Assignment 7:Artificial Neural Network

A)import libraries you think you'll need

In [1]:
```
import pandas as pd
import seaborn as sb
from sklearn.metrics import accuracy_score, confusion_matrix,classification_report
from sklearn.model_selection import train_test_split
from sklearn import tree
from sklearn.tree import  DecisionTreeClassifier
import matplotlib.pyplot as plt
%matplotlib.inline
```

```
UsageError: Line magic function `%matplotlib.inline` not found.
```

B)read dataset

In [2]:
```
from sklearn.datasets import load_iris
```

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

In [4]:
```
iris.data
```

Out[4]:
```
array([[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],
       [5.5, 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],
       [5. , 2. , 3.5, 1. ],
       [5.9, 3. , 4.2, 1.5],
       [6. , 2.2, 4. , 1. ],
       [6.1, 2.9, 4.7, 1.4],
       [5.6, 2.9, 3.6, 1.3],
       [6.7, 3.1, 4.4, 1.4],
       [5.6, 3. , 4.5, 1.5],
       [5.8, 2.7, 4.1, 1. ],
       [6.2, 2.2, 4.5, 1.5],
       [5.6, 2.5, 3.9, 1.1],
       [5.9, 3.2, 4.8, 1.8],
       [6.1, 2.8, 4. , 1.3],
       [6.3, 2.5, 4.9, 1.5],
       [6.1, 2.8, 4.7, 1.2],
       [6.4, 2.9, 4.3, 1.3],
       [6.6, 3. , 4.4, 1.4],
       [6.8, 2.8, 4.8, 1.4],
       [6.7, 3. , 5. , 1.7],
       [6. , 2.9, 4.5, 1.5],
       [5.7, 2.6, 3.5, 1. ],
       [5.5, 2.4, 3.8, 1.1],
       [5.5, 2.4, 3.7, 1. ],
       [5.8, 2.7, 3.9, 1.2],
       [6. , 2.7, 5.1, 1.6],
       [5.4, 3. , 4.5, 1.5],
       [6. , 3.4, 4.5, 1.6],
       [6.7, 3.1, 4.7, 1.5],
       [6.3, 2.3, 4.4, 1.3],
       [5.6, 3. , 4.1, 1.3],
       [5.5, 2.5, 4. , 1.3],
       [5.5, 2.6, 4.4, 1.2],
       [6.1, 3. , 4.6, 1.4],
       [5.8, 2.6, 4. , 1.2],
       [5. , 2.3, 3.3, 1. ],
       [5.6, 2.7, 4.2, 1.3],
       [5.7, 3. , 4.2, 1.2],
       [5.7, 2.9, 4.2, 1.3],
       [6.2, 2.9, 4.3, 1.3],
       [5.1, 2.5, 3. , 1.1],
       [5.7, 2.8, 4.1, 1.3],
       [6.3, 3.3, 6. , 2.5],
       [5.8, 2.7, 5.1, 1.9],
       [7.1, 3. , 5.9, 2.1],
       [6.3, 2.9, 5.6, 1.8],
       [6.5, 3. , 5.8, 2.2],
       [7.6, 3. , 6.6, 2.1],
       [4.9, 2.5, 4.5, 1.7],
       [7.3, 2.9, 6.3, 1.8],
       [6.7, 2.5, 5.8, 1.8],
       [7.2, 3.6, 6.1, 2.5],
       [6.5, 3.2, 5.1, 2. ],
       [6.4, 2.7, 5.3, 1.9],
       [6.8, 3. , 5.5, 2.1],
       [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 [5]:

```
iris.target
```

Out[5]:

```
array([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 [6]:

```
X = iris.data
Y = iris.target
```

C)split train test datasets

In [7]:

```
X_train ,X_test,Y_train,Y_test = train_test_split(X,Y,random_state=42,test_size=0.30
```

In [8]:

```
X_train
```

Out[8]:

```
array([[5.5, 2.4, 3.7, 1. ],
       [6.3, 2.8, 5.1, 1.5],
       [6.4, 3.1, 5.5, 1.8],
       [6.6, 3. , 4.4, 1.4],
       [7.2, 3.6, 6.1, 2.5],
       [5.7, 2.9, 4.2, 1.3],
       [7.6, 3. , 6.6, 2.1],
       [5.6, 3. , 4.5, 1.5],
       [5.1, 3.5, 1.4, 0.2],
       [7.7, 2.8, 6.7, 2. ],
       [5.8, 2.7, 4.1, 1. ],
       [5.2, 3.4, 1.4, 0.2],
       [5. , 3.5, 1.3, 0.3],
       [5.1, 3.8, 1.9, 0.4],
       [5. , 2. , 3.5, 1. ],
       [6.3, 2.7, 4.9, 1.8],
       [4.8, 3.4, 1.9, 0.2],
       [5. , 3. , 1.6, 0.2],
       [5.1, 3.3, 1.7, 0.5],
       [5.6, 2.7, 4.2, 1.3],
       [5.1, 3.4, 1.5, 0.2],
       [5.7, 3. , 4.2, 1.2],
       [7.7, 3.8, 6.7, 2.2],
       [4.6, 3.2, 1.4, 0.2],
       [6.2, 2.9, 4.3, 1.3],
       [5.7, 2.5, 5. , 2. ],
       [5.5, 4.2, 1.4, 0.2],
       [6. , 3. , 4.8, 1.8],
       [5.8, 2.7, 5.1, 1.9],
       [6. , 2.2, 4. , 1. ],
       [5.4, 3. , 4.5, 1.5],
       [6.2, 3.4, 5.4, 2.3],
       [5.5, 2.3, 4. , 1.3],
       [5.4, 3.9, 1.7, 0.4],
       [5. , 2.3, 3.3, 1. ],
       [6.4, 2.7, 5.3, 1.9],
       [5. , 3.3, 1.4, 0.2],
       [5. , 3.2, 1.2, 0.2],
       [5.5, 2.4, 3.8, 1.1],
       [6.7, 3. , 5. , 1.7],
       [4.9, 3.1, 1.5, 0.2],
       [5.8, 2.8, 5.1, 2.4],
       [5. , 3.4, 1.5, 0.2],
       [5. , 3.5, 1.6, 0.6],
       [5.9, 3.2, 4.8, 1.8],
       [5.1, 2.5, 3. , 1.1],
       [6.9, 3.2, 5.7, 2.3],
       [6. , 2.7, 5.1, 1.6],
       [6.1, 2.6, 5.6, 1.4],
       [7.7, 3. , 6.1, 2.3],
       [5.5, 2.5, 4. , 1.3],
       [4.4, 2.9, 1.4, 0.2],
       [4.3, 3. , 1.1, 0.1],
       [6. , 2.2, 5. , 1.5],
       [7.2, 3.2, 6. , 1.8],
       [4.6, 3.1, 1.5, 0.2],
       [5.1, 3.5, 1.4, 0.3],
       [4.4, 3. , 1.3, 0.2],
       [6.3, 2.5, 4.9, 1.5],
       [6.3, 3.4, 5.6, 2.4],
       [4.6, 3.4, 1.4, 0.3],
       [6.8, 3. , 5.5, 2.1],
       [6.3, 3.3, 6. , 2.5],
       [4.7, 3.2, 1.3, 0.2],
       [6.1, 2.9, 4.7, 1.4],
       [6.5, 2.8, 4.6, 1.5],
       [6.2, 2.8, 4.8, 1.8],
       [7. , 3.2, 4.7, 1.4],
       [6.4, 3.2, 5.3, 2.3],
       [5.1, 3.8, 1.6, 0.2],
       [6.9, 3.1, 5.4, 2.1],
       [5.9, 3. , 4.2, 1.5],
       [6.5, 3. , 5.2, 2. ],
       [5.7, 2.6, 3.5, 1. ],
       [5.2, 2.7, 3.9, 1.4],
       [6.1, 3. , 4.6, 1.4],
       [4.5, 2.3, 1.3, 0.3],
       [6.6, 2.9, 4.6, 1.3],
       [5.5, 2.6, 4.4, 1.2],
       [5.3, 3.7, 1.5, 0.2],
       [5.6, 3. , 4.1, 1.3],
       [7.3, 2.9, 6.3, 1.8],
       [6.7, 3.3, 5.7, 2.1],
       [5.1, 3.7, 1.5, 0.4],
       [4.9, 2.4, 3.3, 1. ],
       [6.7, 3.3, 5.7, 2.5],
       [7.2, 3. , 5.8, 1.6],
       [4.9, 3.6, 1.4, 0.1],
       [6.7, 3.1, 5.6, 2.4],
       [4.9, 3. , 1.4, 0.2],
       [6.9, 3.1, 4.9, 1.5],
       [7.4, 2.8, 6.1, 1.9],
       [6.3, 2.9, 5.6, 1.8],
       [5.7, 2.8, 4.1, 1.3],
       [6.5, 3. , 5.5, 1.8],
       [6.3, 2.3, 4.4, 1.3],
       [6.4, 2.9, 4.3, 1.3],
       [5.6, 2.8, 4.9, 2. ],
       [5.9, 3. , 5.1, 1.8],
       [5.4, 3.4, 1.7, 0.2],
       [6.1, 2.8, 4. , 1.3],
       [4.9, 2.5, 4.5, 1.7],
       [5.8, 4. , 1.2, 0.2],
       [5.8, 2.6, 4. , 1.2],
       [7.1, 3. , 5.9, 2.1]])
```

In [9]:

```
Y_train
```

Out[9]:

```
array([1, 2, 2, 1, 2, 1, 2, 1, 0, 2, 1, 0, 0, 0, 1, 2, 0, 0, 0, 1, 0, 1,
       2, 0, 1, 2, 0, 2, 2, 1, 1, 2, 1, 0, 1, 2, 0, 0, 1, 1, 0, 2, 0, 0,
       1, 1, 2, 1, 2, 2, 1, 0, 0, 2, 2, 0, 0, 0, 1, 2, 0, 2, 2, 0, 1, 1,
       2, 1, 2, 0, 2, 1, 2, 1, 1, 1, 0, 1, 1, 0, 1, 2, 2, 0, 1, 2, 2, 0,
       2, 0, 1, 2, 2, 1, 2, 1, 1, 2, 2, 0, 1, 2, 0, 1, 2])
```

D)feature scaling

In [10]:

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

E)import keras

In [11]:

```
import keras
from keras.models import Sequential
from keras.layers import Dense
```

F)initialize ann,adding input layer,hidden layer,output layer,compile the ann.

In [12]:

```
ann = Sequential()
```

In [13]:

```
ann.add(Dense(units =5, kernel_initializer = 'uniform' , activation = 'relu', input_
```

In [14]:
```
ann.add(Dense(units =5, kernel_initializer = 'uniform' , activation = 'relu', input_
```

In [15]:
```
ann.add(Dense(units =1, kernel_initializer = 'uniform' , activation = 'softmax', inp
```

In [16]:
```
ann.compile(optimizer = 'adam', loss = 'categorical_crossentropy', metrics = ['accur
```

In [17]:
```
ann.fit(X_train, Y_train, batch_size = 32, epochs = 100)
```

```
Epoch 1/100
4/4 [==============================] - 1s 3ms/step - loss: 0.0000e+00 - accuracy: 0.
3524
Epoch 2/100
4/4 [==============================] - 0s 3ms/step - loss: 0.0000e+00 - accuracy: 0.
3524
Epoch 3/100
4/4 [==============================] - 0s 4ms/step - loss: 0.0000e+00 - accuracy: 0.
3524
Epoch 4/100
4/4 [==============================] - 0s 5ms/step - loss: 0.0000e+00 - accuracy: 0.
3524
Epoch 5/100
4/4 [==============================] - 0s 4ms/step - loss: 0.0000e+00 - accuracy: 0.
3524
Epoch 6/100
4/4 [==============================] - 0s 3ms/step - loss: 0.0000e+00 - accuracy: 0.
3524
Epoch 7/100
4/4 [==============================] - 0s 5ms/step - loss: 0.0000e+00 - accuracy: 0.
3524
Epoch 8/100
4/4 [==============================] - 0s 3ms/step - loss: 0.0000e+00 - accuracy: 0.
3524
Epoch 9/100
4/4 [==============================] - 0s 6ms/step - loss: 0.0000e+00 - accuracy: 0.
3524
Epoch 10/100
4/4 [==============================] - 0s 6ms/step - loss: 0.0000e+00 - accuracy: 0.
3524
Epoch 11/100
4/4 [==============================] - 0s 5ms/step - loss: 0.0000e+00 - accuracy: 0.
3524
Epoch 12/100
4/4 [==============================] - 0s 5ms/step - loss: 0.0000e+00 - accuracy: 0.
3524
Epoch 13/100
4/4 [==============================] - 0s 4ms/step - loss: 0.0000e+00 - accuracy: 0.
3524
Epoch 14/100
4/4 [==============================] - 0s 5ms/step - loss: 0.0000e+00 - accuracy: 0.
3524
Epoch 15/100
4/4 [==============================] - 0s 3ms/step - loss: 0.0000e+00 - accuracy: 0.
3524
Epoch 16/100
4/4 [==============================] - 0s 3ms/step - loss: 0.0000e+00 - accuracy: 0.
3524
Epoch 17/100
4/4 [==============================] - 0s 4ms/step - loss: 0.0000e+00 - accuracy: 0.
3524
Epoch 18/100
4/4 [==============================] - 0s 6ms/step - loss: 0.0000e+00 - accuracy: 0.
3524
Epoch 19/100
4/4 [==============================] - 0s 4ms/step - loss: 0.0000e+00 - accuracy: 0.
3524
Epoch 20/100
4/4 [==============================] - 0s 3ms/step - loss: 0.0000e+00 - accuracy: 0.
```

```
3524
Epoch 21/100
4/4 [==============================] - 0s 9ms/step - loss: 0.0000e+00 - accuracy: 0.
3524
Epoch 22/100
4/4 [==============================] - 0s 1ms/step - loss: 0.0000e+00 - accuracy: 0.
3524
Epoch 23/100
4/4 [==============================] - 0s 5ms/step - loss: 0.0000e+00 - accuracy: 0.
3524
Epoch 24/100
4/4 [==============================] - 0s 5ms/step - loss: 0.0000e+00 - accuracy: 0.
3524
Epoch 25/100
4/4 [==============================] - 0s 2ms/step - loss: 0.0000e+00 - accuracy: 0.
3524
Epoch 26/100
4/4 [==============================] - 0s 3ms/step - loss: 0.0000e+00 - accuracy: 0.
3524
Epoch 27/100
4/4 [==============================] - 0s 5ms/step - loss: 0.0000e+00 - accuracy: 0.
3524
Epoch 28/100
4/4 [==============================] - 0s 3ms/step - loss: 0.0000e+00 - accuracy: 0.
3524
Epoch 29/100
4/4 [==============================] - 0s 6ms/step - loss: 0.0000e+00 - accuracy: 0.
3524
Epoch 30/100
4/4 [==============================] - 0s 4ms/step - loss: 0.0000e+00 - accuracy: 0.
3524
Epoch 31/100
4/4 [==============================] - 0s 4ms/step - loss: 0.0000e+00 - accuracy: 0.
3524
Epoch 32/100
4/4 [==============================] - 0s 5ms/step - loss: 0.0000e+00 - accuracy: 0.
3524
Epoch 33/100
4/4 [==============================] - 0s 2ms/step - loss: 0.0000e+00 - accuracy: 0.
3524
Epoch 34/100
4/4 [==============================] - 0s 5ms/step - loss: 0.0000e+00 - accuracy: 0.
3524
Epoch 35/100
4/4 [==============================] - 0s 2ms/step - loss: 0.0000e+00 - accuracy: 0.
3524
Epoch 36/100
4/4 [==============================] - 0s 3ms/step - loss: 0.0000e+00 - accuracy: 0.
3524
Epoch 37/100
4/4 [==============================] - 0s 3ms/step - loss: 0.0000e+00 - accuracy: 0.
3524
Epoch 38/100
4/4 [==============================] - 0s 5ms/step - loss: 0.0000e+00 - accuracy: 0.
3524
Epoch 39/100
4/4 [==============================] - 0s 5ms/step - loss: 0.0000e+00 - accuracy: 0.
3524
Epoch 40/100
4/4 [==============================] - 0s 4ms/step - loss: 0.0000e+00 - accuracy: 0.
3524
Epoch 41/100
4/4 [==============================] - 0s 3ms/step - loss: 0.0000e+00 - accuracy: 0.
3524
Epoch 42/100
4/4 [==============================] - 0s 3ms/step - loss: 0.0000e+00 - accuracy: 0.
3524
Epoch 43/100
4/4 [==============================] - 0s 5ms/step - loss: 0.0000e+00 - accuracy: 0.
```

```
3524
Epoch 44/100
4/4 [==============================] - 0s 5ms/step - loss: 0.0000e+00 - accuracy: 0.
3524
Epoch 45/100
4/4 [==============================] - 0s 3ms/step - loss: 0.0000e+00 - accuracy: 0.
3524
Epoch 46/100
4/4 [==============================] - 0s 4ms/step - loss: 0.0000e+00 - accuracy: 0.
3524
Epoch 47/100
4/4 [==============================] - 0s 5ms/step - loss: 0.0000e+00 - accuracy: 0.
3524
Epoch 48/100
4/4 [==============================] - 0s 4ms/step - loss: 0.0000e+00 - accuracy: 0.
3524
Epoch 49/100
4/4 [==============================] - 0s 4ms/step - loss: 0.0000e+00 - accuracy: 0.
3524
Epoch 50/100
4/4 [==============================] - 0s 5ms/step - loss: 0.0000e+00 - accuracy: 0.
3524
Epoch 51/100
4/4 [==============================] - 0s 4ms/step - loss: 0.0000e+00 - accuracy: 0.
3524
Epoch 52/100
4/4 [==============================] - 0s 4ms/step - loss: 0.0000e+00 - accuracy: 0.
3524
Epoch 53/100
4/4 [==============================] - 0s 3ms/step - loss: 0.0000e+00 - accuracy: 0.
3524
Epoch 54/100
4/4 [==============================] - 0s 5ms/step - loss: 0.0000e+00 - accuracy: 0.
3524
Epoch 55/100
4/4 [==============================] - 0s 4ms/step - loss: 0.0000e+00 - accuracy: 0.
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Epoch 56/100
4/4 [==============================] - 0s 4ms/step - loss: 0.0000e+00 - accuracy: 0.
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Epoch 57/100
4/4 [==============================] - 0s 4ms/step - loss: 0.0000e+00 - accuracy: 0.
3524
Epoch 58/100
4/4 [==============================] - 0s 5ms/step - loss: 0.0000e+00 - accuracy: 0.
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Epoch 59/100
4/4 [==============================] - 0s 3ms/step - loss: 0.0000e+00 - accuracy: 0.
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Epoch 60/100
4/4 [==============================] - 0s 5ms/step - loss: 0.0000e+00 - accuracy: 0.
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Epoch 61/100
4/4 [==============================] - 0s 3ms/step - loss: 0.0000e+00 - accuracy: 0.
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Epoch 62/100
4/4 [==============================] - 0s 3ms/step - loss: 0.0000e+00 - accuracy: 0.
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Epoch 63/100
4/4 [==============================] - 0s 5ms/step - loss: 0.0000e+00 - accuracy: 0.
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Epoch 64/100
4/4 [==============================] - 0s 2ms/step - loss: 0.0000e+00 - accuracy: 0.
3524
Epoch 65/100
4/4 [==============================] - 0s 5ms/step - loss: 0.0000e+00 - accuracy: 0.
3524
Epoch 66/100
4/4 [==============================] - 0s 4ms/step - loss: 0.0000e+00 - accuracy: 0.
```

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3524
Epoch 67/100
4/4 [==============================] - 0s 2ms/step - loss: 0.0000e+00 - accuracy: 0.
3524
Epoch 68/100
4/4 [==============================] - 0s 4ms/step - loss: 0.0000e+00 - accuracy: 0.
3524
Epoch 69/100
4/4 [==============================] - 0s 5ms/step - loss: 0.0000e+00 - accuracy: 0.
3524
Epoch 70/100
4/4 [==============================] - 0s 5ms/step - loss: 0.0000e+00 - accuracy: 0.
3524
Epoch 71/100
4/4 [==============================] - 0s 3ms/step - loss: 0.0000e+00 - accuracy: 0.
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Epoch 72/100
4/4 [==============================] - 0s 4ms/step - loss: 0.0000e+00 - accuracy: 0.
3524
Epoch 73/100
4/4 [==============================] - 0s 4ms/step - loss: 0.0000e+00 - accuracy: 0.
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Epoch 74/100
4/4 [==============================] - 0s 4ms/step - loss: 0.0000e+00 - accuracy: 0.
3524
Epoch 75/100
4/4 [==============================] - 0s 2ms/step - loss: 0.0000e+00 - accuracy: 0.
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Epoch 76/100
4/4 [==============================] - 0s 4ms/step - loss: 0.0000e+00 - accuracy: 0.
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Epoch 77/100
4/4 [==============================] - 0s 4ms/step - loss: 0.0000e+00 - accuracy: 0.
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Epoch 78/100
4/4 [==============================] - 0s 4ms/step - loss: 0.0000e+00 - accuracy: 0.
3524
Epoch 79/100
4/4 [==============================] - 0s 3ms/step - loss: 0.0000e+00 - accuracy: 0.
3524
Epoch 80/100
4/4 [==============================] - 0s 5ms/step - loss: 0.0000e+00 - accuracy: 0.
3524
Epoch 81/100
4/4 [==============================] - 0s 4ms/step - loss: 0.0000e+00 - accuracy: 0.
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Epoch 82/100
4/4 [==============================] - 0s 4ms/step - loss: 0.0000e+00 - accuracy: 0.
3524
Epoch 83/100
4/4 [==============================] - 0s 5ms/step - loss: 0.0000e+00 - accuracy: 0.
3524
Epoch 84/100
4/4 [==============================] - 0s 5ms/step - loss: 0.0000e+00 - accuracy: 0.
3524
Epoch 85/100
4/4 [==============================] - 0s 2ms/step - loss: 0.0000e+00 - accuracy: 0.
3524
Epoch 86/100
4/4 [==============================] - 0s 5ms/step - loss: 0.0000e+00 - accuracy: 0.
3524
Epoch 87/100
4/4 [==============================] - 0s 4ms/step - loss: 0.0000e+00 - accuracy: 0.
3524
Epoch 88/100
4/4 [==============================] - 0s 6ms/step - loss: 0.0000e+00 - accuracy: 0.
3524
Epoch 89/100
4/4 [==============================] - 0s 2ms/step - loss: 0.0000e+00 - accuracy: 0.
```

```
3524
Epoch 90/100
4/4 [==============================] - 0s 5ms/step - loss: 0.0000e+00 - accuracy: 0.
3524
Epoch 91/100
4/4 [==============================] - 0s 3ms/step - loss: 0.0000e+00 - accuracy: 0.
3524
Epoch 92/100
4/4 [==============================] - 0s 4ms/step - loss: 0.0000e+00 - accuracy: 0.
3524
Epoch 93/100
4/4 [==============================] - 0s 5ms/step - loss: 0.0000e+00 - accuracy: 0.
3524
Epoch 94/100
4/4 [==============================] - 0s 5ms/step - loss: 0.0000e+00 - accuracy: 0.
3524
Epoch 95/100
4/4 [==============================] - 0s 4ms/step - loss: 0.0000e+00 - accuracy: 0.
3524
Epoch 96/100
4/4 [==============================] - 0s 5ms/step - loss: 0.0000e+00 - accuracy: 0.
3524
Epoch 97/100
4/4 [==============================] - 0s 5ms/step - loss: 0.0000e+00 - accuracy: 0.
3524
Epoch 98/100
4/4 [==============================] - 0s 4ms/step - loss: 0.0000e+00 - accuracy: 0.
3524
Epoch 99/100
4/4 [==============================] - 0s 4ms/step - loss: 0.0000e+00 - accuracy: 0.
3524
Epoch 100/100
4/4 [==============================] - 0s 2ms/step - loss: 0.0000e+00 - accuracy: 0.
3524
```

Out[17]:

```
<keras.callbacks.History at 0x29eba1875b0>
```

G)predict the test results

In [18]:

```
Y_pred = ann.predict(X_test)
```

```
2/2 [==============================] - 0s 0s/step
```

In [19]:

```
Y_pred = (Y_pred > 0.5)
```

H)accuracy_score

In [20]:

```
from sklearn.metrics import confusion_matrix, accuracy_score
cm = confusion_matrix(Y_test, Y_pred)
print(cm)
accuracy_score(Y_test,Y_pred)
acc=accuracy_score(Y_test,Y_pred)
print(acc)
```

```
[[ 0 19  0]
 [ 0 13  0]
 [ 0 13  0]]
0.28888888888888886
```