Decision_Trees_Assignment15

Importing the libraries

In [1]:
```
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
%matplotlib inline
import seaborn as sns
sns.set(color_codes=True)
from sklearn.preprocessing import LabelEncoder
```

Importing the dataset

In [2]:
```
dataset = pd.read_csv("Social_Network_Ads.csv")
```

In [3]:
```
dataset.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 [4]:
```
dataset.shape
```

Out[4]:
```
(400, 5)
```

In [5]:
```
dataset.columns
```

Out[5]:
```
Index(['User ID', 'Gender', 'Age', 'EstimatedSalary', 'Purchased'], dtype='object')
```

In [6]:
```
dataset.isna().any()
```

Out[6]:
```
User ID            False
Gender             False
Age                False
EstimatedSalary    False
Purchased          False
dtype: bool
```

In [7]:
```
dataset.isna().sum()
```

Out[7]:
```
User ID            0
Gender             0
Age                0
EstimatedSalary    0
Purchased          0
dtype: int64
```

In [8]:
```
from sklearn.preprocessing import LabelEncoder
```

In [9]:
```
Gender=LabelEncoder()
```

In [10]:
```
dataset['Gender']=Gender.fit_transform(dataset['Gender'])
```

In [11]:
```
dataset
```

Out[11]:

	User ID	Gender	Age	EstimatedSalary	Purchased
0	15624510	1	19	19000	0
1	15810944	1	35	20000	0
2	15668575	0	26	43000	0
3	15603246	0	27	57000	0
4	15804002	1	19	76000	0
...	...	...	...	...	...
395	15691863	0	46	41000	1
396	15706071	1	51	23000	1
397	15654296	0	50	20000	1
398	15755018	1	36	33000	0
399	15594041	0	49	36000	1

400 rows × 5 columns

In [12]:
```
feature_cols=['Gender','Age','EstimatedSalary']
X=dataset[feature_cols]
y=dataset.Purchased
```

In [13]:
```
X
```

Out[13]:

	Gender	Age	EstimatedSalary
0	1	19	19000
1	1	35	20000
2	0	26	43000
3	0	27	57000
4	1	19	76000
...	...	...	...
395	0	46	41000
396	1	51	23000
397	0	50	20000
398	1	36	33000
399	0	49	36000

400 rows × 3 columns

In [14]:
```
y
```

Out[14]:
```
0      0
1      0
2      0
3      0
4      0
      ..
395    1
396    1
397    1
398    0
399    1
Name: Purchased, Length: 400, dtype: int64
```

Splitting the dataset into the Training set and Test set

In [15]:
```
from sklearn.model_selection import train_test_split
```

In [16]:
```
X_train, X_test, y_train, y_test = train_test_split(X,y,test_size=0.2)
```

Feature Scaling

In [17]:
```
from sklearn.preprocessing import StandardScaler
```

In [18]:
```
sc= StandardScaler()
```

In [19]:
```
X_train = sc.fit_transform(X_train)
X_test = sc.transform(X_test)
```

Fitting Decision Tree Classification to the Training set

In [20]:
```
from sklearn.tree import DecisionTreeClassifier
```

In [21]:
```
classifier=DecisionTreeClassifier(criterion='gini')
```

In [22]:
```
classifier.fit(X_train,y_train)
```

Out[22]:
```
DecisionTreeClassifier()
```

Predicting the Test set results

In [23]:
```
classifier.predict(X_test)
```

Out[23]:
```
array([0, 1, 0, 0, 0, 0, 1, 1, 0, 0, 0, 0, 0, 0, 0, 1, 0, 0, 0, 0, 1, 1,
       1, 0, 0, 0, 1, 1, 0, 0, 0, 0, 0, 0, 0, 0, 1, 1, 0, 0, 1, 0, 0,
       1, 0, 0, 1, 1, 0, 0, 0, 0, 0, 0, 1, 0, 1, 1, 0, 1, 1, 0, 1, 1,
       1, 0, 0, 0, 0, 0, 1, 0, 0, 0, 0, 0, 1, 1], dtype=int64)
```

In [24]:
```
X_test
```

Out[24]:
```
array([[-0.98142253, -1.66291941,  0.36467588],
       [-0.98142253,  0.74576609, -1.37446394],
       [-0.98142253, -0.45857666, -0.53387969],
       [ 1.01892912, -0.73650191,  0.30670455],
       [-0.98142253, -0.27329316, -1.28750695],
       [-0.98142253,  0.93104959,  0.77047517],
       [-0.98142253,  0.00463209,  1.26323146],
       [-0.98142253,  0.18991559,  2.10381571],
       [ 1.01892912, -1.19971066,  0.27771889],
       [ 1.01892912, -1.01442716, -1.43243527],
       [ 1.01892912, -0.08800966, -0.50489403],
       [ 1.01892912, -1.10706891, -1.14257863],
       [-0.98142253, -0.27329316,  0.04583358],
       [ 1.01892912, -1.29235241, -0.33098005],
       [ 1.01892912, -0.36593491, -0.765765  ],
       [-0.98142253,  0.00463209,  1.23424579],
       [ 1.01892912, -1.19971066,  0.5096042 ],
       [-0.98142253, -0.82914366, -0.64982235],
       [ 1.01892912, -1.10706891, -1.0846073 ],
       [ 1.01892912,  0.18991559, -0.1280804 ],
       [ 1.01892912,  0.18991559,  0.24873323],
       [-0.98142253,  1.48690009,  1.00236048],
       [-0.98142253,  0.46784084,  1.84294473],
       [-0.98142253, -0.82914366,  0.39366155],
       [ 1.01892912, -0.27329316,  0.16177624],
       [-0.98142253,  0.00463209, -0.1280804 ],
       [-0.98142253,  1.11633309, -1.43243527],
       [-0.98142253,  0.28255734,  0.30670455],
       [-0.98142253, -1.10706891, -0.99765031],
       [-0.98142253, -0.73650191,  1.35018845],
       [ 1.01892912, -0.27329316, -0.56286536],
       [-0.98142253, -0.27329316, -0.56286536],
       [-0.98142253, -0.45857666, -1.20054996],
       [-0.98142253, -0.64386016,  0.56757553],
       [-0.98142253, -1.29235241, -1.0846073 ],
       [-0.98142253, -1.01442716, -0.4469227 ],
       [-0.98142253, -0.36593491, -0.765765  ],
       [-0.98142253,  1.39425834,  0.36467588],
       [-0.98142253,  0.93104959,  1.7849734 ],
       [ 1.01892912, -0.18065141, -0.27300872],
       [ 1.01892912, -0.73650191,  0.56757553],
       [-0.98142253,  0.09727384,  1.8719304 ],
       [ 1.01892912, -0.27329316, -0.88170766],
       [ 1.01892912,  0.37519909, -0.1280804 ],
       [-0.98142253,  1.95010884, -0.79475067],
       [-0.98142253, -0.18065141,  0.16177624],
       [-0.98142253, -0.92178541, -0.30199438],
       [-0.98142253, -0.45857666,  1.26323146],
       [-0.98142253, -0.08800966,  0.68351818],
       [ 1.01892912, -0.92178541,  0.56757553],
       [ 1.01892912, -1.19971066,  0.59656119],
       [ 1.01892912, -0.27329316,  0.10380491],
       [-0.98142253, -1.57027766, -1.54837792],
       [ 1.01892912, -1.38499416, -0.18605173],
       [ 1.01892912,  0.09727384,  0.21974756],
       [ 1.01892912, -0.82914366,  0.30670455],
       [ 1.01892912,  0.93104959, -1.05562164],
       [ 1.01892912, -0.64386016, -0.09909474],
       [ 1.01892912,  1.95010884,  2.13280137],
       [-0.98142253,  0.83840784, -0.64982235],
       [ 1.01892912,  0.28255734, -0.50489403],
       [-0.98142253,  0.83840784, -0.56286536],
       [-0.98142253,  0.83840784,  2.16178703],
       [ 1.01892912, -1.10706891, -1.57736359],
       [ 1.01892912,  0.37519909,  1.00236048],
       [ 1.01892912,  0.74576609,  1.37917411],
       [-0.98142253,  2.04275059,  1.11830314],
       [ 1.01892912,  0.37519909, -0.4469227 ],
       [ 1.01892912,  0.18991559, -0.35996571],
       [ 1.01892912,  0.00463209, -0.30199438],
       [-0.98142253, -0.27329316, -0.73677934],
       [ 1.01892912,  1.02369134, -0.1280804 ],
       [ 1.01892912,  0.28255734,  0.27771889],
       [ 1.01892912, -0.73650191,  0.5096042 ],
       [ 1.01892912,  0.18991559, -0.35996571],
       [-0.98142253,  0.18991559,  0.07481924],
       [ 1.01892912,  0.00463209,  0.04583358],
       [ 1.01892912, -0.92178541, -1.0846073 ],
       [-0.98142253, -0.27329316,  0.79946084],
       [-0.98142253, -0.64386016,  1.40815978]])
```

In [25]:
```
classifier.score(X_test,y_test)
```

Out[25]:
```
0.875
```

Making the Confusion Matrix

In [26]:
```
y_pred = classifier.predict(X_test)
```

In [27]:
```
from sklearn.metrics import confusion_matrix
```

In [28]:
```
cm = confusion_matrix(y_test, y_pred)
```

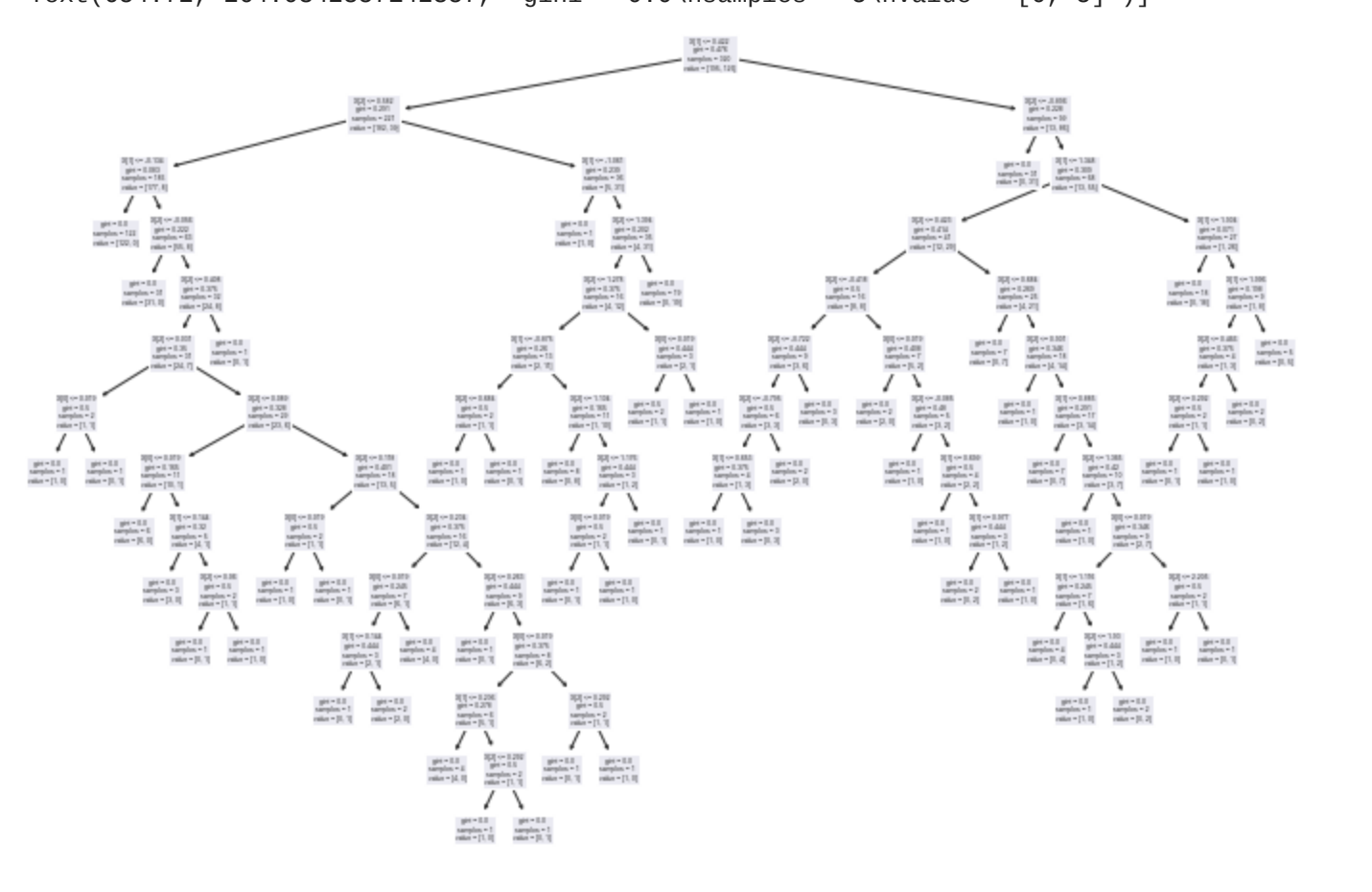
In [29]:
```
print(cm)
```

```
[[53  9]
 [ 1 17]]
```

Visualising the Training set results

In [33]:
```
plt.figure(figsize=(12,8))
from sklearn import tree
tree.plot_tree(classifier.fit(X_train, y_train))
```

Out[33]:
```
[Text(360.375, 419.3485714285714, 'X[1] <= 0.422\ngini = 0.476\nsamples = 320\nvalue = [195, 125]'),
 Text(185.07000000000002, 388.2857142857143, 'X[2] <= 0.582\ngini = 0.291\nsamples = 221\nvalue = [182, 39]'),
 Text(65.10000000000001, 357.22285714285715, 'X[1] <= -0.134\ngini = 0.083\nsamples = 185\nvalue = [177, 8]'),
 Text(50.220000000000006, 326.15999999999997, 'gini = 0.0\nsamples = 122\nvalue = [122, 0]'),
 Text(79.98, 326.15999999999997, 'X[2] <= -0.056\ngini = 0.222\nsamples = 63\nvalue = [55, 8]'),
 Text(65.10000000000001, 295.09714285714284, 'gini = 0.0\nsamples = 31\nvalue = [31, 0]'),
 Text(94.86, 295.09714285714284, 'X[2] <= 0.408\ngini = 0.375\nsamples = 32\nvalue = [24, 8]'),
 Text(79.98, 264.0342857142857, 'X[2] <= 0.031\ngini = 0.35\nsamples = 31\nvalue = [24, 7]'),
 Text(29.76, 232.97142857142856, 'X[0] <= 0.019\ngini = 0.5\nsamples = 2\nvalue = [1, 1]'),
 Text(14.88, 201.9085714285714, 'gini = 0.0\nsamples = 1\nvalue = [1, 0]'),
 Text(44.64, 201.9085714285714, 'gini = 0.0\nsamples = 1\nvalue = [0, 1]'),
 Text(130.20000000000002, 232.97142857142856, 'X[2] <= 0.089\ngini = 0.328\nsamples = 29\nvalue = [23, 6]'),
 Text(74.4, 201.9085714285714, 'X[0] <= 0.019\ngini = 0.165\nsamples = 11\nvalue = [10, 1]'),
 Text(59.52, 170.84571428571428, 'gini = 0.0\nsamples = 6\nvalue = [6, 0]'),
 Text(89.28, 170.84571428571428, 'X[1] <= 0.144\ngini = 0.32\nsamples = 5\nvalue = [4, 1]'),
 Text(74.4, 139.78285714285715, 'gini = 0.0\nsamples = 3\nvalue = [3, 0]'),
 Text(104.16000000000001, 139.78285714285715, 'X[2] <= 0.06\ngini = 0.5\nsamples = 2\nvalue = [1, 1]'),
 Text(89.28, 108.71999999999997, 'gini = 0.0\nsamples = 1\nvalue = [0, 1]'),
 Text(119.04, 108.71999999999997, 'gini = 0.0\nsamples = 1\nvalue = [1, 0]'),
 Text(186.0, 201.9085714285714, 'X[2] <= 0.118\ngini = 0.401\nsamples = 18\nvalue = [13, 5]'),
 Text(148.8, 170.84571428571428, 'X[0] <= 0.019\ngini = 0.5\nsamples = 2\nvalue = [1, 1]'),
 Text(133.92000000000002, 139.78285714285715, 'gini = 0.0\nsamples = 1\nvalue = [1, 0]'),
 Text(163.68, 139.78285714285715, 'gini = 0.0\nsamples = 1\nvalue = [0, 1]'),
 Text(223.20000000000002, 170.84571428571428, 'X[2] <= 0.234\ngini = 0.375\nsamples = 16\nvalue = [12, 4]'),
 Text(193.44, 139.78285714285715, 'X[0] <= 0.019\ngini = 0.245\nsamples = 7\nvalue = [6, 1]'),
 Text(178.56, 108.71999999999997, 'X[1] <= 0.144\ngini = 0.444\nsamples = 3\nvalue = [2, 1]'),
 Text(163.68, 77.65714285714284, 'gini = 0.0\nsamples = 1\nvalue = [0, 1]'),
 Text(193.44, 77.65714285714284, 'gini = 0.0\nsamples = 2\nvalue = [2, 0]'),
 Text(208.32000000000002, 108.71999999999997, 'gini = 0.0\nsamples = 4\nvalue = [4, 0]'),
 Text(252.96, 139.78285714285715, 'X[2] <= 0.263\ngini = 0.444\nsamples = 9\nvalue = [6, 3]'),
 Text(238.08, 108.71999999999997, 'gini = 0.0\nsamples = 1\nvalue = [0, 1]'),
 Text(267.84000000000003, 108.71999999999997, 'X[0] <= 0.019\ngini = 0.375\nsamples = 8\nvalue = [6, 2]'),
 Text(238.08, 77.65714285714284, 'X[1] <= 0.236\ngini = 0.278\nsamples = 6\nvalue = [5, 1]'),
 Text(223.20000000000002, 46.59428571428572, 'gini = 0.0\nsamples = 4\nvalue = [4, 0]'),
 Text(252.96, 46.59428571428572, 'X[2] <= 0.292\ngini = 0.5\nsamples = 2\nvalue = [1, 1]'),
 Text(238.08, 15.531428571428535, 'gini = 0.0\nsamples = 1\nvalue = [1, 0]'),
 Text(267.84000000000003, 15.531428571428535, 'gini = 0.0\nsamples = 1\nvalue = [0, 1]'),
 Text(297.6, 77.65714285714284, 'X[2] <= 0.292\ngini = 0.5\nsamples = 2\nvalue = [1, 1]'),
 Text(282.72, 46.59428571428572, 'gini = 0.0\nsamples = 1\nvalue = [0, 1]'),
 Text(312.48, 46.59428571428572, 'gini = 0.0\nsamples = 1\nvalue = [1, 0]'),
 Text(109.74000000000001, 264.0342857142857, 'gini = 0.0\nsamples = 1\nvalue = [0, 1]'),
 Text(305.04, 357.22285714285715, 'X[1] <= -1.061\ngini = 0.239\nsamples = 36\nvalue = [5, 31]'),
 Text(290.16, 326.15999999999997, 'gini = 0.0\nsamples = 1\nvalue = [1, 0]'),
 Text(319.92, 326.15999999999997, 'X[2] <= 1.394\ngini = 0.202\nsamples = 35\nvalue = [4, 31]'),
 Text(305.04, 295.09714285714284, 'X[2] <= 1.278\ngini = 0.375\nsamples = 16\nvalue = [4, 12]'),
 Text(267.84000000000003, 264.0342857142857, 'X[1] <= -0.875\ngini = 0.26\nsamples = 13\nvalue = [2, 11]'),
 Text(238.08, 232.97142857142856, 'X[2] <= 0.684\ngini = 0.5\nsamples = 2\nvalue = [1, 1]'),
 Text(223.20000000000002, 201.9085714285714, 'gini = 0.0\nsamples = 1\nvalue = [1, 0]'),
 Text(252.96, 201.9085714285714, 'gini = 0.0\nsamples = 1\nvalue = [0, 1]'),
 Text(297.6, 232.97142857142856, 'X[2] <= 1.104\ngini = 0.165\nsamples = 11\nvalue = [1, 10]'),
 Text(282.72, 201.9085714285714, 'gini = 0.0\nsamples = 8\nvalue = [0, 8]'),
 Text(312.48, 201.9085714285714, 'X[2] <= 1.176\ngini = 0.444\nsamples = 3\nvalue = [1, 2]'),
 Text(297.6, 170.84571428571428, 'X[0] <= 0.019\ngini = 0.5\nsamples = 2\nvalue = [1, 1]'),
 Text(282.72, 139.78285714285715, 'gini = 0.0\nsamples = 1\nvalue = [0, 1]'),
 Text(312.48, 139.78285714285715, 'gini = 0.0\nsamples = 1\nvalue = [1, 0]'),
 Text(327.36, 170.84571428571428, 'gini = 0.0\nsamples = 1\nvalue = [0, 1]'),
 Text(342.24, 264.0342857142857, 'X[0] <= 0.019\ngini = 0.444\nsamples = 3\nvalue = [2, 1]'),
 Text(327.36, 232.97142857142856, 'gini = 0.5\nsamples = 2\nvalue = [1, 1]'),
 Text(357.12, 232.97142857142856, 'gini = 0.0\nsamples = 1\nvalue = [1, 0]'),
 Text(334.8, 295.09714285714284, 'gini = 0.0\nsamples = 19\nvalue = [0, 19]'),
 Text(535.6800000000001, 388.2857142857143, 'X[2] <= -0.896\ngini = 0.228\nsamples = 99\nvalue = [13, 86]'),
 Text(520.8000000000001, 357.22285714285715, 'gini = 0.0\nsamples = 31\nvalue = [0, 31]'),
 Text(550.5600000000001, 357.22285714285715, 'X[1] <= 1.348\ngini = 0.309\nsamples = 68\nvalue = [13, 55]'),
 Text(476.16, 326.15999999999997, 'X[2] <= 0.423\ngini = 0.414\nsamples = 41\nvalue = [12, 29]'),
 Text(431.52000000000004, 295.09714285714284, 'X[2] <= -0.418\ngini = 0.5\nsamples = 16\nvalue = [8, 8]'),
 Text(401.76000000000005, 264.0342857142857, 'X[2] <= -0.722\ngini = 0.444\nsamples = 9\nvalue = [3, 6]'),
 Text(386.88, 232.97142857142856, 'X[2] <= -0.795\ngini = 0.5\nsamples = 6\nvalue = [3, 3]'),
 Text(372.0, 201.9085714285714, 'X[1] <= 0.653\ngini = 0.375\nsamples = 4\nvalue = [1, 3]'),
 Text(357.12, 170.84571428571428, 'gini = 0.0\nsamples = 1\nvalue = [1, 0]'),
 Text(386.88, 170.84571428571428, 'gini = 0.0\nsamples = 3\nvalue = [0, 3]'),
 Text(401.76000000000005, 201.9085714285714, 'gini = 0.0\nsamples = 2\nvalue = [2, 0]'),
 Text(416.64000000000004, 232.97142857142856, 'gini = 0.0\nsamples = 3\nvalue = [0, 3]'),
 Text(461.28000000000003, 264.0342857142857, 'X[0] <= 0.019\ngini = 0.408\nsamples = 7\nvalue = [5, 2]'),
 Text(446.40000000000003, 232.97142857142856, 'gini = 0.0\nsamples = 2\nvalue = [2, 0]'),
 Text(476.16, 232.97142857142856, 'X[2] <= -0.085\ngini = 0.48\nsamples = 5\nvalue = [3, 2]'),
 Text(461.28000000000003, 201.9085714285714, 'gini = 0.0\nsamples = 1\nvalue = [1, 0]'),
 Text(491.04, 201.9085714285714, 'X[1] <= 0.699\ngini = 0.5\nsamples = 4\nvalue = [2, 2]'),
 Text(476.16, 170.84571428571428, 'gini = 0.0\nsamples = 1\nvalue = [1, 0]'),
 Text(505.92, 170.84571428571428, 'X[1] <= 0.977\ngini = 0.444\nsamples = 3\nvalue = [1, 2]'),
 Text(491.04, 139.78285714285715, 'gini = 0.0\nsamples = 2\nvalue = [0, 2]'),
 Text(520.8000000000001, 139.78285714285715, 'gini = 0.0\nsamples = 1\nvalue = [1, 0]'),
 Text(520.8000000000001, 295.09714285714284, 'X[2] <= 0.684\ngini = 0.269\nsamples = 25\nvalue = [4, 21]'),
 Text(505.92, 264.0342857142857, 'gini = 0.0\nsamples = 7\nvalue = [0, 7]'),
 Text(535.6800000000001, 264.0342857142857, 'X[2] <= 0.901\ngini = 0.346\nsamples = 18\nvalue = [4, 14]'),
 Text(520.8000000000001, 232.97142857142856, 'gini = 0.0\nsamples = 1\nvalue = [1, 0]'),
 Text(550.5600000000001, 232.97142857142856, 'X[1] <= 0.885\ngini = 0.291\nsamples = 17\nvalue = [3, 14]'),
 Text(535.6800000000001, 201.9085714285714, 'gini = 0.0\nsamples = 7\nvalue = [0, 7]'),
 Text(565.44, 201.9085714285714, 'X[2] <= 1.365\ngini = 0.42\nsamples = 10\nvalue = [3, 7]'),
 Text(550.5600000000001, 170.84571428571428, 'gini = 0.0\nsamples = 1\nvalue = [1, 0]'),
 Text(580.32, 170.84571428571428, 'X[0] <= 0.019\ngini = 0.346\nsamples = 9\nvalue = [2, 7]'),
 Text(550.5600000000001, 139.78285714285715, 'X[1] <= 1.116\ngini = 0.245\nsamples = 7\nvalue = [1, 6]'),
 Text(535.6800000000001, 108.71999999999997, 'gini = 0.0\nsamples = 4\nvalue = [0, 4]'),
 Text(565.44, 108.71999999999997, 'X[2] <= 1.93\ngini = 0.444\nsamples = 3\nvalue = [1, 2]'),
 Text(550.5600000000001, 77.65714285714284, 'gini = 0.0\nsamples = 1\nvalue = [1, 0]'),
 Text(580.32, 77.65714285714284, 'gini = 0.0\nsamples = 2\nvalue = [0, 2]'),
 Text(610.08, 139.78285714285715, 'X[2] <= 2.205\ngini = 0.5\nsamples = 2\nvalue = [1, 1]'),
 Text(595.2, 108.71999999999997, 'gini = 0.0\nsamples = 1\nvalue = [1, 0]'),
 Text(624.96, 108.71999999999997, 'gini = 0.0\nsamples = 1\nvalue = [0, 1]'),
 Text(624.96, 326.15999999999997, 'X[1] <= 1.904\ngini = 0.071\nsamples = 27\nvalue = [1, 26]'),
 Text(610.08, 295.09714285714284, 'gini = 0.0\nsamples = 18\nvalue = [0, 18]'),
 Text(639.84, 295.09714285714284, 'X[1] <= 1.996\ngini = 0.198\nsamples = 9\nvalue = [1, 8]'),
 Text(624.96, 264.0342857142857, 'X[2] <= 0.466\ngini = 0.375\nsamples = 4\nvalue = [1, 3]'),
 Text(610.08, 232.97142857142856, 'X[2] <= 0.292\ngini = 0.5\nsamples = 2\nvalue = [1, 1]'),
 Text(595.2, 201.9085714285714, 'gini = 0.0\nsamples = 1\nvalue = [0, 1]'),
 Text(624.96, 201.9085714285714, 'gini = 0.0\nsamples = 1\nvalue = [1, 0]'),
 Text(639.84, 232.97142857142856, 'gini = 0.0\nsamples = 2\nvalue = [0, 2]'),
 Text(654.72, 264.0342857142857, 'gini = 0.0\nsamples = 5\nvalue = [0, 5]')]
```



Visualising the Test set results

In [39]:
```
from sklearn import tree
tree.plot_tree(classifier)
```

Out[39]:
```
[Text(180.1875, 209.6742857142857, 'X[1] <= 0.422\ngini = 0.476\nsamples = 320\nvalue = [195, 125]'),
 Text(92.53500000000001, 194.14285714285714, 'X[2] <= 0.582\ngini = 0.291\nsamples = 221\nvalue = [182, 39]'),
 Text(32.550000000000004, 178.61142857142858, 'X[1] <= -0.134\ngini = 0.083\nsamples = 185\nvalue = [177, 8]'),
 Text(25.110000000000003, 163.07999999999998, 'gini = 0.0\nsamples = 122\nvalue = [122, 0]'),
 Text(39.99, 163.07999999999998, 'X[2] <= -0.056\ngini = 0.222\nsamples = 63\nvalue = [55, 8]'),
 Text(32.550000000000004, 147.54857142857142, 'gini = 0.0\nsamples = 31\nvalue = [31, 0]'),
 Text(47.43, 147.54857142857142, 'X[2] <= 0.408\ngini = 0.375\nsamples = 32\nvalue = [24, 8]'),
 Text(39.99, 132.01714285714286, 'X[2] <= 0.031\ngini = 0.35\nsamples = 31\nvalue = [24, 7]'),
 Text(14.88, 116.48571428571428, 'X[0] <= 0.019\ngini = 0.5\nsamples = 2\nvalue = [1, 1]'),
 Text(7.44, 100.9542857142857, 'gini = 0.0\nsamples = 1\nvalue = [1, 0]'),
 Text(22.32, 100.9542857142857, 'gini = 0.0\nsamples = 1\nvalue = [0, 1]'),
 Text(65.10000000000001, 116.48571428571428, 'X[2] <= 0.089\ngini = 0.328\nsamples = 29\nvalue = [23, 6]'),
 Text(37.2, 100.9542857142857, 'X[0] <= 0.019\ngini = 0.165\nsamples = 11\nvalue = [10, 1]'),
 Text(29.76, 85.42285714285714, 'gini = 0.0\nsamples = 6\nvalue = [6, 0]'),
 Text(44.64, 85.42285714285714, 'X[1] <= 0.144\ngini = 0.32\nsamples = 5\nvalue = [4, 1]'),
 Text(37.2, 69.89142857142858, 'gini = 0.0\nsamples = 3\nvalue = [3, 0]'),
 Text(52.080000000000005, 69.89142857142858, 'X[2] <= 0.06\ngini = 0.5\nsamples = 2\nvalue = [1, 1]'),
 Text(44.64, 54.359999999999985, 'gini = 0.0\nsamples = 1\nvalue = [0, 1]'),
 Text(59.52, 54.359999999999985, 'gini = 0.0\nsamples = 1\nvalue = [1, 0]'),
 Text(93.0, 100.9542857142857, 'X[2] <= 0.118\ngini = 0.401\nsamples = 18\nvalue = [13, 5]'),
 Text(74.4, 85.42285714285714, 'X[0] <= 0.019\ngini = 0.5\nsamples = 2\nvalue = [1, 1]'),
 Text(66.96000000000001, 69.89142857142858, 'gini = 0.0\nsamples = 1\nvalue = [1, 0]'),
 Text(81.84, 69.89142857142858, 'gini = 0.0\nsamples = 1\nvalue = [0, 1]'),
 Text(111.60000000000001, 85.42285714285714, 'X[2] <= 0.234\ngini = 0.375\nsamples = 16\nvalue = [12, 4]'),
 Text(96.72, 69.89142857142858, 'X[0] <= 0.019\ngini = 0.245\nsamples = 7\nvalue = [6, 1]'),
 Text(89.28, 54.359999999999985, 'X[1] <= 0.144\ngini = 0.444\nsamples = 3\nvalue = [2, 1]'),
 Text(81.84, 38.82857142857142, 'gini = 0.0\nsamples = 1\nvalue = [0, 1]'),
 Text(96.72, 38.82857142857142, 'gini = 0.0\nsamples = 2\nvalue = [2, 0]'),
 Text(104.16000000000001, 54.359999999999985, 'gini = 0.0\nsamples = 4\nvalue = [4, 0]'),
 Text(126.48, 69.89142857142858, 'X[2] <= 0.263\ngini = 0.444\nsamples = 9\nvalue = [6, 3]'),
 Text(119.04, 54.359999999999985, 'gini = 0.0\nsamples = 1\nvalue = [0, 1]'),
 Text(133.92000000000002, 54.359999999999985, 'X[0] <= 0.019\ngini = 0.375\nsamples = 8\nvalue = [6, 2]'),
 Text(119.04, 38.82857142857142, 'X[1] <= 0.236\ngini = 0.278\nsamples = 6\nvalue = [5, 1]'),
 Text(111.60000000000001, 23.29714285714286, 'gini = 0.0\nsamples = 4\nvalue = [4, 0]'),
 Text(126.48, 23.29714285714286, 'X[2] <= 0.292\ngini = 0.5\nsamples = 2\nvalue = [1, 1]'),
 Text(119.04, 7.765714285714267, 'gini = 0.0\nsamples = 1\nvalue = [1, 0]'),
 Text(133.92000000000002, 7.765714285714267, 'gini = 0.0\nsamples = 1\nvalue = [0, 1]'),
 Text(148.8, 38.82857142857142, 'X[2] <= 0.292\ngini = 0.5\nsamples = 2\nvalue = [1, 1]'),
 Text(141.36, 23.29714285714286, 'gini = 0.0\nsamples = 1\nvalue = [0, 1]'),
 Text(156.24, 23.29714285714286, 'gini = 0.0\nsamples = 1\nvalue = [1, 0]'),
 Text(54.870000000000005, 132.01714285714286, 'gini = 0.0\nsamples = 1\nvalue = [0, 1]'),
 Text(152.52, 178.61142857142858, 'X[1] <= -1.061\ngini = 0.239\nsamples = 36\nvalue = [5, 31]'),
 Text(145.08, 163.07999999999998, 'gini = 0.0\nsamples = 1\nvalue = [1, 0]'),
 Text(159.96, 163.07999999999998, 'X[2] <= 1.394\ngini = 0.202\nsamples = 35\nvalue = [4, 31]'),
 Text(152.52, 147.54857142857142, 'X[2] <= 1.278\ngini = 0.375\nsamples = 16\nvalue = [4, 12]'),
 Text(133.92000000000002, 132.01714285714286, 'X[1] <= -0.875\ngini = 0.26\nsamples = 13\nvalue = [2, 11]'),
 Text(119.04, 116.48571428571428, 'X[2] <= 0.684\ngini = 0.5\nsamples = 2\nvalue = [1, 1]'),
 Text(111.60000000000001, 100.9542857142857, 'gini = 0.0\nsamples = 1\nvalue = [1, 0]'),
 Text(126.48, 100.9542857142857, 'gini = 0.0\nsamples = 1\nvalue = [0, 1]'),
 Text(148.8, 116.48571428571428, 'X[2] <= 1.104\ngini = 0.165\nsamples = 11\nvalue = [1, 10]'),
 Text(141.36, 100.9542857142857, 'gini = 0.0\nsamples = 8\nvalue = [0, 8]'),
 Text(156.24, 100.9542857142857, 'X[2] <= 1.176\ngini = 0.444\nsamples = 3\nvalue = [1, 2]'),
 Text(148.8, 85.42285714285714, 'X[0] <= 0.019\ngini = 0.5\nsamples = 2\nvalue = [1, 1]'),
 Text(141.36, 69.89142857142858, 'gini = 0.0\nsamples = 1\nvalue = [0, 1]'),
 Text(156.24, 69.89142857142858, 'gini = 0.0\nsamples = 1\nvalue = [1, 0]'),
 Text(163.68, 85.42285714285714, 'gini = 0.0\nsamples = 1\nvalue = [0, 1]'),
 Text(171.12, 132.01714285714286, 'X[0] <= 0.019\ngini = 0.444\nsamples = 3\nvalue = [2, 1]'),
 Text(163.68, 116.48571428571428, 'gini = 0.5\nsamples = 2\nvalue = [1, 1]'),
 Text(178.56, 116.48571428571428, 'gini = 0.0\nsamples = 1\nvalue = [1, 0]'),
 Text(167.4, 147.54857142857142, 'gini = 0.0\nsamples = 19\nvalue = [0, 19]'),
 Text(267.84000000000003, 194.14285714285714, 'X[2] <= -0.896\ngini = 0.228\nsamples = 99\nvalue = [13, 86]'),
 Text(260.40000000000003, 178.61142857142858, 'gini = 0.0\nsamples = 31\nvalue = [0, 31]'),
 Text(275.28000000000003, 178.61142857142858, 'X[1] <= 1.348\ngini = 0.309\nsamples = 68\nvalue = [13, 55]'),
 Text(238.08, 163.07999999999998, 'X[2] <= 0.423\ngini = 0.414\nsamples = 41\nvalue = [12, 29]'),
 Text(215.76000000000002, 147.54857142857142, 'X[2] <= -0.418\ngini = 0.5\nsamples = 16\nvalue = [8, 8]'),
 Text(200.88000000000002, 132.01714285714286, 'X[2] <= -0.722\ngini = 0.444\nsamples = 9\nvalue = [3, 6]'),
 Text(193.44, 116.48571428571428, 'X[2] <= -0.795\ngini = 0.5\nsamples = 6\nvalue = [3, 3]'),
 Text(186.0, 100.9542857142857, 'X[1] <= 0.653\ngini = 0.375\nsamples = 4\nvalue = [1, 3]'),
 Text(178.56, 85.42285714285714, 'gini = 0.0\nsamples = 1\nvalue = [1, 0]'),
 Text(193.44, 85.42285714285714, 'gini = 0.0\nsamples = 3\nvalue = [0, 3]'),
 Text(200.88000000000002, 100.9542857142857, 'gini = 0.0\nsamples = 2\nvalue = [2, 0]'),
 Text(208.32000000000002, 116.48571428571428, 'gini = 0.0\nsamples = 3\nvalue = [0, 3]'),
 Text(230.64000000000001, 132.01714285714286, 'X[0] <= 0.019\ngini = 0.408\nsamples = 7\nvalue = [5, 2]'),
 Text(223.20000000000002, 116.48571428571428, 'gini = 0.0\nsamples = 2\nvalue = [2, 0]'),
 Text(238.08, 116.48571428571428, 'X[2] <= -0.085\ngini = 0.48\nsamples = 5\nvalue = [3, 2]'),
 Text(230.64000000000001, 100.9542857142857, 'gini = 0.0\nsamples = 1\nvalue = [1, 0]'),
 Text(245.52, 100.9542857142857, 'X[1] <= 0.699\ngini = 0.5\nsamples = 4\nvalue = [2, 2]'),
 Text(238.08, 85.42285714285714, 'gini = 0.0\nsamples = 1\nvalue = [1, 0]'),
 Text(252.96, 85.42285714285714, 'X[1] <= 0.977\ngini = 0.444\nsamples = 3\nvalue = [1, 2]'),
 Text(245.52, 69.89142857142858, 'gini = 0.0\nsamples = 2\nvalue = [0, 2]'),
 Text(260.40000000000003, 69.89142857142858, 'gini = 0.0\nsamples = 1\nvalue = [1, 0]'),
 Text(260.40000000000003, 147.54857142857142, 'X[2] <= 0.684\ngini = 0.269\nsamples = 25\nvalue = [4, 21]'),
 Text(252.96, 132.01714285714286, 'gini = 0.0\nsamples = 7\nvalue = [0, 7]'),
 Text(267.84000000000003, 132.01714285714286, 'X[2] <= 0.901\ngini = 0.346\nsamples = 18\nvalue = [4, 14]'),
 Text(260.40000000000003, 116.48571428571428, 'gini = 0.0\nsamples = 1\nvalue = [1, 0]'),
 Text(275.28000000000003, 116.48571428571428, 'X[1] <= 0.885\ngini = 0.291\nsamples = 17\nvalue = [3, 14]'),
 Text(267.84000000000003, 100.9542857142857, 'gini = 0.0\nsamples = 7\nvalue = [0, 7]'),
 Text(282.72, 100.9542857142857, 'X[2] <= 1.365\ngini = 0.42\nsamples = 10\nvalue = [3, 7]'),
 Text(275.28000000000003, 85.42285714285714, 'gini = 0.0\nsamples = 1\nvalue = [1, 0]'),
 Text(290.16, 85.42285714285714, 'X[0] <= 0.019\ngini = 0.346\nsamples = 9\nvalue = [2, 7]'),
 Text(275.28000000000003, 69.89142857142858, 'X[1] <= 1.116\ngini = 0.245\nsamples = 7\nvalue = [1, 6]'),
 Text(267.84000000000003, 54.359999999999985, 'gini = 0.0\nsamples = 4\nvalue = [0, 4]'),
 Text(282.72, 54.359999999999985, 'X[2] <= 1.93\ngini = 0.444\nsamples = 3\nvalue = [1, 2]'),
 Text(275.28000000000003, 38.82857142857142, 'gini = 0.0\nsamples = 1\nvalue = [1, 0]'),
 Text(290.16, 38.82857142857142, 'gini = 0.0\nsamples = 2\nvalue = [0, 2]'),
 Text(305.04, 69.89142857142858, 'X[2] <= 2.205\ngini = 0.5\nsamples = 2\nvalue = [1, 1]'),
 Text(297.6, 54.359999999999985, 'gini = 0.0\nsamples = 1\nvalue = [1, 0]'),
 Text(312.48, 54.359999999999985, 'gini = 0.0\nsamples = 1\nvalue = [0, 1]'),
 Text(312.48, 163.07999999999998, 'X[1] <= 1.904\ngini = 0.071\nsamples = 27\nvalue = [1, 26]'),
 Text(305.04, 147.54857142857142, 'gini = 0.0\nsamples = 18\nvalue = [0, 18]'),
 Text(319.92, 147.54857142857142, 'X[1] <= 1.996\ngini = 0.198\nsamples = 9\nvalue = [1, 8]'),
 Text(312.48, 132.01714285714286, 'X[2] <= 0.466\ngini = 0.375\nsamples = 4\nvalue = [1, 3]'),
 Text(305.04, 116.48571428571428, 'X[2] <= 0.292\ngini = 0.5\nsamples = 2\nvalue = [1, 1]'),
 Text(297.6, 100.9542857142857, 'gini = 0.0\nsamples = 1\nvalue = [0, 1]'),
 Text(312.48, 100.9542857142857, 'gini = 0.0\nsamples = 1\nvalue = [1, 0]'),
 Text(319.92, 116.48571428571428, 'gini = 0.0\nsamples = 2\nvalue = [0, 2]'),
 Text(327.36, 132.01714285714286, 'gini = 0.0\nsamples = 5\nvalue = [0, 5]')]
```