Practical 1

In [1]:
```
import pandas as pd
import numpy as np
from sklearn.model_selection import train_test_split
from sklearn.preprocessing import StandardScaler
from sklearn.linear_model import LogisticRegression
from sklearn.discriminant_analysis import  LinearDiscriminantAnalysis
from sklearn.metrics import accuracy_score , confusion_matrix
```

In [2]:
```
data = pd.read_csv ("iris.csv")
```

In [3]:
```
data.head()
```

Out[3]:

	Id	SepalLengthCm	SepalWidthCm	PetalLengthCm	PetalWidthCm	Species
0	1	5.1	3.5	1.4	0.2	Iris-setosa
1	2	4.9	3.0	1.4	0.2	Iris-setosa
2	3	4.7	3.2	1.3	0.2	Iris-setosa
3	4	4.6	3.1	1.5	0.2	Iris-setosa
4	5	5.0	3.6	1.4	0.2	Iris-setosa

In [4]:
```
x = data.iloc [:, : -1]
y = data['Species']
```

In [5]:
```
x_test, x_train , y_test, y_train = train_test_split (x, y , test_size = 0.
```

In [6]:
```
scale = StandardScaler()
```

In [8]:
```
x_train_s = scale.fit_transform(x_train)
x_test_s = scale.transform(x_test)
```

In [9]:
```
lda = LinearDiscriminantAnalysis()
```

In [12]:
```
x_train_l = lda.fit_transform(x_train_s , y_train)
x_test_l = lda.transform(x_test_s)
```

In [13]:
```
classify = LogisticRegression()
```

In [14]:
```
classify.fit(x_train_l , y_train)
y_pred = classify.predict(x_test_l)
```

In [16]:
```
accuracy = accuracy_score(y_test, y_pred)
conf_m = confusion_matrix(y_test, y_pred)

print("Accuracy :", accuracy)
print ("Confusion Matrix : \n", conf_m)
```

```
Accuracy : 1.0
Confusion Matrix :
 [[40  0  0]
 [ 0 41  0]
 [ 0  0 39]]
```

Practical 2

In [1]:
```
from sklearn.linear_model import LinearRegression
from sklearn.metrics import r2_score
```

In [3]:
```
import warnings
warnings.filterwarnings("ignore")
```

In [5]:
```
data = pd.read_csv("diabetes.csv")
data.head()
```

Out[5]:

	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 [6]:
```
data.skew()
```

Out[6]:
```
Pregnancies                 0.901674
Glucose                     0.173754
BloodPressure              -1.843608
SkinThickness               0.109372
Insulin                     2.272251
BMI                        -0.428982
DiabetesPedigreeFunction    1.919911
Age                         1.129597
Outcome                     0.635017
dtype: float64
```

In [7]:
```
data.kurt()
```

Out[7]:
```
Pregnancies                 0.159220
Glucose                     0.640780
BloodPressure               5.180157
SkinThickness              -0.520072
Insulin                     7.214260
BMI                         3.290443
DiabetesPedigreeFunction    5.594954
Age                         0.643159
Outcome                    -1.600930
dtype: float64
```

In [8]:
```
data.mode().iloc[0]
```

Out[8]:
```
Pregnancies                 1.000
Glucose                    99.000
BloodPressure              70.000
SkinThickness               0.000
Insulin                     0.000
BMI                        32.000
DiabetesPedigreeFunction    0.254
Age                        22.000
Outcome                     0.000
Name: 0, dtype: float64
```

In [14]:
```
x = data.drop('Outcome', axis=1)
y = data['Outcome']
```

In [15]:
```
x_test, x_train , y_test, y_train = train_test_split(x, y, test_size = 0.2,
```

In [16]:
```
linear_r = LinearRegression()
linear_r.fit(x_train, y_train)
y_pred_lin = linear_r.predict(x_test)
```

In [17]:
```
r2_score = r2_score(y_test, y_pred_lin)
print(r2_score)
```

```
0.15432083745026837
```

In [18]:
```
log_r = LogisticRegression()
log_r.fit(x_train , y_train)
y_pred_log = log_r.predict(x_test)
```

In [19]:
```
accuracy = accuracy_score(y_test, y_pred_log)
print("Accuracy :", accuracy)
```

```
Accuracy : 0.749185667752443
```

Practical 3

In [55]:
```
from sklearn.neighbors import KNeighborsClassifier
from sklearn.metrics import precision_score , recall_score
```

In [26]:
```
data3 = pd.read_csv("Social_Network_Ads.csv")
data3.head()
```

Out[26]:

	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 [28]:
```
x = data3.iloc[:, [2,3]]
y = data3["Purchased"]
```

In [41]:
```
x_train , x_test, y_train, y_test = train_test_split(x,y, test_size = 0.2 ,
```

In [45]:
```
std_scale = StandardScaler()
x_train_s = std_scale.fit_transform(x_train)
x_test_s = std_scale.transform(x_test)
```

In [46]:
```
k = 5
knn = KNeighborsClassifier(n_neighbors = k)
knn.fit(x_train_s , y_train)
```

Out[46]:
```
KNeighborsClassifier()
```
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In [47]:
```
y_pred = knn.predict(x_test_s)
```

In [49]:
```
conf_m  = confusion_matrix(y_test, y_pred)
print("Conf matrix: \n", conf_m)
```

```
Conf matrix:
 [[48  4]
 [ 3 25]]
```

In [50]:
```
accuracy = accuracy_score(y_test, y_pred)
print("Accuracy :", accuracy)
```

```
Accuracy : 0.9125
```

In [51]:
```
error_rate = 1 - accuracy
print(error_rate)
```

```
0.08750000000000002
```

In [56]:
```
precision = precision_score(y_test, y_pred)
recall = recall_score( y_test, y_pred)
```

In [57]:
```
print("Precision score :", precision)
print("recall score :", recall)
```

```
Precision score : 0.8620689655172413
recall score : 0.8928571428571429
```

Practical 4

In [58]:
```
import matplotlib.pyplot as plt
from sklearn.cluster import KMeans
```

In [59]:
```
data4 = pd.read_csv("iris.csv")
data4.head()
```

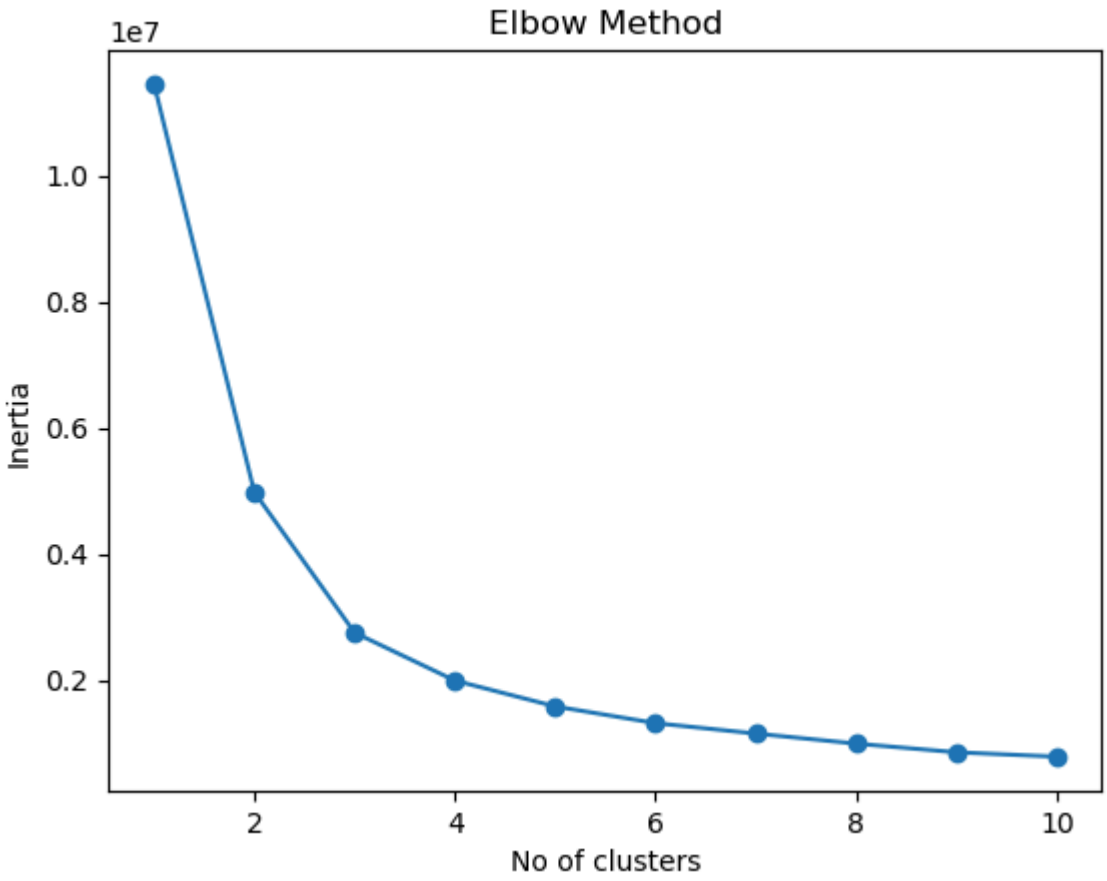
Out[59]:

	Id	SepalLengthCm	SepalWidthCm	PetalLengthCm	PetalWidthCm	Species
0	1	5.1	3.5	1.4	0.2	Iris-setosa
1	2	4.9	3.0	1.4	0.2	Iris-setosa
2	3	4.7	3.2	1.3	0.2	Iris-setosa
3	4	4.6	3.1	1.5	0.2	Iris-setosa
4	5	5.0	3.6	1.4	0.2	Iris-setosa

In [60]:
```
x = data.iloc [:, [1,2,3,4]]
```

In [65]:
```
inertia = []
for i in range (1,11):
    kmeans  = KMeans(n_clusters = i , max_iter = 300 , random_state = 42)
    kmeans.fit(x)
    inertia.append(kmeans.inertia_)
```

In [66]:
```
plt.plot(range (1,11), inertia, marker = 'o')
plt.xlabel("No of clusters")
plt.ylabel("Inertia")
plt.title("Elbow Method")
plt.show()
```



Practical 5

In [16]:
```
from sklearn.ensemble import RandomForestClassifier
from sklearn.preprocessing import LabelEncoder
```

In [17]:
```
data5 = pd.read_csv("car_evaluation.csv")
data5.head()
```

Out[17]:

	Buying price	Maintance cost	No of doors	No of persons	lug_boot	safety	Decision
0	vhigh	vhigh	2	2	small	low	unacc
1	vhigh	vhigh	2	2	small	med	unacc
2	vhigh	vhigh	2	2	small	high	unacc
3	vhigh	vhigh	2	2	med	low	unacc
4	vhigh	vhigh	2	2	med	med	unacc

In [18]:
```
col_names = ['Buying price', 'Maintance cost', 'No of doors', 'No of person
data5.columns = col_names

data5.head()
```

Out[18]:

	Buying price	Maintance cost	No of doors	No of persons	lug_boot	safety	Decision
0	vhigh	vhigh	2	2	small	low	unacc
1	vhigh	vhigh	2	2	small	med	unacc
2	vhigh	vhigh	2	2	small	high	unacc
3	vhigh	vhigh	2	2	med	low	unacc
4	vhigh	vhigh	2	2	med	med	unacc

In [20]:
```
le = LabelEncoder()

for col in data5.columns:
    if data5[col].dtype != 'object':
        continue

    data5[col] = le.fit_transform(data5[col])

data5.head()
```

Out[20]:

	Buying price	Maintance cost	No of doors	No of persons	lug_boot	safety	Decision
0	3	3	0	0	2	1	2
1	3	3	0	0	2	2	2
2	3	3	0	0	2	0	2
3	3	3	0	0	1	1	2
4	3	3	0	0	1	2	2

In [23]:
```
x = data5.drop(['Decision'], axis = 1)
y = data5['Decision']

x_train, x_test, y_train, y_test = train_test_split (x, y, test_size = 0.3
x_train.shape, x_test.shape
```

Out[23]:
```
((1209, 6), (519, 6))
```

In [24]:
```
rfc = RandomForestClassifier(n_estimators = 18+25)
rfc.fit(x_train,y_train)
```

Out[24]:
```
RandomForestClassifier(n_estimators=43)
```
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In [26]:
```
y_pred = rfc.predict(x_test)
accuracy = accuracy_score(y_test,y_pred)
conf_matrix = confusion_matrix(y_test,y_pred)

print('Accuracy:',accuracy*100,'%','\n')
print('Confusion Matrix:\n',conf_matrix)
```

```
Accuracy: 96.91714836223507 %

Confusion Matrix:
 [[108   7   2   1]
 [  0  18   0   1]
 [  2   0 356   0]
 [  3   0   0  21]]
```

Practical 6

In [15]:
```
maze = np.array([
    [0,0,0,0,0],
    [0,1,0,1,0],
    [0,0,0,0,0],
    [0,1,1,1,0],
    [0,0,0,0,2]
])

learning_rate = 0.1
discount_factor = 0.9
epsilon = 0.1
num_episodes = 1000

num_states, num_actions = maze.size, 4
Q = np.zeros((num_states, num_actions))

for _ in range(num_episodes):
    state = 0

    while True:
        action = np.random.choice(num_actions) if np.random.uniform(0,1) <
        new_state = state + [0,1,2,3][action]
        reward = [-1 ,1,0][maze.flat[new_state]]
        if reward: break
        state = new_state

current_state = 0
while current_state != 16:
    action = np.argmax(Q[current_state, :])
    current_state = current_state + (action + 1)
    print("Agent moved to state :", current_state)
```

```
Agent moved to state : 1
Agent moved to state : 2
Agent moved to state : 3
Agent moved to state : 4
Agent moved to state : 5
Agent moved to state : 6
Agent moved to state : 7
Agent moved to state : 8
Agent moved to state : 9
Agent moved to state : 10
Agent moved to state : 11
Agent moved to state : 12
Agent moved to state : 13
Agent moved to state : 14
Agent moved to state : 15
Agent moved to state : 16
```

In [ ]: