Create a decision tree classifier for the the shared data.

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

```
df=pd.read_csv("/content/heart.csv")
df
```

	age	sex	cp	trestbps	chol	fbs	restecg	thalach	exang	oldpeak	slope	ca	thal	target
0	52	1	0	125	212	0	1	168	0	1.0	2	2	3	0
1	53	1	0	140	203	1	0	155	1	3.1	0	0	3	0
2	70	1	0	145	174	0	1	125	1	2.6	0	0	3	0
3	61	1	0	148	203	0	1	161	0	0.0	2	1	3	0
4	62	0	0	138	294	1	1	106	0	1.9	1	3	2	0
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1020	59	1	1	140	221	0	1	164	1	0.0	2	0	2	1
1021	60	1	0	125	258	0	0	141	1	2.8	1	1	3	0
1022	47	1	0	110	275	0	0	118	1	1.0	1	1	2	0
1023	50	0	0	110	254	0	0	159	0	0.0	2	0	2	1
1024	54	1	0	120	188	0	1	113	0	1.4	1	1	3	0

1025 rows × 14 columns

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

```
x
```

	age	sex	cp	trestbps	chol	fbs	restecg	thalach	exang	oldpeak	slope	ca	thal
0	52	1	0	125	212	0	1	168	0	1.0	2	2	3
1	53	1	0	140	203	1	0	155	1	3.1	0	0	3
2	70	1	0	145	174	0	1	125	1	2.6	0	0	3
3	61	1	0	148	203	0	1	161	0	0.0	2	1	3
4	62	0	0	138	294	1	1	106	0	1.9	1	3	2
...	...	...	...	...	...	...	...	...	...	...	...	...	...
1020	59	1	1	140	221	0	1	164	1	0.0	2	0	2
1021	60	1	0	125	258	0	0	141	1	2.8	1	1	3
1022	47	1	0	110	275	0	0	118	1	1.0	1	1	2
1023	50	0	0	110	254	0	0	159	0	0.0	2	0	2
1024	54	1	0	120	188	0	1	113	0	1.4	1	1	3

1025 rows × 13 columns

```
y
```

```
0       0
1       0
2       0
3       0
4       0
       ..
1020    1
1021    0
1022    0
1023    1
1024    0
Name: target, Length: 1025, dtype: int64
```

```
from sklearn.model_selection import train_test_split
```

```
X_train, X_test, y_train, y_test = train_test_split(x,y,test_size=0.3,random_state=1)
```

```
print(X_train.shape)
print(X_test.shape)
print(y_train.shape)
print(y_test.shape)
```

```
    (717, 13)
    (308, 13)
    (717,)
    (308,)
```

```
from sklearn import tree
clf = tree.DecisionTreeClassifier()
model = clf.fit(X_train, y_train)
```

```
y_pred=model.predict(X_test)
```

```
y_pred
```

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

```
y_test
```

```
    49      0
    525     1
    119     1
    629     0
    186     0
           ..
    663     1
    185     0
    286     1
    1001    1
    808     1
    Name: target, Length: 308, dtype: int64
```

```
from sklearn.metrics import accuracy_score
score=accuracy_score(y_test,y_pred)
score
```

```
    0.9902597402597403
```

```
from sklearn.metrics import classification_report,confusion_matrix
print(classification_report(y_test,y_pred))
```

```
                  precision    recall  f1-score   support

               0       0.98      1.00      0.99       161
               1       1.00      0.98      0.99       147

        accuracy                           0.99       308
       macro avg       0.99      0.99      0.99       308
    weighted avg       0.99      0.99      0.99       308
```

```
confusion_matrix(y_test,y_pred)
tree.plot_tree(clf)
```

   ⤷

```
 [Text(0.5482142857142858, 0.9545454545454546, 'x[2] <= 0.5\ngini = 0.498\nsamples = 717\nvalue = [338, 379]'),
 Text(0.2892857142857143, 0.8636363636363636, 'x[11] <= 0.5\ngini = 0.39\nsamples = 346\nvalue = [254, 92]'),
 Text(0.2, 0.7727272727272727, 'x[12] <= 2.5\ngini = 0.5\nsamples = 160\nvalue = [82, 78]'),
 Text(0.11428571428571428, 0.6818181818181818, 'x[8] <= 0.5\ngini = 0.378\nsamples = 91\nvalue = [23, 68]'),
 Text(0.05714285714285714, 0.5909090909090909, 'x[4] <= 316.5\ngini = 0.16\nsamples = 57\nvalue = [5, 52]'),
 Text(0.02857142857142857, 0.5, 'x[7] <= 96.5\ngini = 0.073\nsamples = 53\nvalue = [2, 51]'),
 Text(0.014285714285714285, 0.4090909090909091, 'gini = 0.0\nsamples = 2\nvalue = [2, 0]'),
 Text(0.04285714285714286, 0.4090909090909091, 'gini = 0.0\nsamples = 51\nvalue = [0, 51]'),
 Text(0.08571428571428572, 0.5, 'x[9] <= 0.6\ngini = 0.375\nsamples = 4\nvalue = [3, 1]'),
 Text(0.07142857142857142, 0.4090909090909091, 'gini = 0.0\nsamples = 3\nvalue = [3, 0]'),
 Text(0.1, 0.4090909090909091, 'gini = 0.0\nsamples = 1\nvalue = [0, 1]'),
 Text(0.17142857142857143, 0.5909090909090909, 'x[7] <= 146.0\ngini = 0.498\nsamples = 34\nvalue = [18, 16]'),
 Text(0.14285714285714285, 0.5, 'x[3] <= 115.0\ngini = 0.219\nsamples = 16\nvalue = [14, 2]'),
 Text(0.12857142857142856, 0.4090909090909091, 'gini = 0.0\nsamples = 2\nvalue = [0, 2]'),
 Text(0.15714285714285714, 0.4090909090909091, 'gini = 0.0\nsamples = 14\nvalue = [14, 0]'),
 Text(0.2, 0.5, 'x[9] <= 0.8\ngini = 0.346\nsamples = 18\nvalue = [4, 14]'),
 Text(0.18571428571428572, 0.4090909090909091, 'gini = 0.0\nsamples = 12\nvalue = [0, 12]'),
 Text(0.21428571428571427, 0.4090909090909091, 'x[7] <= 151.0\ngini = 0.444\nsamples = 6\nvalue = [4, 2]'),
 Text(0.2, 0.3181818181818182, 'gini = 0.0\nsamples = 2\nvalue = [0, 2]'),
 Text(0.22857142857142856, 0.3181818181818182, 'gini = 0.0\nsamples = 4\nvalue = [4, 0]'),
 Text(0.2857142857142857, 0.6818181818181818, 'x[9] <= 0.65\ngini = 0.248\nsamples = 69\nvalue = [59, 10]'),
 Text(0.2714285714285714, 0.5909090909090909, 'x[4] <= 237.5\ngini = 0.496\nsamples = 22\nvalue = [12, 10]'),
 Text(0.2571428571428571, 0.5, 'x[0] <= 42.0\ngini = 0.355\nsamples = 13\nvalue = [3, 10]'),
 Text(0.24285714285714285, 0.4090909090909091, 'gini = 0.0\nsamples = 3\nvalue = [3, 0]'),
 Text(0.2714285714285714, 0.4090909090909091, 'gini = 0.0\nsamples = 10\nvalue = [0, 10]'),
 Text(0.2857142857142857, 0.5, 'gini = 0.0\nsamples = 9\nvalue = [9, 0]'),
 Text(0.3, 0.5909090909090909, 'gini = 0.0\nsamples = 47\nvalue = [47, 0]'),
 Text(0.37857142857142856, 0.7727272727272727, 'x[3] <= 109.0\ngini = 0.139\nsamples = 186\nvalue = [172, 14]'),
 Text(0.34285714285714286, 0.6818181818181818, 'x[4] <= 233.5\ngini = 0.497\nsamples = 13\nvalue = [7, 6]'),
 Text(0.32857142857142857, 0.5909090909090909, 'gini = 0.0\nsamples = 6\nvalue = [0, 6]'),
 Text(0.35714285714285715, 0.5909090909090909, 'gini = 0.0\nsamples = 7\nvalue = [7, 0]'),
 Text(0.4142857142857143, 0.6818181818181818, 'x[4] <= 301.5\ngini = 0.088\nsamples = 173\nvalue = [165, 8]'),
 Text(0.38571428571428573, 0.5909090909090909, 'x[7] <= 105.5\ngini = 0.041\nsamples = 145\nvalue = [142, 3]'),
 Text(0.37142857142857144, 0.5, 'x[9] <= 0.6\ngini = 0.266\nsamples = 19\nvalue = [16, 3]'),
 Text(0.35714285714285715, 0.4090909090909091, 'gini = 0.0\nsamples = 3\nvalue = [0, 3]'),
 Text(0.38571428571428573, 0.4090909090909091, 'gini = 0.0\nsamples = 16\nvalue = [16, 0]'),
 Text(0.4, 0.5, 'gini = 0.0\nsamples = 126\nvalue = [126, 0]'),
 Text(0.44285714285714284, 0.5909090909090909, 'x[4] <= 303.5\ngini = 0.293\nsamples = 28\nvalue = [23, 5]'),
 Text(0.42857142857142855, 0.5, 'gini = 0.0\nsamples = 5\nvalue = [0, 5]'),
 Text(0.45714285714285713, 0.5, 'gini = 0.0\nsamples = 23\nvalue = [23, 0]'),
 Text(0.8071428571428572, 0.8636363636363636, 'x[9] <= 1.95\ngini = 0.35\nsamples = 371\nvalue = [84, 287]'),
 Text(0.6571428571428571, 0.7727272727272727, 'x[0] <= 55.5\ngini = 0.28\nsamples = 333\nvalue = [56, 277]'),
 Text(0.5357142857142857, 0.6818181818181818, 'x[3] <= 182.0\ngini = 0.12\nsamples = 202\nvalue = [13, 189]'),
 Text(0.5214285714285715, 0.5909090909090909, 'x[4] <= 153.0\ngini = 0.095\nsamples = 199\nvalue = [10, 189]'),
 Text(0.4857142857142857, 0.5, 'x[11] <= 1.5\ngini = 0.444\nsamples = 3\nvalue = [2, 1]'),
 Text(0.4714285714285714, 0.4090909090909091, 'gini = 0.0\nsamples = 1\nvalue = [0, 1]'),
 Text(0.5, 0.4090909090909091, 'gini = 0.0\nsamples = 2\nvalue = [2, 0]'),
 Text(0.5571428571428572, 0.5, 'x[3] <= 111.0\ngini = 0.078\nsamples = 196\nvalue = [8, 188]'),
 Text(0.5285714285714286, 0.4090909090909091, 'x[10] <= 0.5\ngini = 0.32\nsamples = 35\nvalue = [7, 28]'),
 Text(0.5142857142857142, 0.3181818181818182, 'gini = 0.0\nsamples = 3\nvalue = [3, 0]'),
 Text(0.5428571428571428, 0.3181818181818182, 'x[2] <= 2.5\ngini = 0.219\nsamples = 32\nvalue = [4, 28]'),
 Text(0.5285714285714286, 0.22727272727272727, 'x[4] <= 239.0\ngini = 0.124\nsamples = 30\nvalue = [2, 28]'),
 Text(0.5142857142857142, 0.13636363636363635, 'gini = 0.0\nsamples = 23\nvalue = [0, 23]'),
 Text(0.5428571428571428, 0.13636363636363635, 'x[0] <= 50.5\ngini = 0.408\nsamples = 7\nvalue = [2, 5]'),
 Text(0.5285714285714286, 0.045454545454545456, 'gini = 0.0\nsamples = 2\nvalue = [2, 0]'),
 Text(0.5571428571428572, 0.045454545454545456, 'gini = 0.0\nsamples = 5\nvalue = [0, 5]'),
 Text(0.5571428571428572, 0.22727272727272727, 'gini = 0.0\nsamples = 2\nvalue = [2, 0]'),
 Text(0.5857142857142857, 0.4090909090909091, 'x[12] <= 2.5\ngini = 0.012\nsamples = 161\nvalue = [1, 160]'),
 Text(0.5714285714285714, 0.3181818181818182, 'gini = 0.0\nsamples = 144\nvalue = [0, 144]'),
 Text(0.6, 0.3181818181818182, 'x[11] <= 0.5\ngini = 0.111\nsamples = 17\nvalue = [1, 16]'),
 Text(0.5857142857142857, 0.22727272727272727, 'gini = 0.0\nsamples = 16\nvalue = [0, 16]'),
 Text(0.6142857142857143, 0.22727272727272727, 'gini = 0.0\nsamples = 1\nvalue = [1, 0]'),
 Text(0.55, 0.5909090909090909, 'gini = 0.0\nsamples = 3\nvalue = [3, 0]'),
 Text(0.7785714285714286, 0.6818181818181818, 'x[4] <= 245.5\ngini = 0.441\nsamples = 131\nvalue = [43, 88]'),
 Text(0.6785714285714286, 0.5909090909090909, 'x[11] <= 0.5\ngini = 0.278\nsamples = 66\nvalue = [11, 55]'),
 Text(0.6285714285714286, 0.5, 'x[0] <= 65.5\ngini = 0.091\nsamples = 42\nvalue = [2, 40]'),
 Text(0.6142857142857143, 0.4090909090909091, 'gini = 0.0\nsamples = 34\nvalue = [0, 34]'),
 Text(0.6428571428571429, 0.4090909090909091, 'x[7] <= 146.5\ngini = 0.375\nsamples = 8\nvalue = [2, 6]'),
 Text(0.6285714285714286, 0.3181818181818182, 'gini = 0.0\nsamples = 6\nvalue = [0, 6]'),
 Text(0.6571428571428571, 0.3181818181818182, 'gini = 0.0\nsamples = 2\nvalue = [2, 0]'),
 Text(0.7285714285714285, 0.5, 'x[0] <= 57.5\ngini = 0.469\nsamples = 24\nvalue = [9, 15]'),
 Text(0.7, 0.4090909090909091, 'x[6] <= 0.5\ngini = 0.32\nsamples = 10\nvalue = [8, 2]'),
 Text(0.6857142857142857, 0.3181818181818182, 'gini = 0.0\nsamples = 8\nvalue = [8, 0]'),
 Text(0.7142857142857143, 0.3181818181818182, 'gini = 0.0\nsamples = 2\nvalue = [0, 2]'),
 Text(0.7571428571428571, 0.4090909090909091, 'x[4] <= 212.0\ngini = 0.133\nsamples = 14\nvalue = [1, 13]'),
 Text(0.7428571428571429, 0.3181818181818182, 'x[1] <= 0.5\ngini = 0.375\nsamples = 4\nvalue = [1, 3]'),
 Text(0.7285714285714285, 0.22727272727272727, 'gini = 0.0\nsamples = 3\nvalue = [0, 3]'),
 Text(0.7571428571428571, 0.22727272727272727, 'gini = 0.0\nsamples = 1\nvalue = [1, 0]'),
 Text(0.7714285714285715, 0.3181818181818182, 'gini = 0.0\nsamples = 10\nvalue = [0, 10]'),
 Text(0.8785714285714286, 0.5909090909090909, 'x[1] <= 0.5\ngini = 0.5\nsamples = 65\nvalue = [32, 33]'),
 Text(0.8428571428571429, 0.5, 'x[11] <= 1.5\ngini = 0.239\nsamples = 36\nvalue = [5, 31]'),
 Text(0.8142857142857143, 0.4090909090909091, 'x[7] <= 109.0\ngini = 0.117\nsamples = 32\nvalue = [2, 30]'),
 Text(0.8, 0.3181818181818182, 'gini = 0.0\nsamples = 2\nvalue = [2, 0]'),
 Text(0.8285714285714286, 0.3181818181818182, 'gini = 0.0\nsamples = 30\nvalue = [0, 30]'),
 Text(0.8714285714285714, 0.4090909090909091, 'x[4] <= 310.5\ngini = 0.375\nsamples = 4\nvalue = [3, 1]'),
 Text(0.8571428571428571, 0.3181818181818182, 'gini = 0.0\nsamples = 1\nvalue = [0, 1]'),
 Text(0.8857142857142857, 0.3181818181818182, 'gini = 0.0\nsamples = 3\nvalue = [3, 0]'),
 Text(0.9142857142857143, 0.5, 'x[3] <= 119.0\ngini = 0.128\nsamples = 29\nvalue = [27, 2]'),
 Text(0.9, 0.4090909090909091, 'gini = 0.0\nsamples = 2\nvalue = [0, 2]'),
 Text(0.9285714285714286, 0.4090909090909091, 'gini = 0.0\nsamples = 27\nvalue = [27, 0]'),
```

```
Text(0.9571428571428572, 0.7727272727272727, 'x[10] <= 0.5\ngini = 0.388\nsamples = 38\nvalue = [28, 10]'),


Text(0.9571428571428572, 0.5909090909090909, 'x[7] <= 175.0\ngini = 0.444\nsamples = 3\nvalue = [2, 1]'),
Text(0.94428571428571428, 0.5, 'gini = 0.0\nsamples = 1\nvalue = [0, 1]'),
Text(0.9714285714285714, 0.5, 'gini = 0.0\nsamples = 2\nvalue = [2, 0]'),
Text(0.9857142857142858, 0.5909090909090909, 'gini = 0.0\nsamples = 26\nvalue = [26, 0]')]
```
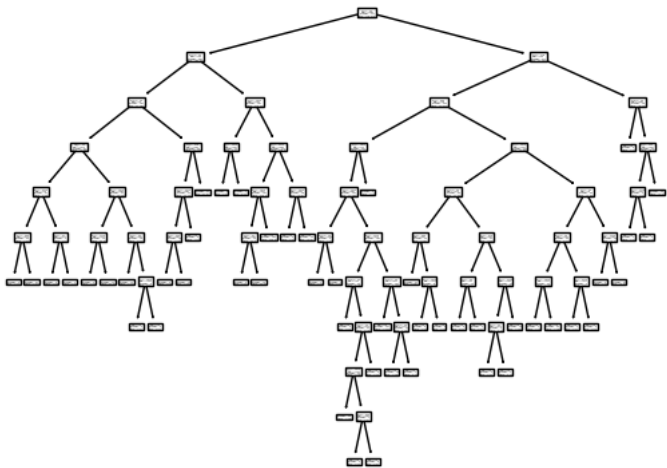

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