In [1]:
```
# Predicting Survival in the Titanic Data Set
# We will be using a decision tree to make predictions about the Titanic data
 set from
# Kaggle. This data set provides information on the Titanic passengers and can
be used to
# predict whether a passenger survived or not.
# Loading Data and modules
# import numpy as np
# import pandas as pd
# import seaborn as sb
# import matplotlib.pyplot as plt
# import sklearn
# from pandas import Series, DataFrame
# from pylab import rcParams
# from sklearn import preprocessing
# from sklearn.linear_model import LogisticRegression
# from sklearn.cross_validation import train_test_split
# from sklearn import metrics
# from sklearn.metrics import classification_report
# Url= https://raw.githubusercontent.com/BigDataGal/Python-for-DataScience/mas
ter/titanic-train.csv
# titanic = pd.read_csv(url)
# titanic.columns =
# ['PassengerId','Survived','Pclass','Name','Sex','Age','SibSp','Parch','Ticke
t','Fare','Cabin','E
# mbarked']
# You use only Pclass, Sex, Age, SibSp (Siblings aboard), Parch (Parents/child
ren aboard),
# and Fare to predict whether a passenger survived.
```

In [2]:
```
import numpy as np
import pandas as pd
import seaborn as sb
import matplotlib.pyplot as plt
import pydotplus
from IPython.display import Image, display
from sklearn import tree
from sklearn.tree import DecisionTreeClassifier
from sklearn.model_selection import train_test_split
from sklearn.model_selection import cross_val_score
from sklearn.model_selection import cross_val_predict
from sklearn.model_selection import GridSearchCV
from sklearn import metrics
import warnings
warnings.filterwarnings('ignore')
```

In [3]:
```
titanic = pd.read_csv('https://raw.githubusercontent.com/BigDataGal/Python-for
-Data-Science/master/titanic-train.csv')
```

In [4]:
```
titanic.head()
```

Out[4]:

| | PassengerId | Survived | Pclass | Name | Sex | Age | SibSp | Parch | Ticket | Fare | C |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **0** | 1 | 0 | 3 | Braund, Mr. Owen Harris | male | 22.0 | 1 | 0 | A/5 21171 | 7.2500 | |
| **1** | 2 | 1 | 1 | Cumings, Mrs. John Bradley (Florence Briggs Th... | female | 38.0 | 1 | 0 | PC 17599 | 71.2833 | |
| **2** | 3 | 1 | 3 | Heikkinen, Miss. Laina | female | 26.0 | 0 | 0 | STON/O2. 3101282 | 7.9250 | |
| **3** | 4 | 1 | 1 | Futrelle, Mrs. Jacques Heath (Lily May Peel) | female | 35.0 | 1 | 0 | 113803 | 53.1000 | C |
| **4** | 5 | 0 | 3 | Allen, Mr. William Henry | male | 35.0 | 0 | 0 | 373450 | 8.0500 | |

In [5]:
```
print("Shape:", titanic.shape)
print("Size:", titanic.size)
```

```
Shape: (891, 12)
Size: 10692
```

In [6]:
```
print("Null Error Rate:", format(titanic['Survived'].mean() * 100, '.2f'), '%'
)
print('The overall probability of survival is less')
```

```
Null Error Rate: 38.38 %
The overall probability of survival is less
```

In [7]:
```
titanic.groupby('Pclass').mean()
```

Out[7]:

| Pclass | PassengerId | Survived | Age | SibSp | Parch | Fare |
|---|---|---|---|---|---|---|
| **1** | 461.597222 | 0.629630 | 38.233441 | 0.416667 | 0.356481 | 84.154687 |
| **2** | 445.956522 | 0.472826 | 29.877630 | 0.402174 | 0.380435 | 20.662183 |
| **3** | 439.154786 | 0.242363 | 25.140620 | 0.615071 | 0.393075 | 13.675550 |

In [8]:
```
print('Probability of survival is high for 1st class passengers (63%) compared to those in 2nd class (47%) and 3rd class (24%)')
```

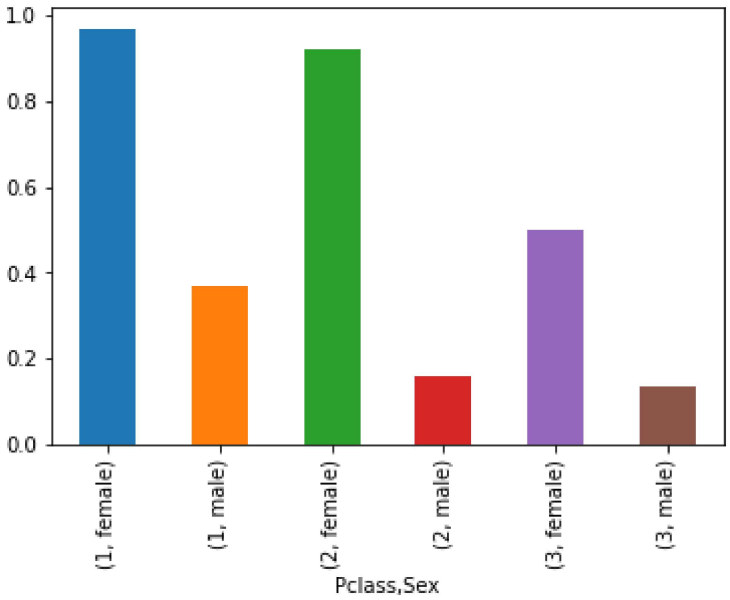
```
Probability of survival is high for 1st class passengers (63%) compared to th
ose in 2nd class (47%) and 3rd class (24%)
```

In [9]:
```
class_sex_grouping = titanic.groupby(['Pclass','Sex']).mean()
class_sex_grouping
```

Out[9]:

| | | PassengerId | Survived | Age | SibSp | Parch | Fare |
|---|---|---|---|---|---|---|---|
| **Pclass** | **Sex** | | | | | | |
| **1** | **female** | 469.212766 | 0.968085 | 34.611765 | 0.553191 | 0.457447 | 106.125798 |
| | **male** | 455.729508 | 0.368852 | 41.281386 | 0.311475 | 0.278689 | 67.226127 |
| **2** | **female** | 443.105263 | 0.921053 | 28.722973 | 0.486842 | 0.605263 | 21.970121 |
| | **male** | 447.962963 | 0.157407 | 30.740707 | 0.342593 | 0.222222 | 19.741782 |
| **3** | **female** | 399.729167 | 0.500000 | 21.750000 | 0.895833 | 0.798611 | 16.118810 |
| | **male** | 455.515850 | 0.135447 | 26.507589 | 0.498559 | 0.224784 | 12.661633 |

In [10]:
```
class_sex_grouping['Survived'].plot.bar()
plt.show()
```




In [11]:
```
print('Females are likely to survive more in each class')
```

```
Females are likely to survive more in each class
```

In [12]:
```
# Data Preparation
# We use only Pclass, Sex, Age, SibSp (Siblings aboard), Parch (Parents/childr
en aboard), and Fare to predict whether
# a passenger survived.
titanic = titanic[['Pclass', 'Sex', 'Age', 'SibSp', 'Parch', 'Fare', 'Survive
d']]
```

In [13]:
```
titanic.isnull().any()
```

Out[13]:
```
Pclass      False
Sex         False
Age          True
SibSp       False
Parch       False
Fare        False
Survived    False
dtype: bool
```

In [14]:
```
titanic.Age.describe()
```

Out[14]:
```
count    714.000000
mean      29.699118
std       14.526497
min        0.420000
25%       20.125000
50%       28.000000
75%       38.000000
max       80.000000
Name: Age, dtype: float64
```

In [15]:
```
# Substitute NANs in age column
titanic["Age"].fillna(titanic["Age"].mean(),inplace=True)
```

In [16]:
```
# Counting the passengers on basis of gender
titanic.Sex.value_counts()
```

Out[16]:
```
male      577
female    314
Name: Sex, dtype: int64
```

In [17]:
```
# Mapping Sex
titanic['Sex'] = titanic['Sex'].map( {'female': 0, 'male': 1} ).astype(int)
```

In [18]:
```
# The columns that we will be making predictions with
X = titanic[['Pclass', 'Sex', 'Age', 'SibSp', 'Parch', 'Fare']]

#The column that we will be making predictions on
y = titanic['Survived']
```

In [19]:
```
### Split data randomly into 70% training and 30% test ###
X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.3, rando
m_state=0)
```

In [20]:
```
model2 = DecisionTreeClassifier()
model2.fit(X_train, y_train)
```

Out[20]:
```
DecisionTreeClassifier(class_weight=None, criterion='gini', max_depth=None,
            max_features=None, max_leaf_nodes=None,
            min_impurity_decrease=0.0, min_impurity_split=None,
            min_samples_leaf=1, min_samples_split=2,
            min_weight_fraction_leaf=0.0, presort=False, random_state=None,
            splitter='best')
```

In [29]:
```
predicted = model2.predict(X_test)
print ("Accuracy for test data set:",format(metrics.accuracy_score(y_test, pre
dicted) * 100,'.2f'), '%.')
```

```
Accuracy for test data set: 81.34 %.
```

In [30]:
```
param_test1 = {
 'max_depth': range(2, 5),
 'min_samples_split': [2, 3, 5],
 'min_samples_leaf': [1, 2, 3]
}

grid_result = GridSearchCV(DecisionTreeClassifier(), param_grid=param_test1, c
v=10, n_jobs=-1, verbose=1)
grid_result.fit(X_train, y_train)

print("Best: %f using %s" % (grid_result.best_score_, grid_result.best_params_
))
```

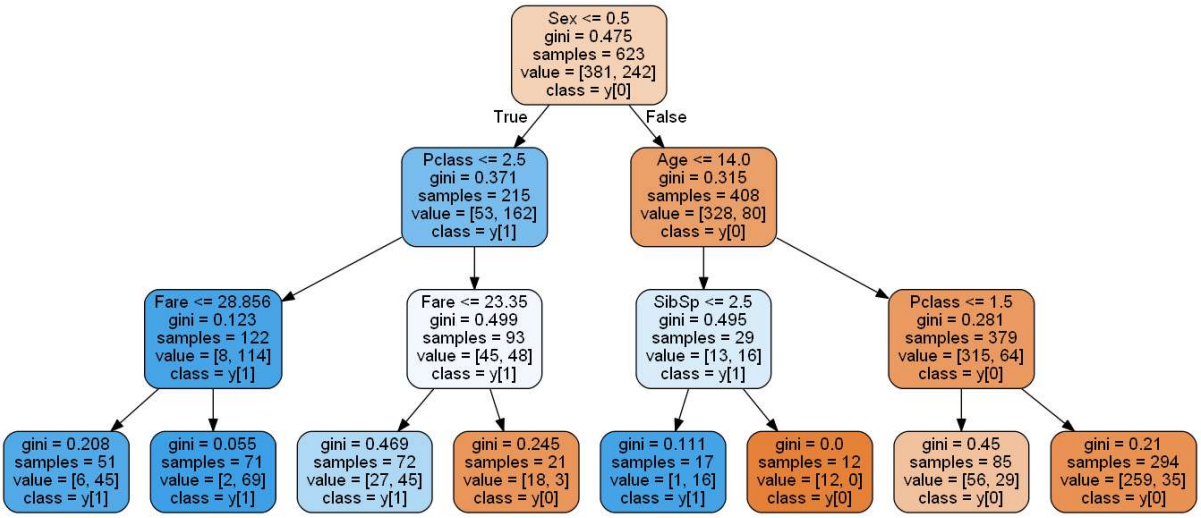
```
Fitting 10 folds for each of 27 candidates, totalling 270 fits

[Parallel(n_jobs=-1)]: Using backend LokyBackend with 8 concurrent workers.

Best: 0.820225 using {'max_depth': 3, 'min_samples_leaf': 3, 'min_samples_spl
it': 2}

[Parallel(n_jobs=-1)]: Done 270 out of 270 | elapsed:    0.2s finished
```

In [33]:
```
predicted = grid_result.predict(X_test)
print ("Accuracy for test data set:",format(metrics.accuracy_score(y_test, pre
dicted) * 100,'.2f'), '%.')
```

```
Accuracy for test data set: 82.46 %.
```

In [34]:
```
dot_data = tree.export_graphviz(grid_result.best_estimator_, out_file=None, fi
lled=True, rounded=True,
                                feature_names=['Pclass', 'Sex', 'Age', 'SibSp'
, 'Parch', 'Fare'],
                                class_names=True)
graph = pydotplus.graph_from_dot_data(dot_data)
```

In [35]:
```
display(Image(graph.create_png()))
```




In [36]:
```
# Lets predict the chances of survival for a 3 year old boy travelling in seco
nd class with parents
grid_result.predict_proba(np.array([[2, 1, 3, 0, 2, 0.0]]))
```

Out[36]:
```
array([[0.05882353, 0.94117647]])
```

In [38]:
```
print('Probability of the boy surviving is 94%')
```

```
Probability of the boy surviving is 94%
```