```
In [3]: import sklearn
         import numpy as np
         from sklearn import datasets
         from sklearn.datasets import make_classification
 In [4]: | X, y = make_classification(n_samples=100, n_features=2, n_classes=3,
                              n redundant=0, n informative=2,
                              n clusters per class=1, random state=0)
 In [7]: import matplotlib.pyplot as plt
         colors = np.array(["blue", "orange", "pink"])
         plt.scatter(X[:,0], X[:, 1], color=colors[y])
         <matplotlib.collections.PathCollection at 0x7f351b0d1f10>
 Out[7]:
           3
           2
           1
                                                                         0
          ^{-1}
          -2
                                                           2
               -3
                       -2
                                -1
                                                  1
                                                                   3
                                         0
 In [9]: from sklearn.model_selection import train_test_split
         X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.2, random_state=0)
In [12]: from sklearn.tree import DecisionTreeClassifier
         dt = DecisionTreeClassifier(max_leaf_nodes=10)
         dt.fit(X train, y train)
Out[12]:
                    DecisionTreeClassifier
         DecisionTreeClassifier(max_leaf_nodes=10)
In [13]:
         dt.score(X_test, y_test)
         0.65
Out[13]:
In [14]:
        dt.get depth()
Out[14]:
In [16]: dt.predict proba(X test[-2:])
```

```
array([[0.16666667, 0.
                                                    , 0.83333333],
Out[16]:
                      [1.
                                  , 0.
                                                      , 0.
In [18]: from sklearn import tree
             tree.plot_tree(dt)
             plt.show()
                                          x[0] <= -0.594
                                          gini = 0.665
                                          samples = 80
                                         value = [28, 24, 28]
                       x[1] \le -0.492
                                                            x[1] \le 0.071
                        gini = 0.159
                                                              gini = 0.6
                                                            samples = 57
                       samples = 23
                      value = [21, 0, 2]
                                                           value = [7, 24, 26]
                                             x[1] <= -1.372
gini = 0.442
                                                                           x[0] <= 0.758
gini = 0.368
                 gini = 0.0
                                gini = 0.0
                               samples = 21
                 samples = 2
                                              samples = 35
                                                                           samples = 22
               value = [0, 0, 2]
                              value = [21, 0, 0]
                                             value = [3, 7, 25]
                                                                          value = [4, 17, 1]
                                                                                  x[0] \le 2.613
                                                     x[0] \le 0.621
                                       gini = 0.133
                                                                     gini = 0.0
                                                                                   gini = 0.194
                                                     gini = 0.553
                                                                    samples = 3
                                      samples = 14
                                                                                  samples = 19
                                                     samples = 21
                                     value = [1, 0, 13]
                                                                   value = [3, 0, 0]
                                                    value = [2, 7, 12]
                                                                                 value = [1, 17, 1]
                                                            x[0] <= 1.029
gini = 0.56
                                              gini = 0.278
                                                                           gini = 0.105
                                                                                           gini = 0.0
                                              samples = 6
                                                                           samples = 18
                                                                                          samples = 1
                                                            samples = 15
                                                                          value = [1, 17, 0]
                                             value = [1, 0, 5]
                                                                                         value = [0, 0, 1]
                                                           value = [1, 7, 7]
                                                                   x[1] <= -1.088
                                                      aini = 0.0
                                                                     gini = 0.46
                                                     samples = 5
                                                                    samples = 10
                                                     value = [0, 5, 0]
                                                                   value = [1, 2, 7]
                                                                           gini = 0.219
                                                              gini = 0.0
                                                           samples = 2
value = [0, 2, 0]
                                                                          samples = 8
value = [1, 0, 7]
In [19]: tr = dt.tree_ j# tree object
In [23]: # root node 0
             tr.feature[0], tr.threshold[0], tr.impurity[0], tr.value[0]
             (0, -0.5935284197330475, 0.665, array([[28., 24., 28.]]))
Out[23]:
In [25]: # left child of root node 0
             left child index = tr.children left[0]
             tr.threshold[left child index]
             -0.4916086085140705
Out[25]:
In [26]: dt.feature_importances_
             array([0.58489068, 0.41510932])
Out[26]:
In [27]:
             from sklearn.ensemble import RandomForestClassifier
             rf = RandomForestClassifier(n estimators=3, random state=0, max features=1)
             rf.fit(X_train, y_train)
Out[27]:
                                                  RandomForestClassifier
             RandomForestClassifier(max_features=1, n_estimators=3, random_state=0)
In [28]:
             param grid = [
                   {"n estimators": np.arange(1,10),
                    "max features": [1,2]}
             ]
```