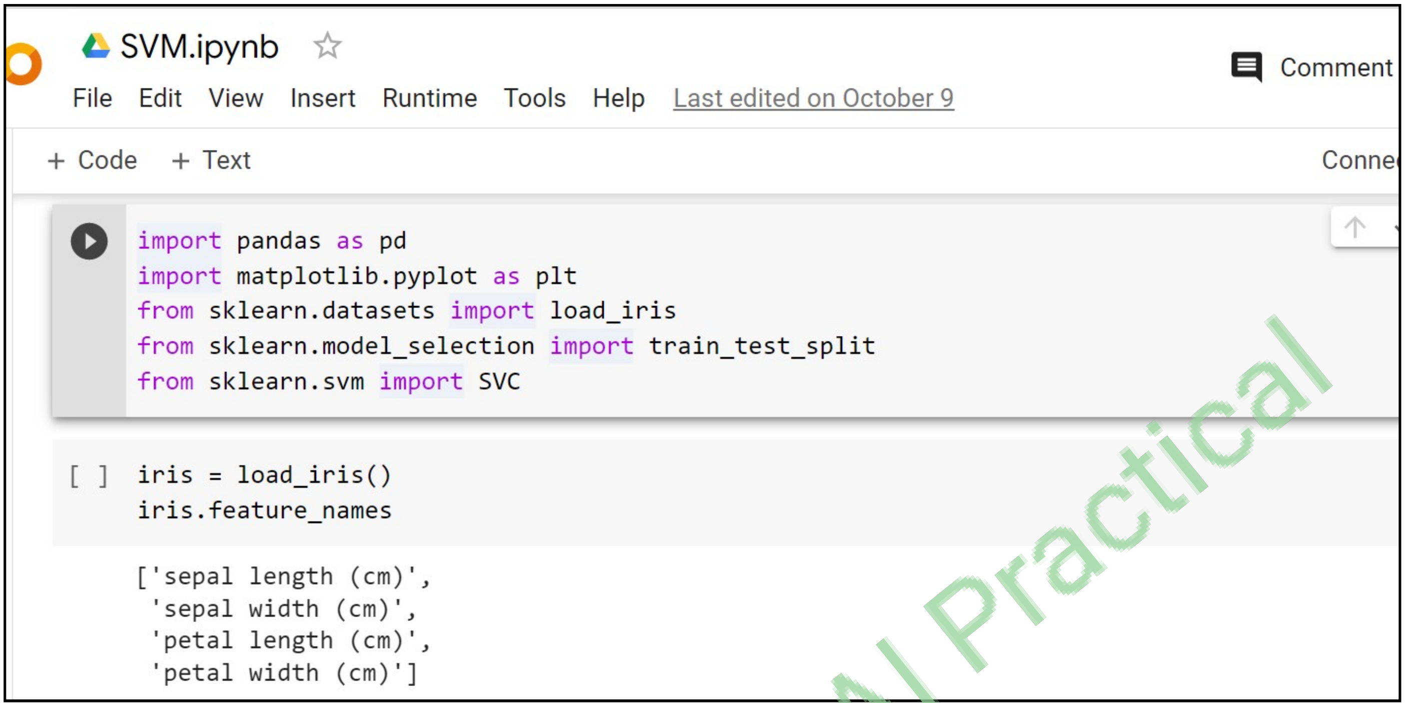
```
import pandas as pd
import matplotlib.pyplot as plt
from sklearn.datasets import load_iris
from sklearn.model_selection import train_test_split
from sklearn.svm import SVC

iris = load_iris()
iris.feature_names
iris.target_names
df = pd.DataFrame(iris.data, columns=iris.feature_names)
df['target'] = iris.target
df['flower_name'] = df.target.apply(lambda x : iris.target_names[x])
df0 = df[:50]
df1 = df[50:100]
df2 = df[100:150]
plt.xlabel('Sepal Length')
plt.ylabel('Sepal Width')
plt.scatter(df0['sepal length (cm)'], df0['sepal width (cm)'], color='green', marker='+')
plt.scatter(df1['sepal length (cm)'], df1['sepal width (cm)'], color='red', marker='.')

X = df.drop(['target', 'flower_name'], axis='columns')
y = df.target
X_train, X_test, y_train, y_test = train_test_split(X,y,test_size=0.2)
model=SVC()
model.fit(X_train, y_train)
model.score(X_test, y_test)
```



```
X = df.drop(['target', 'flower_name'], axis='columns')
y = df.target
X_train, X_test, y_train, y_test = train_test_split(X,y,t
```

```
model=SVC()
model.fit(X_train, y_train)
model.score(X_test, y_test)
```

Output:


SVM.ipynb
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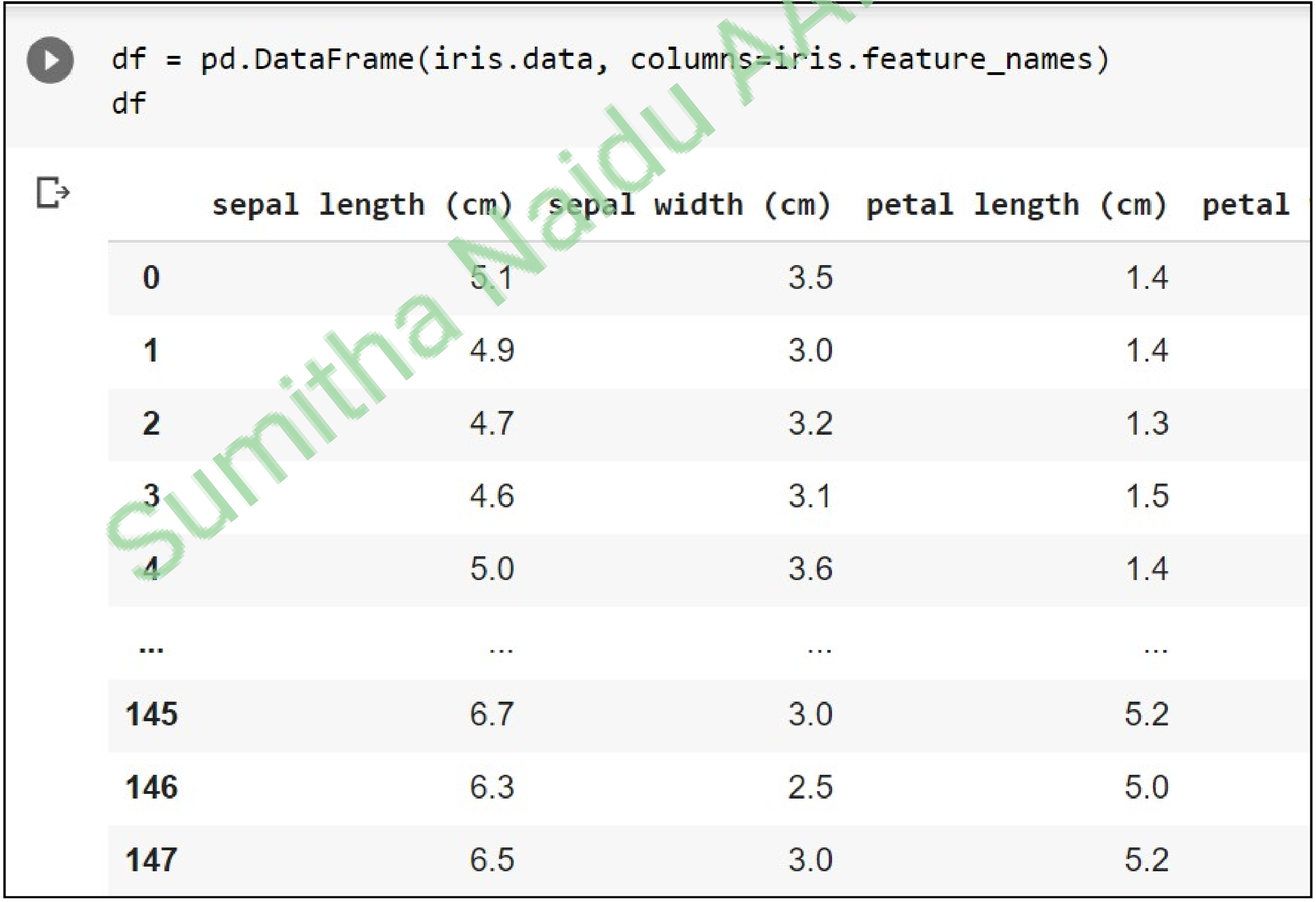
```
import pandas as pd
import matplotlib.pyplot as plt
from sklearn.datasets import load_iris
from sklearn.model_selection import train_test_split
from sklearn.svm import SVC
```

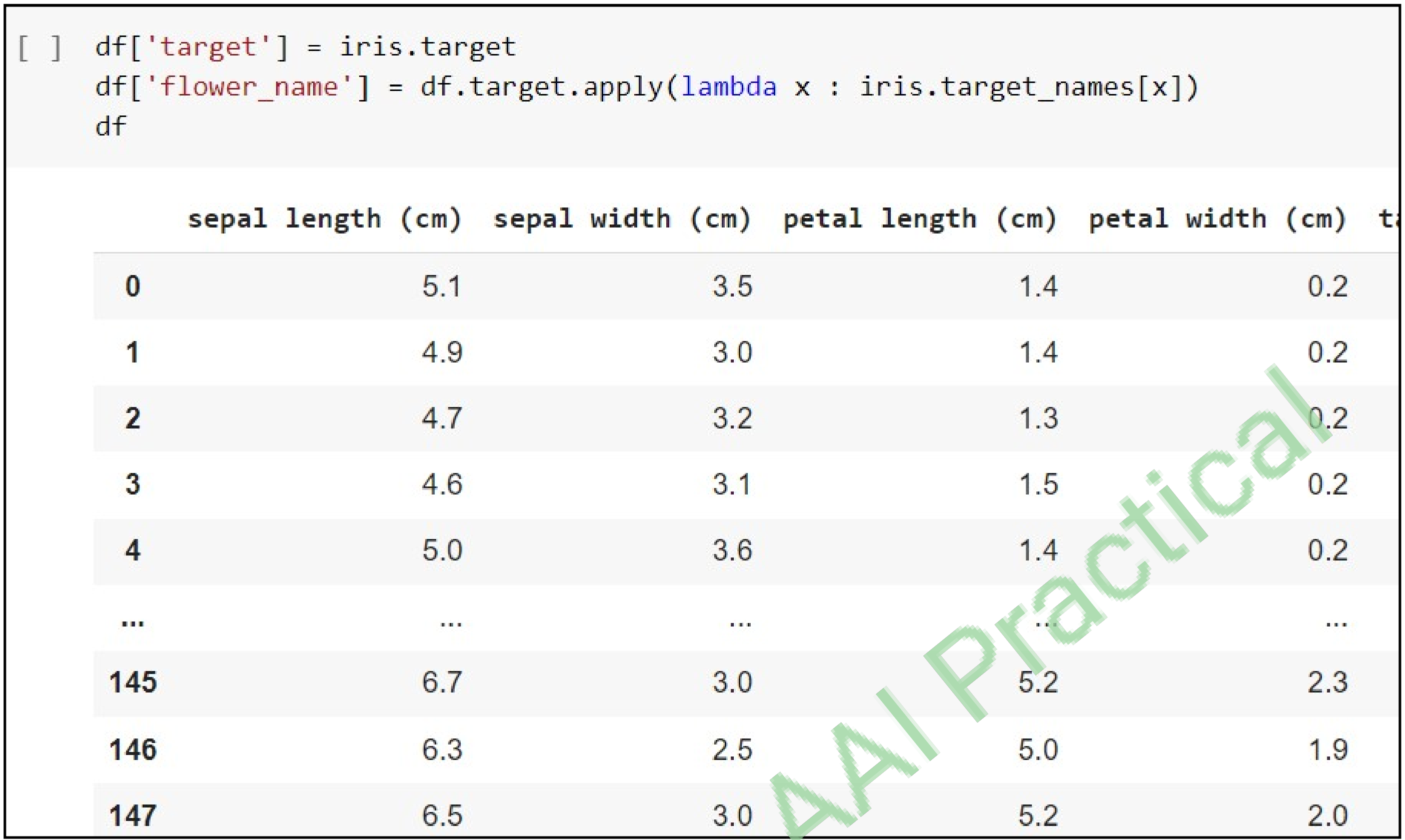
```
[ ] iris = load_iris()
    iris.feature_names
```

```
['sepal length (cm)',
 'sepal width (cm)',
 'petal length (cm)',
 'petal width (cm)']
```



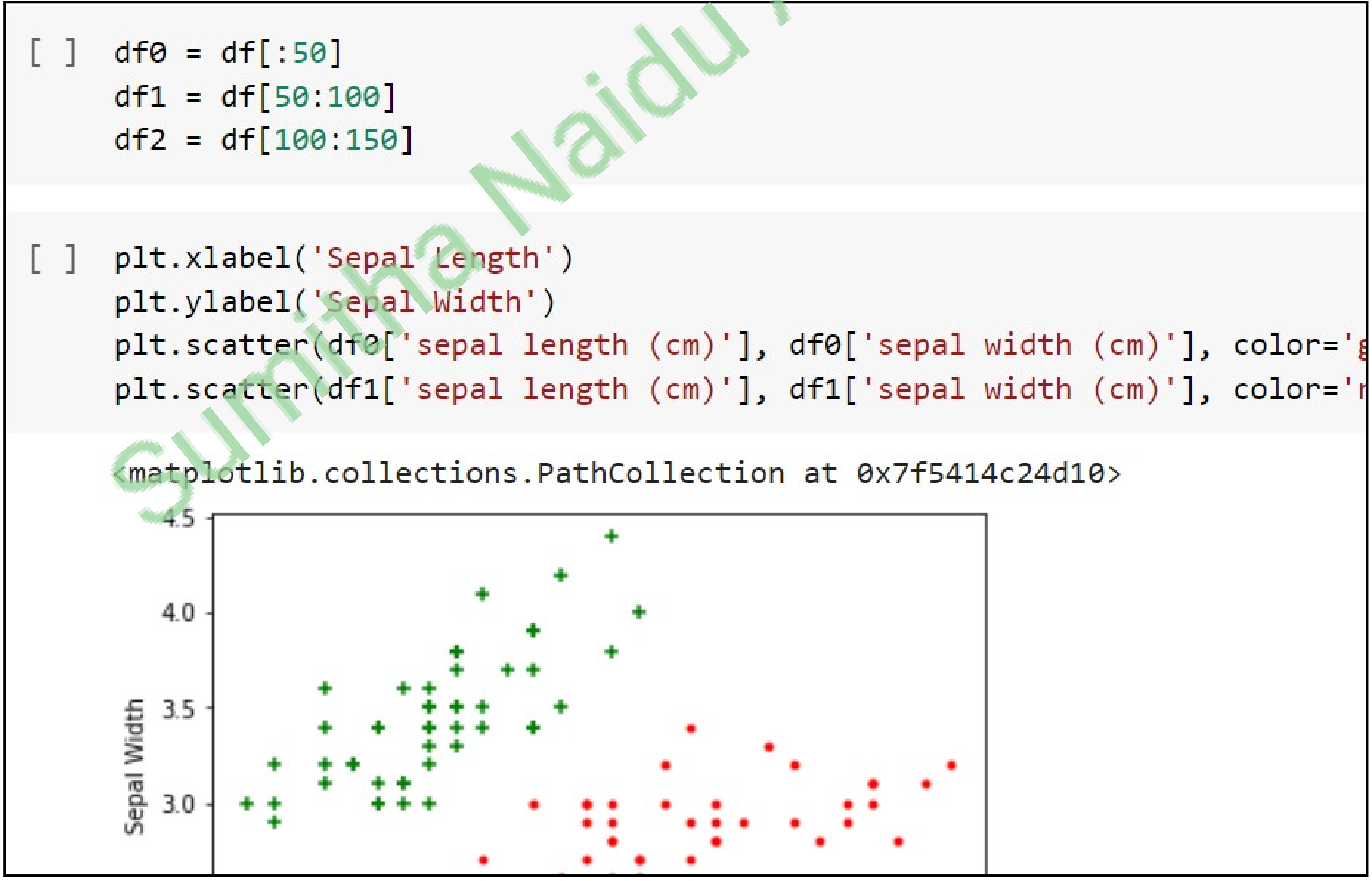
```
df = pd.DataFrame(iris.data, columns=iris.feature_names)
df
```

	sepal length (cm)	sepal width (cm)	petal length (cm)	petal
0	5.1	3.5	1.4	
1	4.9	3.0	1.4	
2	4.7	3.2	1.3	
3	4.6	3.1	1.5	
4	5.0	3.6	1.4	
...	...	...	...	
145	6.7	3.0	5.2	
146	6.3	2.5	5.0	
147	6.5	3.0	5.2	



```
[ ]  df['target'] = iris.target
     df['flower_name'] = df.target.apply(lambda x : iris.target_names[x])
     df
```

	sepal length (cm)	sepal width (cm)	petal length (cm)	petal width (cm)	ta
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	
...	...	...	...	...	
145	6.7	3.0	5.2	2.3	
146	6.3	2.5	5.0	1.9	
147	6.5	3.0	5.2	2.0	



```
[ ]  df0 = df[:50]
     df1 = df[50:100]
     df2 = df[100:150]
```

```
[ ]  plt.xlabel('Sepal Length')
     plt.ylabel('Sepal Width')
     plt.scatter(df0['sepal length (cm)'], df0['sepal width (cm)'], color='g
     plt.scatter(df1['sepal length (cm)'], df1['sepal width (cm)'], color='r
```

```
<matplotlib.collections.PathCollection at 0x7f5414c24d10>
```

Practical No. 9

Aim: Design a bot using AIML.

Code with Output:

Install the following packages

- pip install aiml
- pip install python-aiml
- pip3 install aiml
- pip3 install python-aiml

# sillybot.py

```
import aiml

kernel = aiml.Kernel()
kernel.learn("std-startup.xml")
kernel.respond("load aiml b")
while True:
    inputText = input(" > Human : ")
    response = kernel.respond(inputText)
    print(" > Bot : "+response)
```

# std-startup.xml

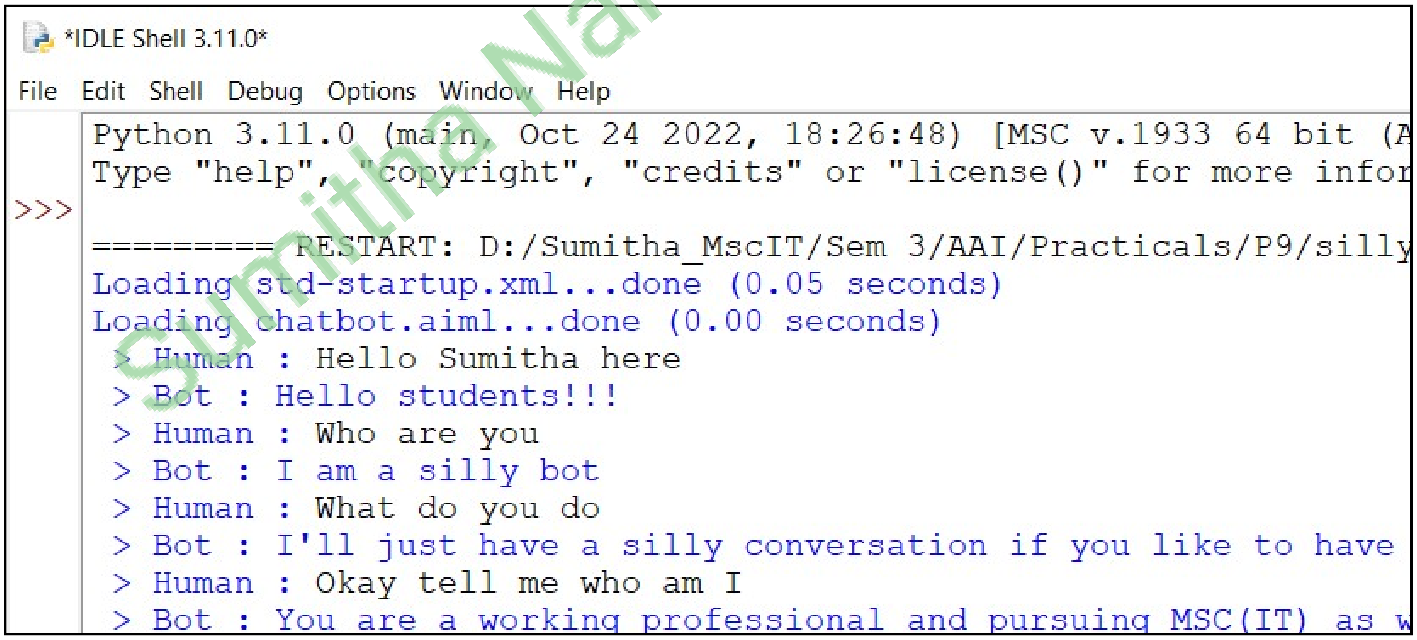
```
<aiml encoding="UTF-8" version="1.0.1">
    <category>
        <pattern>LOAD AIML B</pattern>
        <template>
            <learn>chatbot.aiml</learn>
        </template>
    </category>
</aiml>
```

# chatbot.aiml

```
<aiml version="1.0.1" encoding="UTF-8">
<category>
<pattern>HELLO *</pattern>
<template>Hello students!!!</template>
</category>

<category>
```

```
<pattern>WHO ARE YOU</pattern>
<template>I am a silly bot</template>
</category>

<category>
<pattern>WHAT DO YOU DO</pattern>
<template>I'll just have a silly conversation if you like to have</template>
</category>

<category>
<pattern>OKAY TELL ME WHO AM I</pattern>
<template>You are a working professional and pursuing MSC(IT) as well</template>
</category>

<category>
<pattern>WELL BYE SEE YOU AGAIN</pattern>
<template>Bye, Take Care!!</template>
</category>
</aiml>
```

Output:



```
    Python 3.11.0 (main, Oct 24 2022, 18:26:48) [MSC v.1933 64 bit (A
    Type "help", "copyright", "credits" or "license()" for more infor
>>>
    ========= RESTART: D:/Sumitha_MscIT/Sem 3/AAI/Practicals/P9/silly
    Loading std-startup.xml...done (0.05 seconds)
    Loading chatbot.aiml...done (0.00 seconds)
     > Human : Hello Sumitha here
     > Bot : Hello students!!!
     > Human : Who are you
     > Bot : I am a silly bot
     > Human : What do you do
     > Bot : I'll just have a silly conversation if you like to have
     > Human : Okay tell me who am I
     > Bot : You are a working professional and pursuing MSC(IT) as w
```

Practical No. 10

Aim: Design an Expert System using AIML.

Code :

Install the following packages

- pip install aiml
- pip install python-aiml
- pip3 install aiml
- pip3 install python-aiml

# doctorchat.py

```
import aiml

kernel = aiml.Kernel()
kernel.learn("std-startup.xml")
kernel.respond("load aiml b")
while True:
    input_text=input(">Human : ")
    response=kernel.respond(input_text)
    print(">Bot : "+response)
```

# std-startup.xml

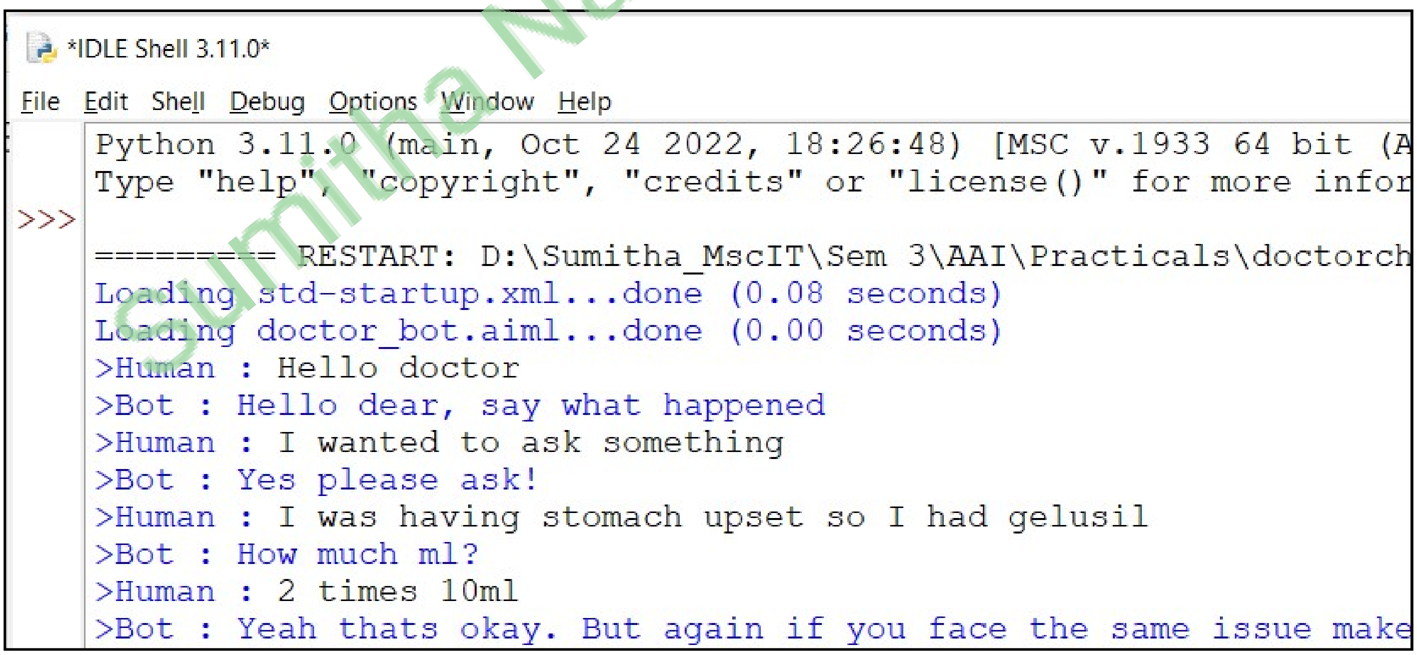
```
<aiml encoding="UTF-8" version="1.0.1">
<category>
<pattern>LOAD AIML B</pattern>
<template>
<learn>doctor_bot.aiml</learn>
</template>
</category>
</aiml>
```

# doctor_bot.aiml

```
<aiml version="1.0.1" encoding="UTF-8">
<category>
<pattern>HELLO DOCTOR</pattern>
<template>Hello dear, say what happened</template>
</category>

<category>
<pattern>I WANTED TO ASK SOME SOMETHING</pattern>
```

```
<template>Yes please ask!</template>
</category>

<category>
<pattern>I was having stomach upset so I had gelusil</pattern>
<template>How much ml?</template>
</category>

<category>
<pattern>2 times 10ml</pattern>
<template>Yeah thats okay. But again if you face the same issue make sure you consult
doctor.</template>
</category>

<category>
<pattern>OKAY DOCTOR THANK YOU</pattern>
<template>WELL. Take Care</template>
</category>
</aiml>
```

Output:



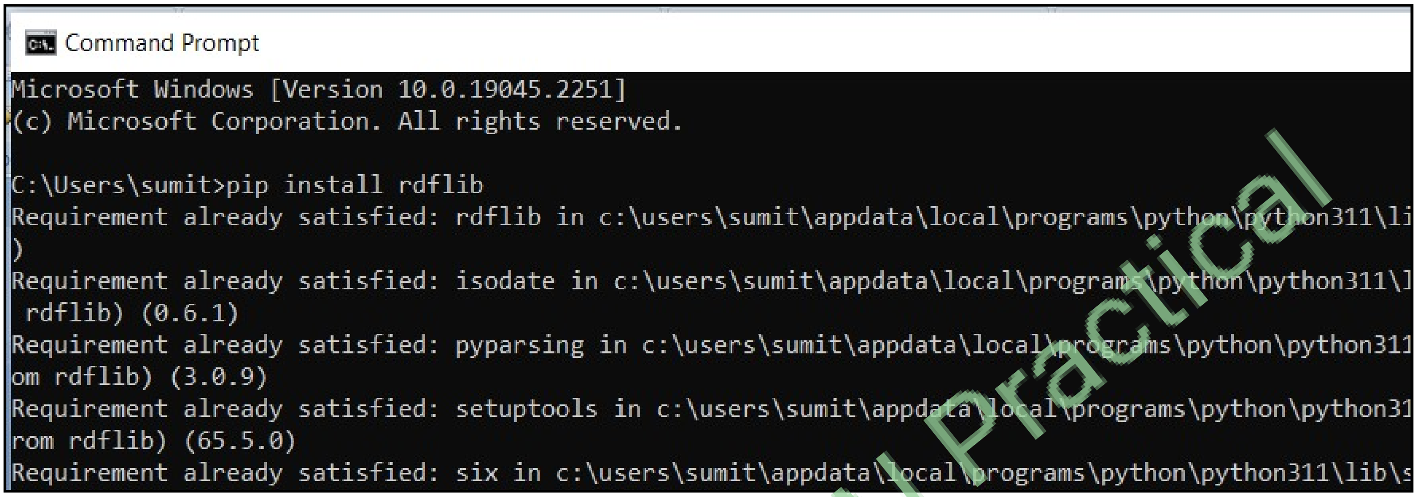
```
Python 3.11.0 (main, Oct 24 2022, 18:26:48) [MSC v.1933 64 bit (A
Type "help", "copyright", "credits" or "license()" for more infor

========= RESTART: D:\Sumitha_MscIT\Sem 3\AAI\Practicals\doctorch
Loading std-startup.xml...done (0.08 seconds)
Loading doctor_bot.aiml...done (0.00 seconds)
>Human : Hello doctor
>Bot : Hello dear, say what happened
>Human : I wanted to ask something
>Bot : Yes please ask!
>Human : I was having stomach upset so I had gelusil
>Bot : How much ml?
>Human : 2 times 10ml
>Bot : Yeah thats okay. But again if you face the same issue make
```

Practical No. 11

Aim: Design an application to simulate Semantic Web.

Code :

Install the following package



```
Microsoft Windows [Version 10.0.19045.2251]
(c) Microsoft Corporation. All rights reserved.

C:\Users\sumit>pip install rdflib
Requirement already satisfied: rdflib in c:\users\sumit\appdata\local\programs\python\python311\li
)
Requirement already satisfied: isodate in c:\users\sumit\appdata\local\programs\python\python311\l
 rdflib) (0.6.1)
Requirement already satisfied: pyparsing in c:\users\sumit\appdata\local\programs\python\python311
om rdflib) (3.0.9)
Requirement already satisfied: setuptools in c:\users\sumit\appdata\local\programs\python\python31
rom rdflib) (65.5.0)
Requirement already satisfied: six in c:\users\sumit\appdata\local\programs\python\python311\lib\s
```

# websemantic.py

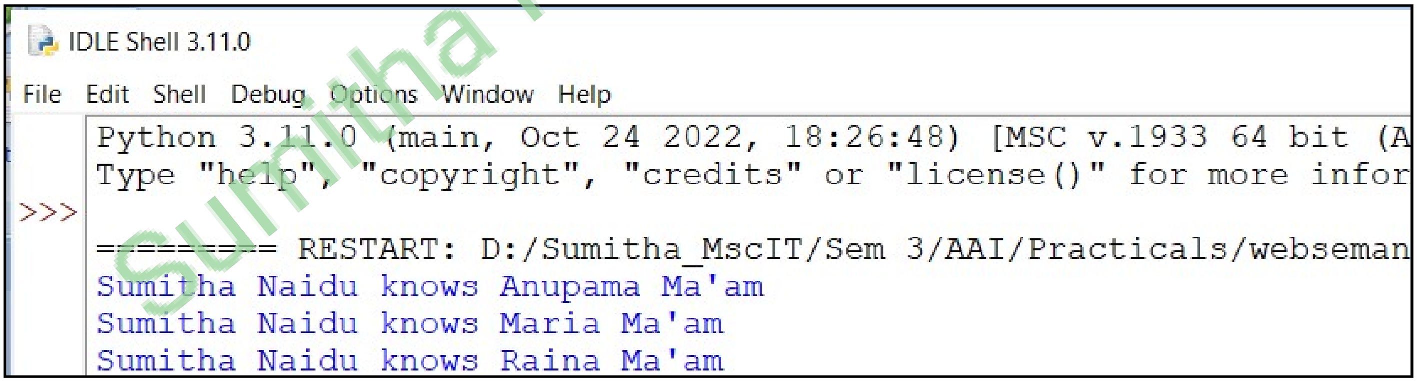
```
import rdflib

myGraph = rdflib.Graph()
myGraph.parse("myfoaf.rdf")
qres=myGraph.query(
"""SELECT DISTINCT ?fname ?lname
WHERE{
?a foaf:knows ?b .
?a foaf:name ?fname .
?b foaf:name ?lname .
}""")
for row in qres:
    print("%s knows %s"%row)
```

# myfoaf.rdf

```
 <rdf:RDF
xmlns:rdf="http://www.w3.org/1999/02/22-rdf-syntax-ns#"
xmlns:rdfs="http://www.w3.org/2000/01/rdf-schema#"
xmlns:foaf="http://xmlns.com/foaf/0.1/"
xmlns:admin="http://webns.net/mvcb/">
```

```
  <foaf:Person rdf:nodeID="me">
    <foaf:name>Sumitha Naidu</foaf:name>
    <foaf:knows>
      <foaf:Person>
        <foaf:name>Anupama Ma'am</foaf:name>
      </foaf:Person>
    </foaf:knows>
    <foaf:knows>
      <foaf:Person>
        <foaf:name>Maria Ma'am</foaf:name>
      </foaf:Person>
    </foaf:knows>
    <foaf:knows>
      <foaf:Person>
        <foaf:name>Raina Ma'am</foaf:name>
      </foaf:Person>
    </foaf:knows>
  </foaf:Person>

</rdf:RDF>
```

Output:



```
Python 3.11.0 (main, Oct 24 2022, 18:26:48) [MSC v.1933 64 bit (A
Type "help", "copyright", "credits" or "license()" for more infor
>>>
========= RESTART: D:/Sumitha_MscIT/Sem 3/AAI/Practicals/webseman
Sumitha Naidu knows Anupama Ma'am
Sumitha Naidu knows Maria Ma'am
Sumitha Naidu knows Raina Ma'am
```

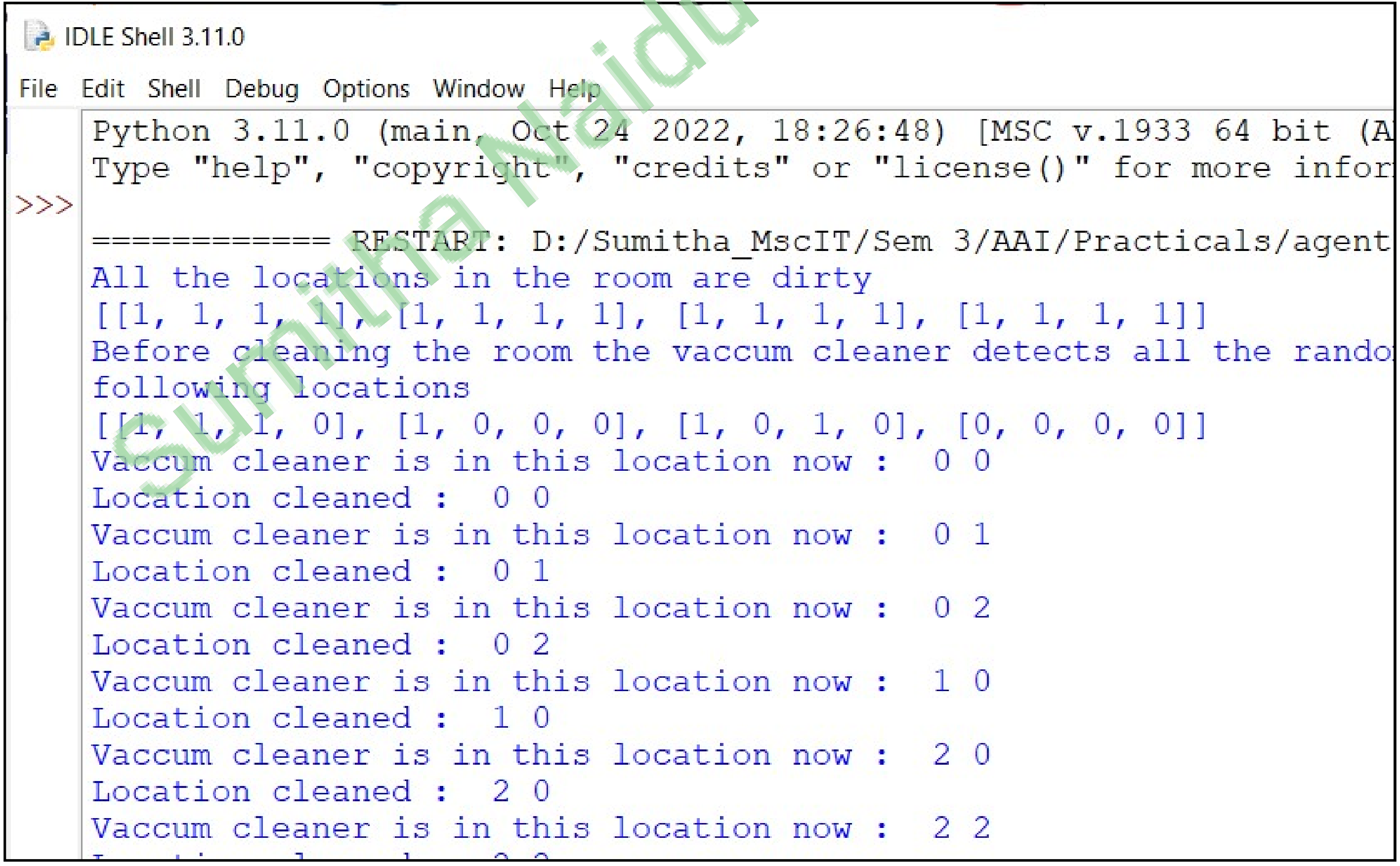
Practical No. 12

Aim: Design an Artificial Intelligence application to implement Intelligent Agent.

Code:

```
import random

def display(room):
    print(room)

# 1 means dirty location
# 0 means clean location

room = [
    [1, 1, 1, 1],
    [1, 1, 1, 1],
    [1, 1, 1, 1],
    [1, 1, 1, 1],
    ]

print("All the locations in the room are dirty")
display(room)

x=0 #rows
y=0 #cols
while x<4:
    while y<4:
        room[x][y] = random.choice([0,1])
        y+=1
    x+=1
    y=0

print("Before cleaning the room the vaccum cleaner detects all the random dirts in the following
locations")
display(room)

x=0
y=0
z=0 #number of rooms cleaned

#Agent code
while x<4:
    while y<4:
        if(room[x][y] == 1):
            print("Vaccum cleaner is in this location now : ",x,y)
            room[x][y] = 0
            print("Location cleaned : ",x,y)
            z+=1
        y+=1

    x+=1
    y=0

print("Number of locations cleaned : ",z)

performance = (100-((z/16)*100))
print("Room is clean now")
display(room)
print("Cleaning performance : ",performance,"%")
```

Output:



```
    Python 3.11.0 (main, Oct 24 2022, 18:26:48) [MSC v.1933 64 bit (A
    Type "help", "copyright", "credits" or "license()" for more infor
>>>
    ============ RESTART: D:/Sumitha_MscIT/Sem 3/AAI/Practicals/agent
    All the locations in the room are dirty
    [[1, 1, 1, 1], [1, 1, 1, 1], [1, 1, 1, 1], [1, 1, 1, 1]]
    Before cleaning the room the vaccum cleaner detects all the rando
    following locations
    [[1, 1, 1, 0], [1, 0, 0, 0], [1, 0, 1, 0], [0, 0, 0, 0]]
    Vaccum cleaner is in this location now :  0 0
    Location cleaned :  0 0
    Vaccum cleaner is in this location now :  0 1
    Location cleaned :  0 1
    Vaccum cleaner is in this location now :  0 2
    Location cleaned :  0 2
    Vaccum cleaner is in this location now :  1 0
    Location cleaned :  1 0
    Vaccum cleaner is in this location now :  2 0
    Location cleaned :  2 0
    Vaccum cleaner is in this location now :  2 2
```