In [2]:
```
#imports:
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
import seaborn as sns
%matplotlib inline
```

In [3]:
```
titanic = pd.read_csv("titanic.csv")
titanic.head()
```

Out[3]:

	PassengerId	Survived	Pclass	Name	Sex	Age	SibSp	Parch	Ticket	Fare	Cabin	Embarked
0	1	0	3	Braund, Mr. Owen Harris	male	22.0	1	0	A/5 21171	7.2500	NaN	S
1	2	1	1	Cumings, Mrs. John Bradley (Florence Briggs Th...	female	38.0	1	0	PC 17599	71.2833	C85	C
2	3	1	3	Heikkinen, Miss. Laina	female	26.0	0	0	STON/O2. 3101282	7.9250	NaN	S
3	4	1	1	Futrelle, Mrs. Jacques Heath (Lily May Peel)	female	35.0	1	0	113803	53.1000	C123	S
4	5	0	3	Allen, Mr. William Henry	male	35.0	0	0	373450	8.0500	NaN	S

In [4]:
```
#distribution of numerical columns
titanic.describe()
```

Out[4]:

	PassengerId	Survived	Pclass	Age	SibSp	Parch	Fare
count	891.000000	891.000000	891.000000	714.000000	891.000000	891.000000	891.000000
mean	446.000000	0.383838	2.308642	29.699118	0.523008	0.381594	32.204208
std	257.353842	0.486592	0.836071	14.526497	1.102743	0.806057	49.693429
min	1.000000	0.000000	1.000000	0.420000	0.000000	0.000000	0.000000
25%	223.500000	0.000000	2.000000	20.125000	0.000000	0.000000	7.910400
50%	446.000000	0.000000	3.000000	28.000000	0.000000	0.000000	14.454200
75%	668.500000	1.000000	3.000000	38.000000	1.000000	0.000000	31.000000
max	891.000000	1.000000	3.000000	80.000000	8.000000	6.000000	512.329200

In [5]:
```
titanic.Survived.unique()
```

Out[5]:
```
array([0, 1], dtype=int64)
```

In [6]:
```
# Survived column has two values. 0 means that the person did not survive. 1 --> Survived
```

In [7]:
```
titanic.Pclass.unique()
```

Out[7]:
```
array([3, 1, 2], dtype=int64)
```

In [8]:
```
#Pclass is the ticket class. It has 3 classes. 1st, 2nd and 3rd.
```

In [9]:
```
#SibSp --> Number of siblings/Spouses.
#Parch --> Number of parents/Children.
#fare --> Ticket price.
#cabin --> cabin number.
```

In [10]:
```
titanic.Embarked.unique()
```

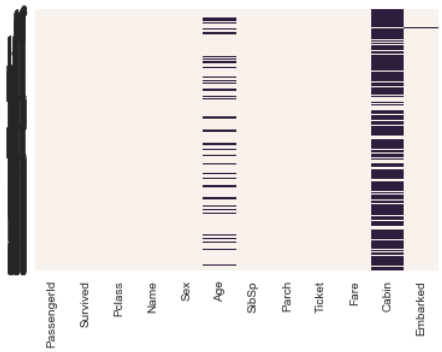
Out[10]:
```
array(['S', 'C', 'Q', nan], dtype=object)
```

In [11]:
```
#embarked --> place of boarding
#C = Cherbourg, Q = Queenstown, S = Southampton
```

In [12]:
```
#check missing values
```

In [13]:
```
sns.heatmap(titanic.isnull(), cbar=False )
```

Out[13]:
```
<matplotlib.axes._subplots.AxesSubplot at 0x247549477b8>
```



In [14]:
```
#we can see that cabin has mostly missing values and in age some values are missing.
```

In [15]:
```
titanic.shape
```

Out[15]:
```
(891, 12)
```

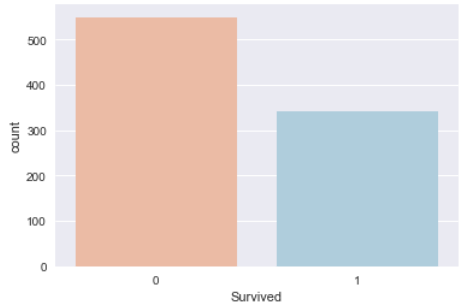
In [16]:
```
#it has 891 rows and 12 columns
```

In [17]:
```
titanic.isnull().sum()
```

Out[17]:
```
PassengerId      0
Survived         0
Pclass           0
Name             0
Sex              0
Age            177
SibSp            0
Parch            0
Ticket           0
Fare             0
Cabin          687
Embarked         2
dtype: int64
```

In [18]:
```
sns.countplot( titanic.Survived , palette = "RdBu")
```

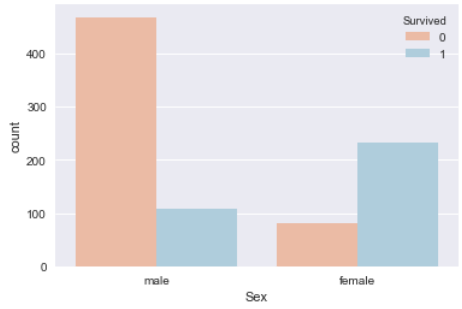
Out[18]:
```
<matplotlib.axes._subplots.AxesSubplot at 0x24756834358>
```



In [19]:
```
#Around 550 did not survive and around 350 survived
```

In [20]:
```
sns.countplot(titanic.Sex, hue=titanic.Survived , palette = "RdBu")
```

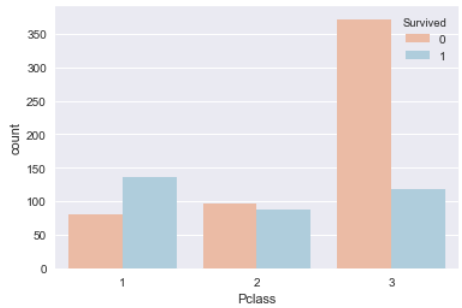
Out[20]:
```
<matplotlib.axes._subplots.AxesSubplot at 0x247567e1e10>
```



In [21]:
```
#we can observe that survival rate of female is higher than male.
```

In [22]:
```
sns.countplot(titanic.Pclass, hue=titanic.Survived , palette = "RdBu")
```

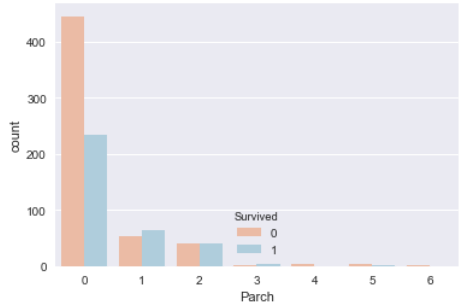
Out[22]:
```
<matplotlib.axes._subplots.AxesSubplot at 0x2475671d630>
```



In [23]:
```
#many people from class 3 did not survive.
#titanic[['Pclass', 'Survived']].groupby(['Pclass'], as_index=False).count().sort_values(by='Survived', ascending=False)
```

In [24]:
```
sns.countplot(titanic.Parch, hue=titanic.Survived , palette = "RdBu")
```

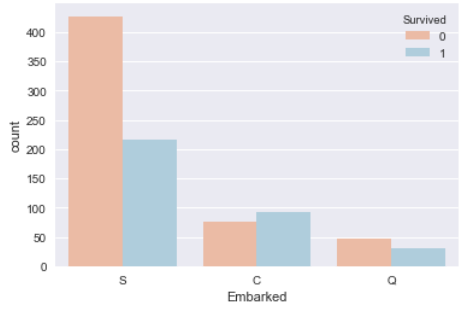
Out[24]:
```
<matplotlib.axes._subplots.AxesSubplot at 0x247562f2080>
```



In [25]:
```
#there were many singles/ couples without children travelling.
```

In [26]:
```
sns.countplot(titanic.Embarked, hue=titanic.Survived , palette = "RdBu")
```

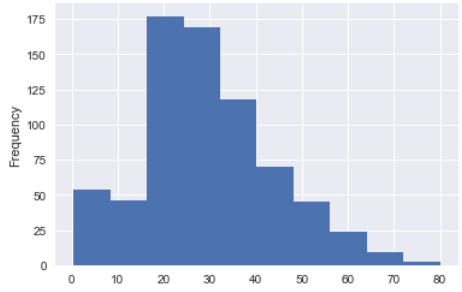
Out[26]:
```
<matplotlib.axes._subplots.AxesSubplot at 0x247561f44a8>
```



In [27]:
```
#there is some slight correlation between Embarked and Survived columns. We shall keep this for training our model
```

In [28]:
```
titanic.Age.plot.hist()
#pandas built in visualization
```

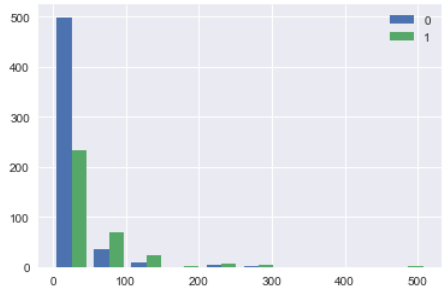
Out[28]:
```
<matplotlib.axes._subplots.AxesSubplot at 0x24755fc0710>
```



In [29]:
```
#most passengers had age in the range 20 to 40
```

In [30]:
```
Survived = titanic.Survived.unique()
plt.hist([titanic.loc[titanic.Survived == x, 'Fare'] for x in Survived], label=Survived)
plt.legend()
```

Out[30]:
```
<matplotlib.legend.Legend at 0x2475659bfd0>
```



In [31]:
```
#most people had paid less Fare. The chances of survival was high for those who paid higer fare.
```

In [32]:
```
#filling out missing data
```

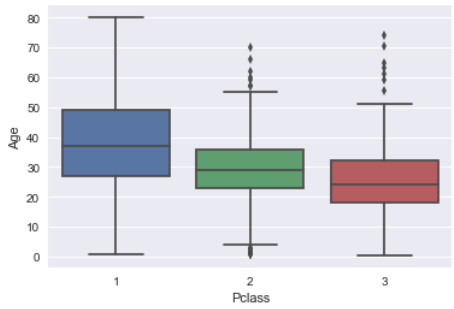
In [33]:
```
#Age
```

In [34]:
```
titanic.Age.mean()
```

Out[34]:
```
29.69911764705882
```

In [35]:
```
sns.boxplot(x=titanic.Pclass,y=titanic.Age)
```

Out[35]:
```
<matplotlib.axes._subplots.AxesSubplot at 0x24755ca7a90>
```



In [36]:
```
#titanic.loc[titanic.Pclass == 1].loc[titanic.Age.isnull()]
titanic.loc[(titanic.Pclass == 1) & (titanic.Age.isnull())]
```

Out[36]:

	PassengerId	Survived	Pclass	Name	Sex	Age	SibSp	Parch	Ticket	Fare	Cabin	Embarked
31	32	1	1	Spencer, Mrs. William Augustus (Marie Eugenie)	female	NaN	1	0	PC 17569	146.5208	B78	C
55	56	1	1	Woolner, Mr. Hugh	male	NaN	0	0	19947	35.5000	C52	S
64	65	0	1	Stewart, Mr. Albert A	male	NaN	0	0	PC 17605	27.7208	NaN	C
166	167	1	1	Chibnall, Mrs. (Edith Martha Bowerman)	female	NaN	0	1	113505	55.0000	E33	S
168	169	0	1	Baumann, Mr. John D	male	NaN	0	0	PC 17318	25.9250	NaN	S
185	186	0	1	Rood, Mr. Hugh Roscoe	male	NaN	0	0	113767	50.0000	A32	S
256	257	1	1	Thorne, Mrs. Gertrude Maybelle	female	NaN	0	0	PC 17585	79.2000	NaN	C
270	271	0	1	Cairns, Mr. Alexander	male	NaN	0	0	113798	31.0000	NaN	S
284	285	0	1	Smith, Mr. Richard William	male	NaN	0	0	113056	26.0000	A19	S
295	296	0	1	Lewy, Mr. Ervin G	male	NaN	0	0	PC 17612	27.7208	NaN	C
298	299	1	1	Saalfeld, Mr. Adolphe	male	NaN	0	0	19988	30.5000	C106	S
306	307	1	1	Fleming, Miss. Margaret	female	NaN	0	0	17421	110.8833	NaN	C
334	335	1	1	Frauenthal, Mrs. Henry William (Clara Heinshei...	female	NaN	1	0	PC 17611	133.6500	NaN	S
351	352	0	1	Williams-Lambert, Mr. Fletcher Fellows	male	NaN	0	0	113510	35.0000	C128	S
375	376	1	1	Meyer, Mrs. Edgar Joseph (Leila Saks)	female	NaN	1	0	PC 17604	82.1708	NaN	C
457	458	1	1	Kenyon, Mrs. Frederick R (Marion)	female	NaN	1	0	17464	51.8625	D21	S
475	476	0	1	Clifford, Mr. George Quincy	male	NaN	0	0	110465	52.0000	A14	S
507	508	1	1	Bradley, Mr. George ("George Arthur Brayton")	male	NaN	0	0	111427	26.5500	NaN	S
527	528	0	1	Farthing, Mr. John	male	NaN	0	0	PC 17483	221.7792	C95	S
557	558	0	1	Robbins, Mr. Victor	male	NaN	0	0	PC 17757	227.5250	NaN	C
602	603	0	1	Harrington, Mr. Charles H	male	NaN	0	0	113796	42.4000	NaN	S
633	634	0	1	Parr, Mr. William Henry Marsh	male	NaN	0	0	112052	0.0000	NaN	S
669	670	1	1	Taylor, Mrs. Elmer Zebley (Juliet Cummins Wright)	female	NaN	1	0	19996	52.0000	C126	S
711	712	0	1	Klaber, Mr. Herman	male	NaN	0	0	113028	26.5500	C124	S
740	741	1	1	Hawksford, Mr. Walter James	male	NaN	0	0	16988	30.0000	D45	S
766	767	0	1	Brewe, Dr. Arthur Jackson	male	NaN	0	0	112379	39.6000	NaN	C
793	794	0	1	Hoyt, Mr. William Fisher	male	NaN	0	0	PC 17600	30.6958	NaN	C
815	816	0	1	Fry, Mr. Richard	male	NaN	0	0	112058	0.0000	B102	S
839	840	1	1	Marechal, Mr. Pierre	male	NaN	0	0	11774	29.7000	C47	C
849	850	1	1	Goldenberg, Mrs. Samuel L (Edwiga Grabowska)	female	NaN	1	0	17453	89.1042	C92	C

In [37]:
```
titanic.loc[(titanic.Pclass == 1) & (titanic.Age.isnull())] .shape
```

Out[37]:
```
(30, 12)
```

In [38]:
```
#So we have around 30 rows with missing age and PClass 1
#We shall fill them with age = 38
```

In [39]:
```
titanic.loc[(titanic.Pclass == 1) & (titanic.Age.isnull()) , 'Age'] = 38
```

In [40]:
```
titanic.loc[(titanic.Pclass == 1) & (titanic.Age.isnull())]
```

Out[40]:

	PassengerId	Survived	Pclass	Name	Sex	Age	SibSp	Parch	Ticket	Fare	Cabin	Embarked

In [41]:
```
titanic.loc[(titanic.Pclass == 2) & (titanic.Age.isnull())]
```

Out[41]:

	PassengerId	Survived	Pclass	Name	Sex	Age	SibSp	Parch	Ticket	Fare	Cabin	Embarked
17	18	1	2	Williams, Mr. Charles Eugene	male	NaN	0	0	244373	13.0000	NaN	S
181	182	0	2	Pernot, Mr. Rene	male	NaN	0	0	SC/PARIS 2131	15.0500	NaN	C
277	278	0	2	Parkes, Mr. Francis "Frank"	male	NaN	0	0	239853	0.0000	NaN	S
303	304	1	2	Keane, Miss. Nora A	female	NaN	0	0	226593	12.3500	E101	Q
413	414	0	2	Cunningham, Mr. Alfred Fleming	male	NaN	0	0	239853	0.0000	NaN	S
466	467	0	2	Campbell, Mr. William	male	NaN	0	0	239853	0.0000	NaN	S
481	482	0	2	Frost, Mr. Anthony Wood "Archie"	male	NaN	0	0	239854	0.0000	NaN	S
547	548	1	2	Padro y Manent, Mr. Julian	male	NaN	0	0	SC/PARIS 2146	13.8625	NaN	C
596	597	1	2	Leitch, Miss. Jessie Wills	female	NaN	0	0	248727	33.0000	NaN	S
674	675	0	2	Watson, Mr. Ennis Hastings	male	NaN	0	0	239856	0.0000	NaN	S
732	733	0	2	Knight, Mr. Robert J	male	NaN	0	0	239855	0.0000	NaN	S

In [42]:
```
#We will fill the missing ages with 29 here
```

In [43]:
```
titanic.loc[(titanic.Pclass == 2) & (titanic.Age.isnull()) , 'Age'] = 29
```

In [44]:
```
titanic.loc[(titanic.Pclass == 1) & (titanic.Age.isnull())]
```

Out[44]:

	PassengerId	Survived	Pclass	Name	Sex	Age	SibSp	Parch	Ticket	Fare	Cabin	Embarked

In [45]:
```
titanic.loc[(titanic.Pclass == 3) & (titanic.Age.isnull())].shape
```

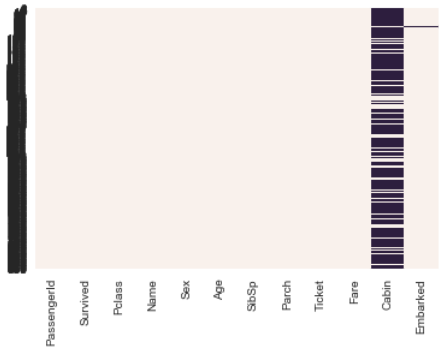
Out[45]:
```
(136, 12)
```

In [46]:
```
#136 rows. We will fill missing age with 25 for PClass 3
```

In [47]:
```
titanic.loc[(titanic.Pclass == 3) & (titanic.Age.isnull()) , 'Age'] = 25
```

In [48]:
```
sns.heatmap(titanic.isnull(), cbar=False )
```

Out[48]:
```
<matplotlib.axes._subplots.AxesSubplot at 0x2475490b748>
```



In [49]:
```
#Next we shall fill Embarked column
```

In [50]:
```
titanic.loc[titanic.Embarked.isnull()].shape
```

Out[50]:
```
(2, 12)
```

In [51]:
```
#Since there are only 2 missing values, we will replace with value having maxmimu records.
```

In [52]:
```
titanic.groupby('Embarked')['PassengerId'].nunique()
```

Out[52]:
```
Embarked
C    168
Q     77
S    644
Name: PassengerId, dtype: int64
```

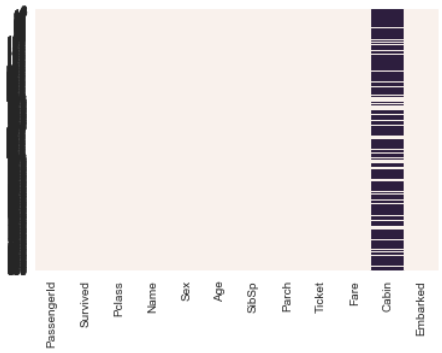
In [53]:
```
titanic.groupby('Embarked').size()
```

Out[53]:
```
Embarked
C    168
Q     77
S    644
dtype: int64
```

In [54]:
```
titanic.loc[titanic.Embarked.isnull(), 'Embarked'] = 'S'
```

In [55]:
```
sns.heatmap(titanic.isnull(), cbar=False )
```

Out[55]:
```
<matplotlib.axes._subplots.AxesSubplot at 0x2475890bbe0>
```



In [56]:
```
titanic.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 891 entries, 0 to 890
Data columns (total 12 columns):
PassengerId    891 non-null int64
Survived       891 non-null int64
Pclass         891 non-null int64
Name           891 non-null object
Sex            891 non-null object
Age            891 non-null float64
SibSp          891 non-null int64
Parch          891 non-null int64
Ticket         891 non-null object
Fare           891 non-null float64
Cabin          204 non-null object
Embarked       891 non-null object
dtypes: float64(2), int64(5), object(5)
memory usage: 83.6+ KB
```

In [57]:
```
#We shall drop columns 'PassengerId','Name','Ticket','Cabin'
```

In [58]:
```
titanic = titanic.drop(['PassengerId','Name','Ticket','Cabin' ],axis=1)
```

In [59]:
```
titanic.head()
```

Out[59]:

	Survived	Pclass	Sex	Age	SibSp	Parch	Fare	Embarked
0	0	3	male	22.0	1	0	7.2500	S
1	1	1	female	38.0	1	0	71.2833	C
2	1	3	female	26.0	0	0	7.9250	S
3	1	1	female	35.0	1	0	53.1000	S
4	0	3	male	35.0	0	0	8.0500	S

In [60]:
```
#Since machine learning algorithms work with only numerical data, we will encode text to numerical
```

In [61]:
```
titanic.groupby('Sex').size()
```

Out[61]:
```
Sex
female    314
male      577
dtype: int64
```

In [62]:
```
titanic.loc[titanic.Sex == 'female', 'Sex'] = 0
titanic.loc[titanic.Sex == 'male', 'Sex'] = 1
```

In [63]:
```
titanic.groupby('Sex').size()
```

Out[63]:
```
Sex
0    314
1    577
dtype: int64
```

In [64]:
```
#We will do the same thing with Embarked column
```

In [65]:
```
titanic.groupby('Embarked').size()
```

Out[65]:
```
Embarked
C    168
Q     77
S    646
dtype: int64
```

In [66]:
```
titanic.loc[titanic.Embarked == 'C', 'Embarked'] = 0
titanic.loc[titanic.Embarked == 'Q', 'Embarked'] = 1
titanic.loc[titanic.Embarked == 'S', 'Embarked'] = 2
```

In [67]:
```
titanic.groupby('Embarked').size()
```

Out[67]:
```
Embarked
0    168
1     77
2    646
dtype: int64
```

In [68]:
```
titanic.head()
```

Out[68]:

	Survived	Pclass	Sex	Age	SibSp	Parch	Fare	Embarked
0	0	3	1	22.0	1	0	7.2500	2
1	1	1	0	38.0	1	0	71.2833	0
2	1	3	0	26.0	0	0	7.9250	2
3	1	1	0	35.0	1	0	53.1000	2
4	0	3	1	35.0	0	0	8.0500	2

In [69]:
```
#Declaring our input and output/target columns:
```

In [70]:
```
X = titanic.drop(['Survived'],axis=1)
X.head()
```

Out[70]:

	Pclass	Sex	Age	SibSp	Parch	Fare	Embarked
0	3	1	22.0	1	0	7.2500	2
1	1	0	38.0	1	0	71.2833	0
2	3	0	26.0	0	0	7.9250	2
3	1	0	35.0	1	0	53.1000	2
4	3	1	35.0	0	0	8.0500	2

In [71]:
```
y = titanic.Survived
y.head()
```

Out[71]:
```
0    0
1    1
2    1
3    1
4    0
Name: Survived, dtype: int64
```

In [72]:
```
#training and testing data:
```

In [73]:
```
from sklearn.model_selection import train_test_split
```

In [74]:
```
X_train, X_test, y_train, y_test = train_test_split(X,y,test_size=0.3)
```

In [75]:
```
X_train.shape
```

Out[75]:
```
(623, 7)
```

In [76]:
```
X_test.shape
```

Out[76]:
```
(268, 7)
```

In [77]:
```
from sklearn.linear_model import LogisticRegression
```

In [78]:
```
logregmodel = LogisticRegression()
```

In [79]:
```
logregmodel.fit(X_train,y_train)
```

Out[79]:
```
LogisticRegression(C=1.0, class_weight=None, dual=False, fit_intercept=True,
          intercept_scaling=1, max_iter=100, multi_class='ovr', n_jobs=1,
          penalty='l2', random_state=None, solver='liblinear', tol=0.0001,
          verbose=0, warm_start=False)
```

In [80]:
```
y_pred = logregmodel.predict(X_test)
```

In [81]:
```
from sklearn.metrics import accuracy_score
```

In [82]:
```
accuracy_score(y_test, y_pred)
```

Out[82]:
```
0.7985074626865671
```

In [83]:
```
from sklearn.metrics import classification_report
```

In [84]:
```
print(classification_report(y_test,y_pred))
```

```
             precision    recall  f1-score   support

          0       0.83      0.86      0.84       171
          1       0.74      0.69      0.71        97

avg / total       0.80      0.80      0.80       268
```

In [85]:
```
from sklearn.tree import DecisionTreeClassifier
```

In [86]:
```
dtreemodel = DecisionTreeClassifier()
```

In [87]:
```
dtreemodel.fit(X_train,y_train)
```

Out[87]:
```
DecisionTreeClassifier(class_weight=None, criterion='gini', max_depth=None,
            max_features=None, max_leaf_nodes=None,
            min_impurity_split=1e-07, min_samples_leaf=1,
            min_samples_split=2, min_weight_fraction_leaf=0.0,
            presort=False, random_state=None, splitter='best')
```

In [88]:
```
y_pred = dtreemodel.predict(X_test)
```

In [89]:
```
accuracy_score(y_test, y_pred)
```

Out[89]:
```
0.7873134328358209
```

```
A random forest classifier.

A random forest is a meta estimator that fits a number of decision tree classifiers on various sub-samples of the dataset and uses averaging to
improve the predictive accuracy and control over-fitting. The sub-sample size is always the same as the original input sample size but the
samples are drawn with replacement if bootstrap=True (default).
```

In [90]:
```
from sklearn.ensemble import RandomForestClassifier
```

In [93]:
```
rfmodel = RandomForestClassifier()
```

In [94]:
```
rfmodel.fit(X_train,y_train)
```

Out[94]:
```
RandomForestClassifier(bootstrap=True, class_weight=None, criterion='gini',
            max_depth=None, max_features='auto', max_leaf_nodes=None,
            min_impurity_split=1e-07, min_samples_leaf=1,
            min_samples_split=2, min_weight_fraction_leaf=0.0,
            n_estimators=10, n_jobs=1, oob_score=False, random_state=None,
            verbose=0, warm_start=False)
```

In [95]:
```
y_pred = rfmodel.predict(X_test)
```

In [96]:
```
accuracy_score(y_test, y_pred)
```

Out[96]:
```
0.8208955223880597
```

In [ ]:
```

```