In [1]:
```
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import seaborn as sns
%matplotlib inline
```

In [2]:
```
train = pd.read_csv(r"C:\Users\kunal perane\Downloads\titanic_train.csv")
```

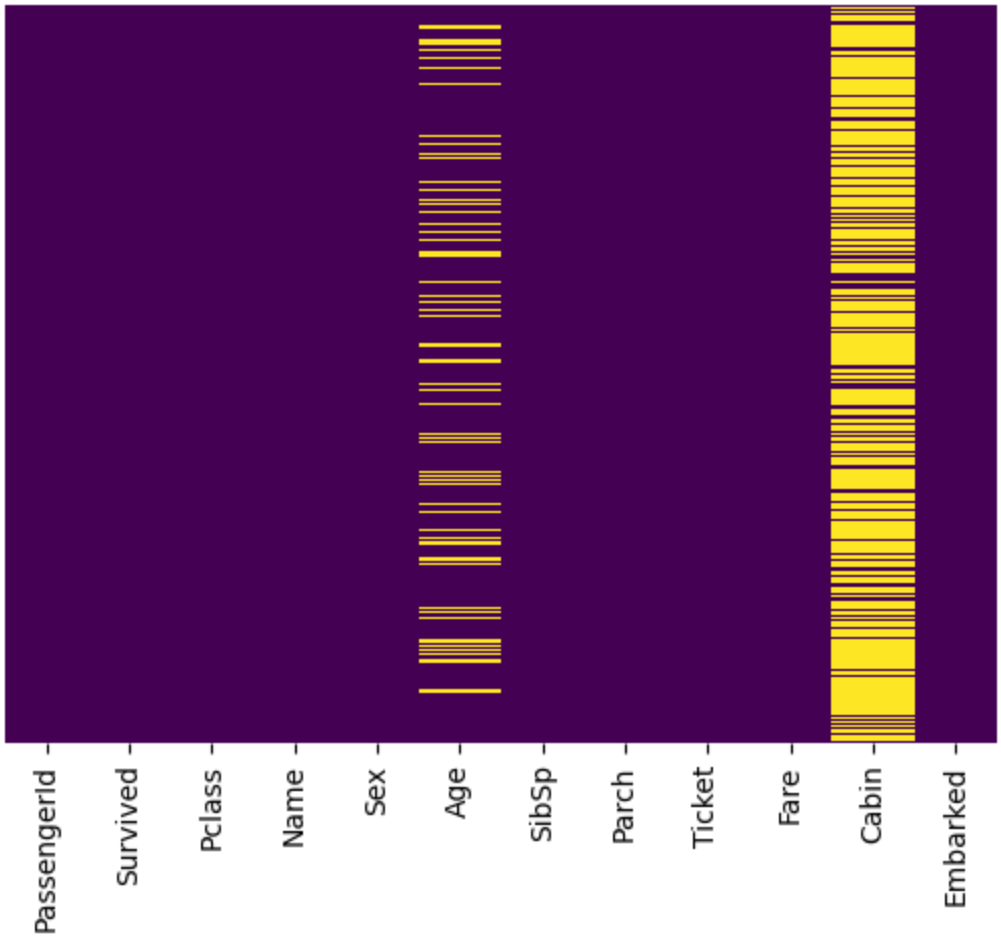
In [3]:
```
train.head()
```

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

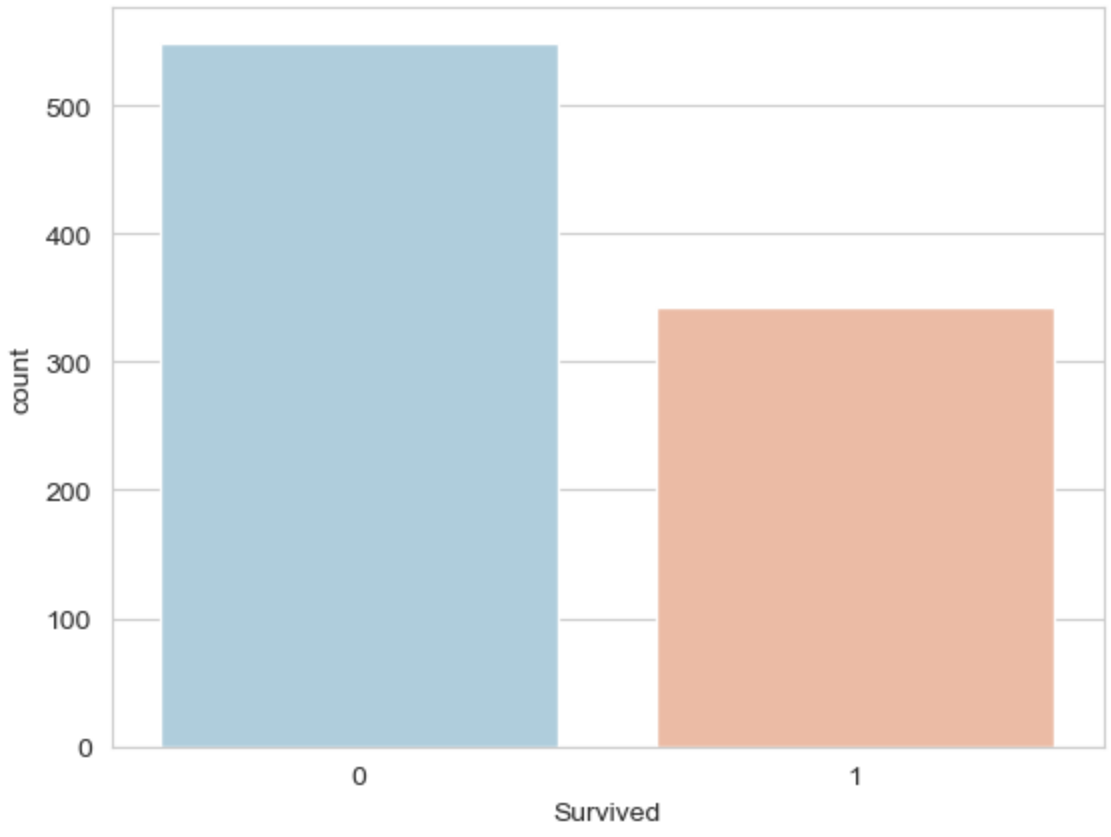
In [4]:
```
sns.heatmap(train.isnull(),yticklabels=False,cbar=False,cmap='viridis')
```

Out[4]:
```
<Axes: >
```



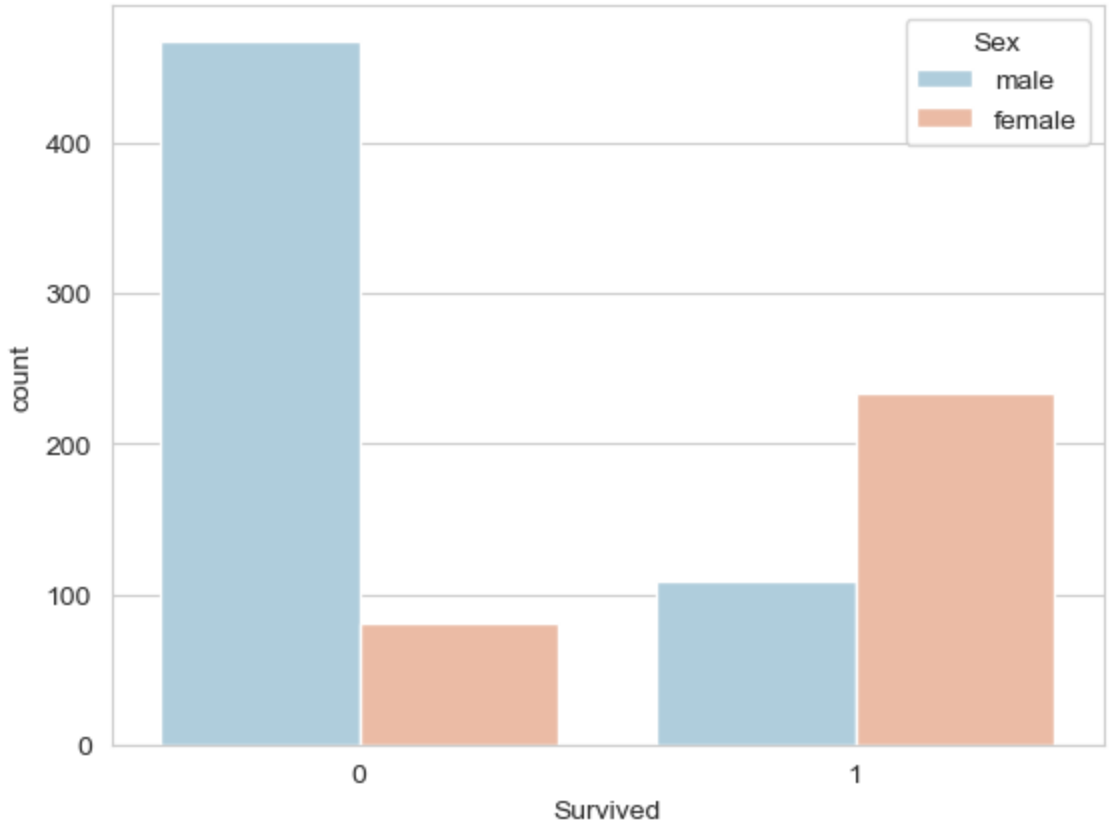
In [5]:
```
sns.set_style('whitegrid')
sns.countplot(x='Survived',data=train,palette='RdBu_r')
```

Out[5]:
```
<Axes: xlabel='Survived', ylabel='count'>
```



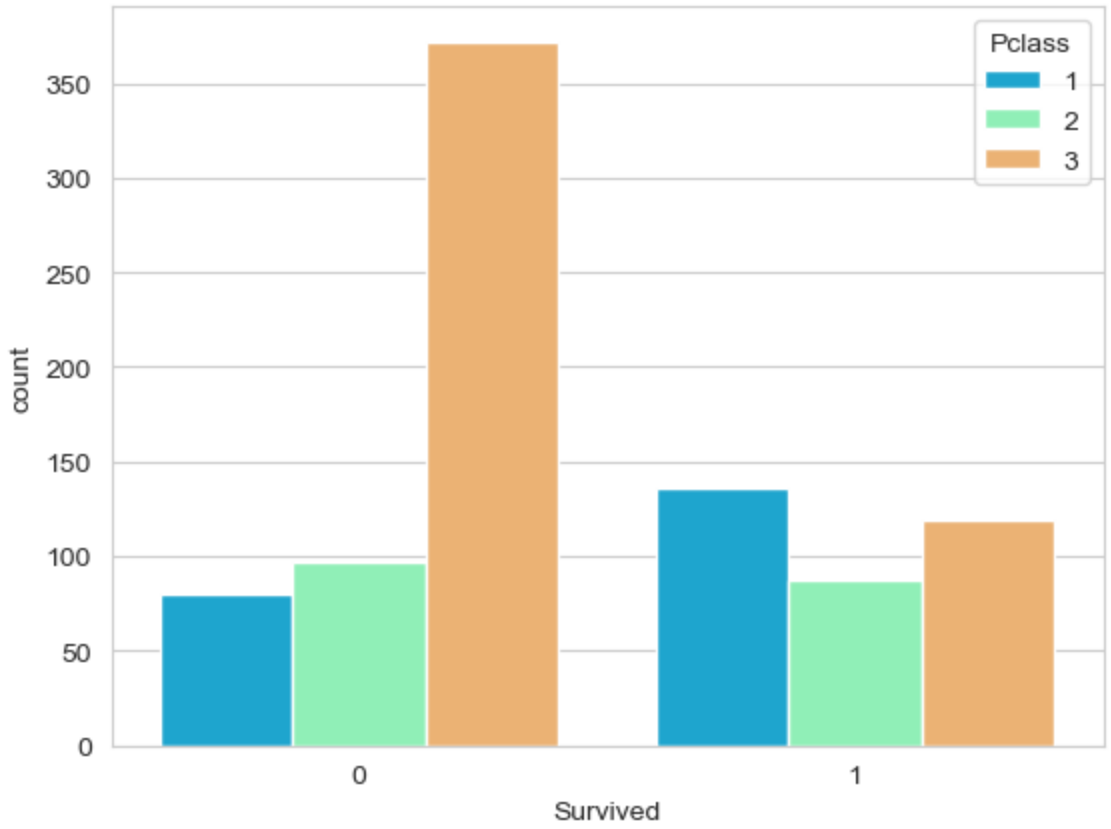
In [6]:
```
sns.set_style('whitegrid')
sns.countplot(x='Survived',hue='Sex',data=train,palette='RdBu_r')
```

Out[6]:
```
<Axes: xlabel='Survived', ylabel='count'>
```



In [7]:
```
sns.set_style('whitegrid')
sns.countplot(x='Survived',hue='Pclass',data=train,palette='rainbow')
```

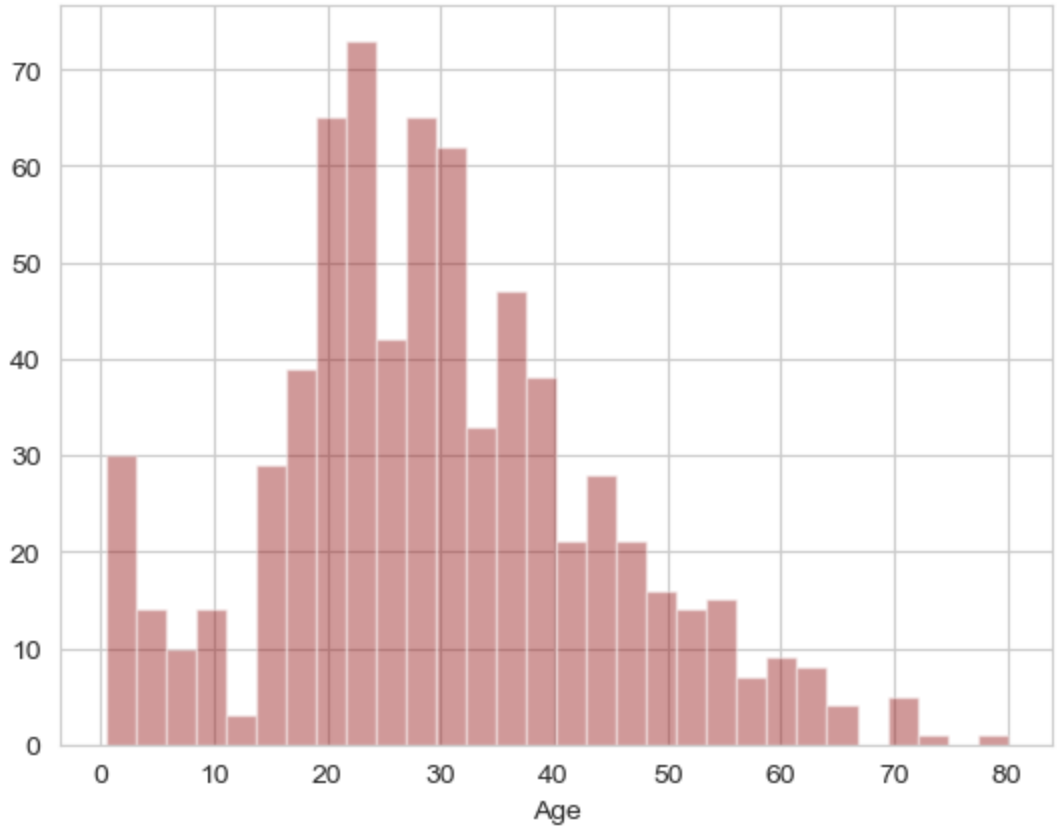
Out[7]:
```
<Axes: xlabel='Survived', ylabel='count'>
```



In [8]:
```
sns.distplot(train['Age'].dropna(),kde=False,color='darkred',bins=30)
```

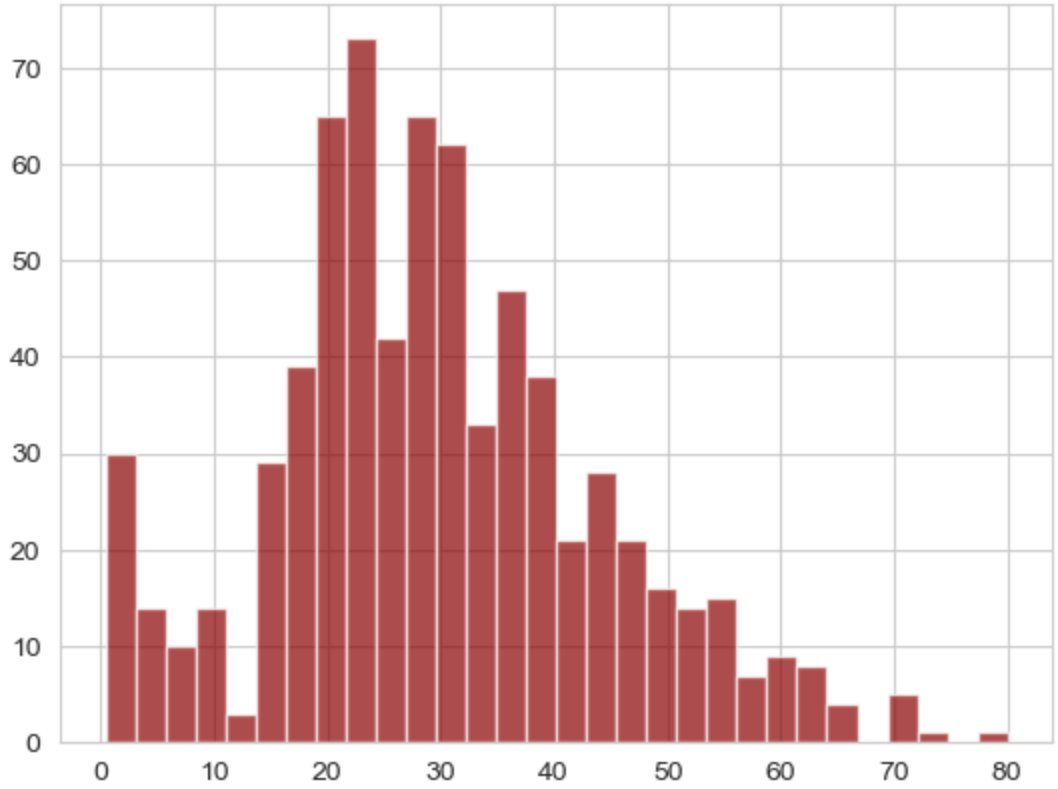
```
C:\Users\kunal perane\AppData\Local\Temp\ipykernel_4848\1781747146.py:1: UserWarning:

`distplot` is a deprecated function and will be removed in seaborn v0.14.0.

Please adapt your code to use either `displot` (a figure-level function with
similar flexibility) or `histplot` (an axes-level function for histograms).

For a guide to updating your code to use the new functions, please see
https://gist.github.com/mwaskom/de44147ed2974457ad6372750bbe5751

  sns.distplot(train['Age'].dropna(),kde=False,color='darkred',bins=30)
```

Out[8]:
```
<Axes: xlabel='Age'>
```



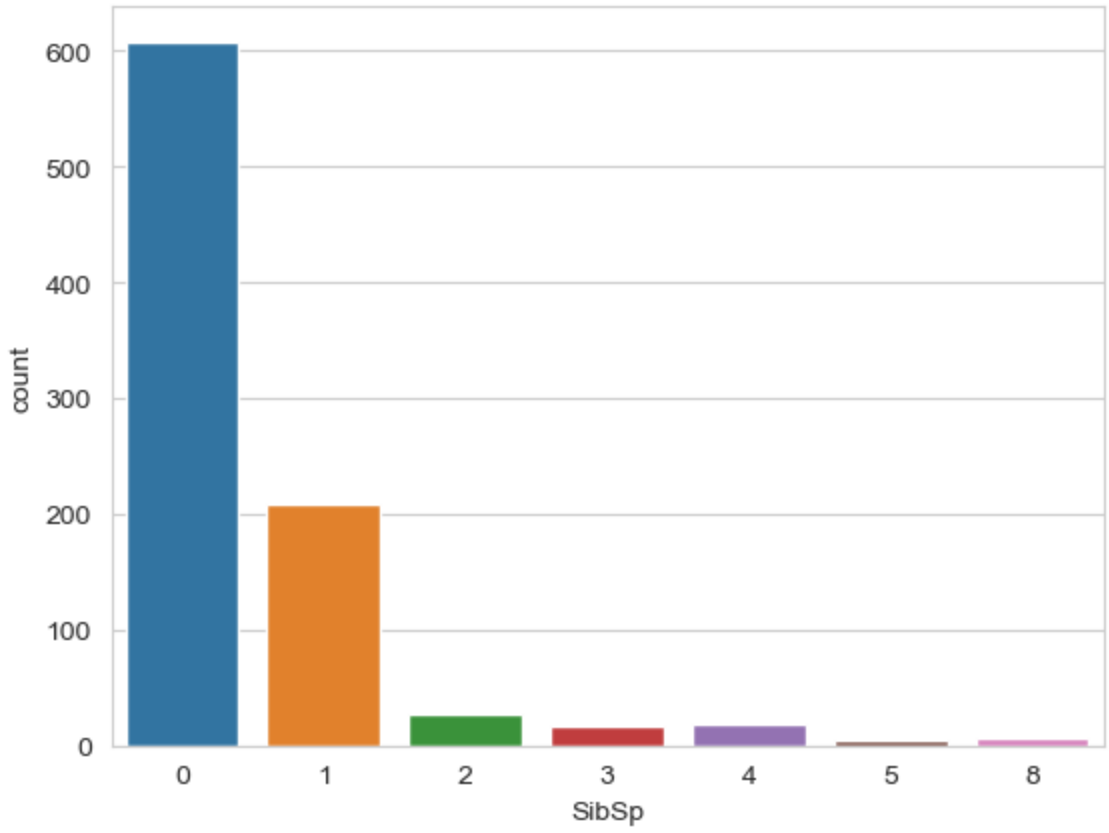
In [9]:
```
train['Age'].hist(bins=30,color='darkred',alpha=0.7)
```

Out[9]:
```
<Axes: >
```



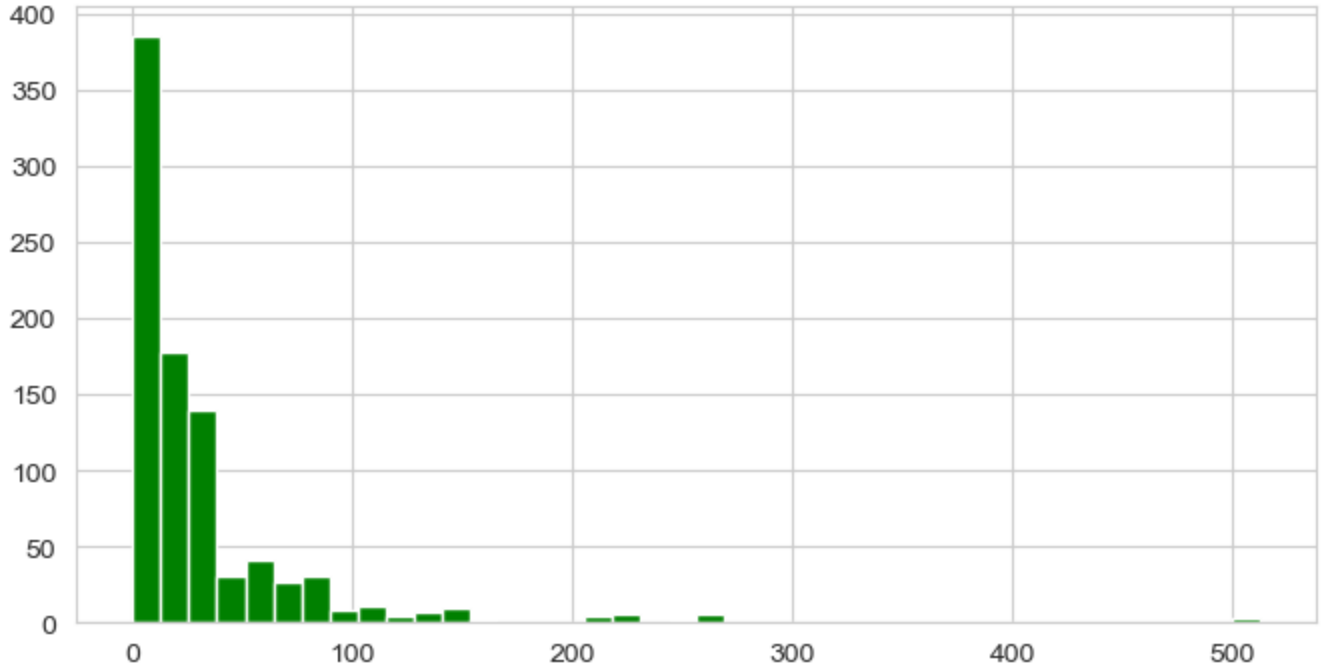
In [10]:
```
sns.countplot(x='SibSp',data=train)
```

Out[10]:
```
<Axes: xlabel='SibSp', ylabel='count'>
```



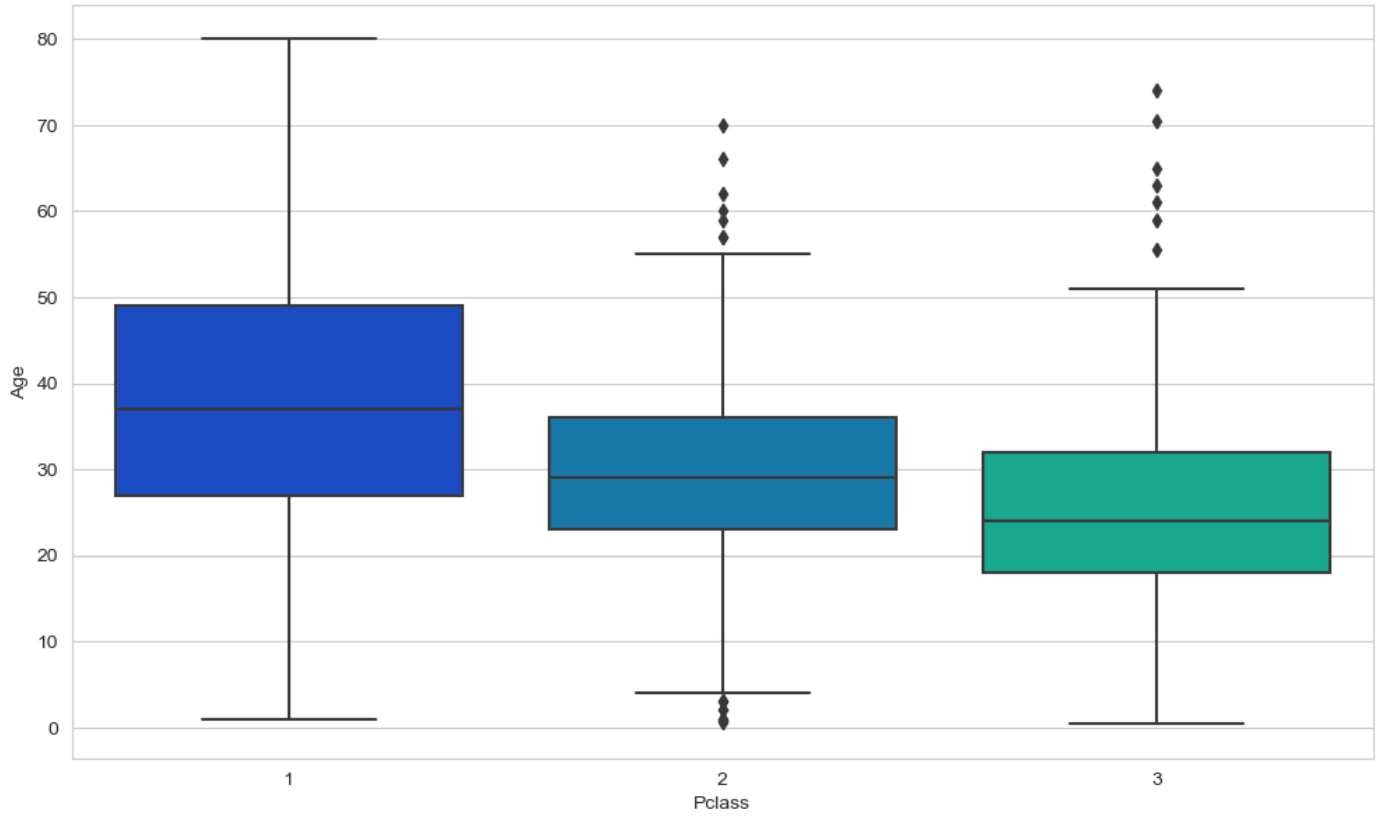
In [11]:
```
train['Fare'].hist(color='green',bins=40,figsize=(8,4))
```

Out[11]:
```
<Axes: >
```



In [12]:
```
plt.figure(figsize=(12, 7))
sns.boxplot(x='Pclass',y='Age',data=train,palette='winter')
```

Out[12]:
```
<Axes: xlabel='Pclass', ylabel='Age'>
```



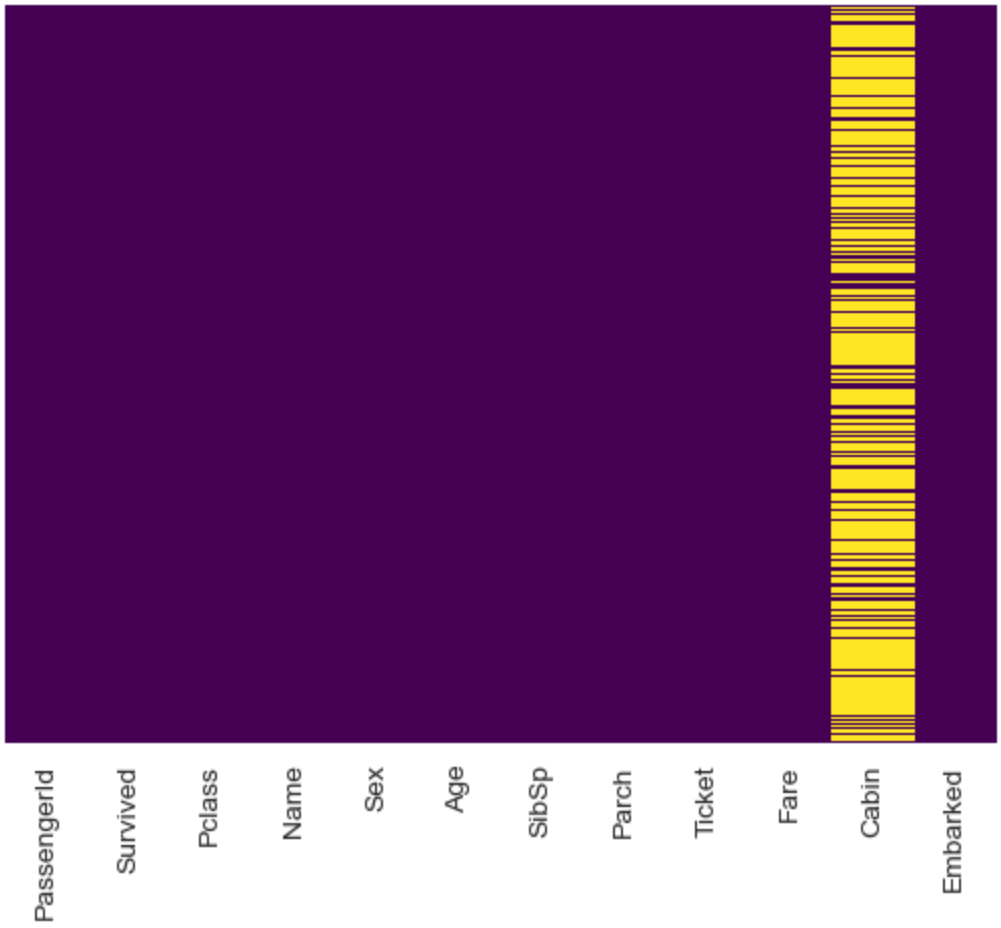
In [13]:
```
def impute_age(cols):
    Age = cols[0]
    Pclass = cols[1]

    if pd.isnull(Age):

        if Pclass == 1:
            return 37

        elif Pclass == 2:
```

```
            return 29

        else:
            return 24

    else:
        return Age
```

In [14]:
```
train['Age'] = train[['Age','Pclass']].apply(impute_age,axis=1)
```

In [15]:
```
sns.heatmap(train.isnull(),yticklabels=False,cbar=False,cmap='viridis')
```

Out[15]:
```
<Axes: >
```



In [16]:
```
train.drop('Cabin',axis=1,inplace=True)
```

In [17]:
```
train.head()
```

Out[17]:

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

In [18]:
```
train.dropna(inplace=True)
```

In [19]:
```
train.info()
```

```
<class 'pandas.core.frame.DataFrame'>
Int64Index: 889 entries, 0 to 890
Data columns (total 11 columns):
 #   Column       Non-Null Count  Dtype  
---  ------       --------------  -----  
 0   PassengerId  889 non-null    int64  
 1   Survived     889 non-null    int64  
 2   Pclass       889 non-null    int64  
 3   Name         889 non-null    object 
 4   Sex          889 non-null    object 
 5   Age          889 non-null    float64
 6   SibSp        889 non-null    int64  
 7   Parch        889 non-null    int64  
 8   Ticket       889 non-null    object 
 9   Fare         889 non-null    float64
 10  Embarked     889 non-null    object 
dtypes: float64(2), int64(5), object(4)
memory usage: 83.3+ KB
```

In [20]:
```
sex = pd.get_dummies(train['Sex'],drop_first=True)
embark = pd.get_dummies(train['Embarked'],drop_first=True)
```

In [21]:
```
train.drop(['Sex','Embarked','Name','Ticket'],axis=1,inplace=True)
```

In [22]:
```
train = pd.concat([train,sex,embark],axis=1)
```

In [23]:
```
train.head()
```

Out[23]:

	PassengerId	Survived	Pclass	Age	SibSp	Parch	Fare	male	Q	S
0	1	0	3	22.0	1	0	7.2500	1	0	1
1	2	1	1	38.0	1	0	71.2833	0	0	0
2	3	1	3	26.0	0	0	7.9250	0	0	1
3	4	1	1	35.0	1	0	53.1000	0	0	1
4	5	0	3	35.0	0	0	8.0500	1	0	1

In [24]:
```
from sklearn.model_selection import train_test_split
```

In [25]:
```
X_train, X_test, y_train, y_test = train_test_split(train.drop('Survived',axis=1),
                                                    train['Survived'], test_size=0.30,
                                                    random_state=101)
```

In [26]:
```
from sklearn.linear_model import LogisticRegression
```

In [27]:
```
logmodel = LogisticRegression()
logmodel.fit(X_train,y_train)
```

```
C:\Users\kunal perane\anaconda3\Lib\site-packages\sklearn\linear_model\_logistic.py:458:
ConvergenceWarning: lbfgs failed to converge (status=1):
STOP: TOTAL NO. of ITERATIONS REACHED LIMIT.

Increase the number of iterations (max_iter) or scale the data as shown in:
    https://scikit-learn.org/stable/modules/preprocessing.html
Please also refer to the documentation for alternative solver options:
    https://scikit-learn.org/stable/modules/linear_model.html#logistic-regression
  n_iter_i = _check_optimize_result(
```

Out[27]:
```
▼ LogisticRegression

LogisticRegression()
```

In [28]:
```
predictions = logmodel.predict(X_test)
```

In [29]:
```
from sklearn.metrics import classification_report
```

In [30]:
```
print(classification_report(y_test,predictions))
```

```
              precision    recall  f1-score   support

           0       0.79      0.91      0.85       163
           1       0.81      0.62      0.71       104

    accuracy                           0.80       267
   macro avg       0.80      0.77      0.78       267
weighted avg       0.80      0.80      0.79       267
```

In [31]:
```
print ('Train Score:',logmodel.score(X_train,y_train))
```

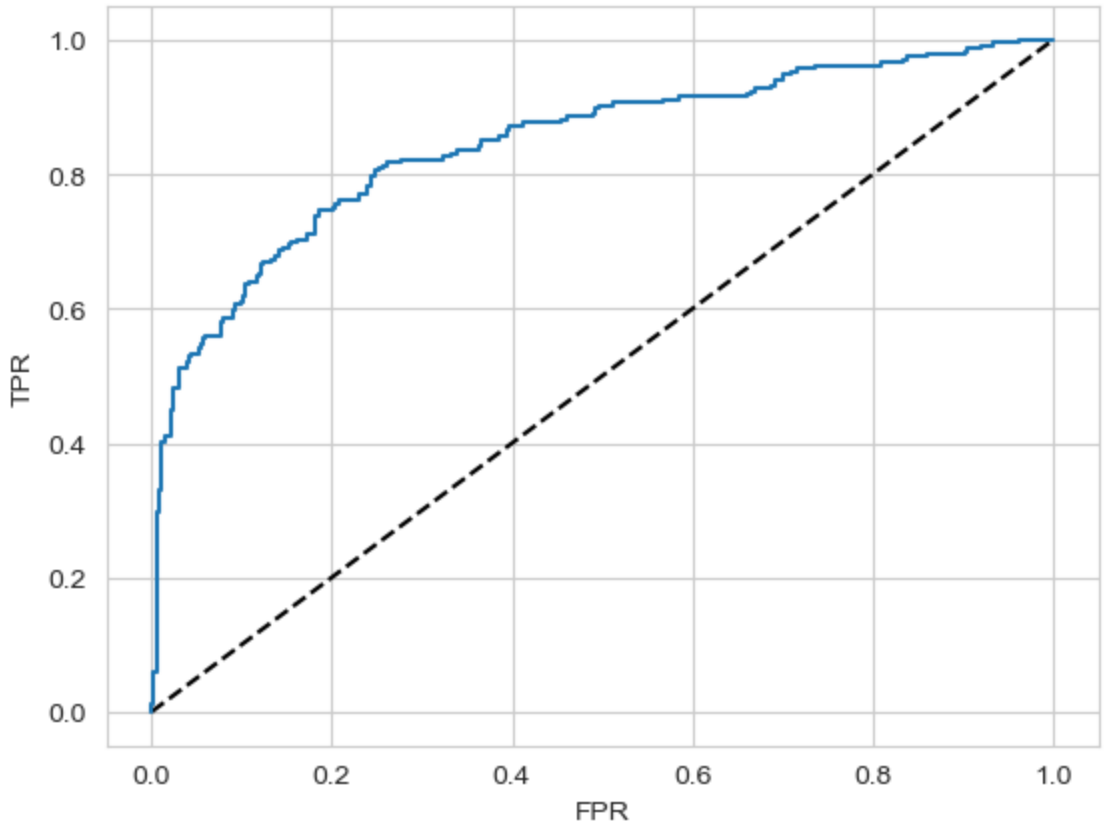
```
Train Score: 0.792604501607717
```

In [32]:
```
print('Test Score:',logmodel.score(X_test,y_test))
```

```
Test Score: 0.797752808988764
```

In [33]:
```
import sklearn.metrics as metrics
```

In [34]:
```
roc = logmodel.predict_proba(X_train)[:,1]
fpr, tpr, threshold = metrics.roc_curve(y_train, roc)
plt.plot([0,1], [0,1],'k--')
plt.plot(fpr, tpr, label='logistic')
plt.ylabel('TPR')
plt.xlabel('FPR')
plt.show()
```



In [35]:
```
metrics.roc_curve(y_train, roc)
```

Out[35]:
```
(array([0.        , 0.        , 0.        , 0.00259067, 0.00259067,
        0.00518135, 0.00518135, 0.00777202, 0.00777202, 0.01036269,
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```

```
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       0.13612589, 0.13463006, 0.13453319, 0.12269138, 0.12246898,
       0.1222621 , 0.12161365, 0.12136257, 0.12122836, 0.11738207,
       0.11718122, 0.11638586, 0.11525092, 0.11357795, 0.1132138 ,
       0.1117598 , 0.11147066, 0.10875616, 0.10839139, 0.10337627,
       0.10274441, 0.09292028, 0.0925663 , 0.09007949, 0.08934441,
       0.08885066, 0.08869942, 0.08360209, 0.08345845, 0.07568427,
       0.07561589, 0.0746545 , 0.074471  , 0.0685933 , 0.06734259,
       0.06290673, 0.06237786, 0.05101986, 0.05085365, 0.01168994]))
```
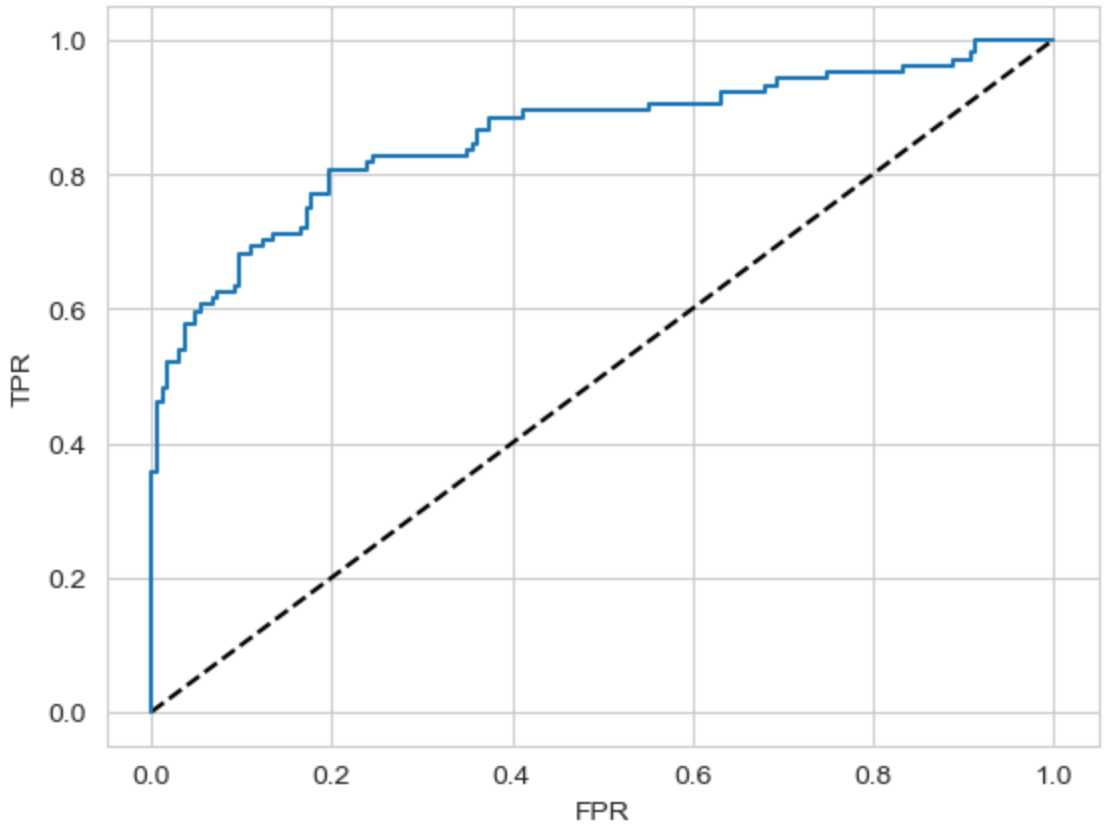

In [36]:

```
roc = logmodel.predict_proba(X_test)[:,1]
fpr, tpr, threshold = metrics.roc_curve(y_test, roc)
plt.plot([0,1], [0,1],'k--')
plt.plot(fpr, tpr, label='logistic')
plt.ylabel('TPR')
plt.xlabel('FPR')
plt.show()
```



In [37]:
```
pred_train = logmodel.predict(X_train)
pred_test = logmodel.predict(X_test)
```

In [38]:
```
from sklearn.metrics import matthews_corrcoef

mcc = matthews_corrcoef(y_test, pred_test)
print('MCC: ',mcc)
```

```
MCC:  0.5673510830910005
```

In [39]:
```
param_grid = {
    'penalty' :['l1','l2'],
    'C' : [0.1,0.5,1,5,10]
}
```

In [40]:
```
from sklearn.model_selection import GridSearchCV
```

In [41]:
```
grid = GridSearchCV(estimator=logmodel, param_grid=param_grid, cv = 5)
```

In [42]:
```
grid.fit(X_train,y_train)
```

```
C:\Users\kunal perane\anaconda3\Lib\site-packages\sklearn\linear_model\_logistic.py:458:
ConvergenceWarning: lbfgs failed to converge (status=1):
STOP: TOTAL NO. of ITERATIONS REACHED LIMIT.

Increase the number of iterations (max_iter) or scale the data as shown in:
    https://scikit-learn.org/stable/modules/preprocessing.html
Please also refer to the documentation for alternative solver options:
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```

```
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Please also refer to the documentation for alternative solver options:
    https://scikit-learn.org/stable/modules/linear_model.html#logistic-regression
  n_iter_i = _check_optimize_result(
C:\Users\kunal perane\anaconda3\Lib\site-packages\sklearn\model_selection\_validation.p
y:378: FitFailedWarning:
25 fits failed out of a total of 50.
The score on these train-test partitions for these parameters will be set to nan.
If these failures are not expected, you can try to debug them by setting error_score='ra
ise'.

Below are more details about the failures:
--------------------------------------------------------------------------------
25 fits failed with the following error:
Traceback (most recent call last):
  File "C:\Users\kunal perane\anaconda3\Lib\site-packages\sklearn\model_selection\_valid
ation.py", line 686, in _fit_and_score
    estimator.fit(X_train, y_train, **fit_params)
  File "C:\Users\kunal perane\anaconda3\Lib\site-packages\sklearn\linear_model\_logisti
c.py", line 1162, in fit
    solver = _check_solver(self.solver, self.penalty, self.dual)
             ^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^
  File "C:\Users\kunal perane\anaconda3\Lib\site-packages\sklearn\linear_model\_logisti
c.py", line 54, in _check_solver
    raise ValueError(
ValueError: Solver lbfgs supports only 'l2' or 'none' penalties, got l1 penalty.

  warnings.warn(some_fits_failed_message, FitFailedWarning)
C:\Users\kunal perane\anaconda3\Lib\site-packages\sklearn\model_selection\_search.py:95
2: UserWarning: One or more of the test scores are non-finite: [       nan 0.77014194
nan 0.77010323        nan 0.77812903
        nan 0.77492903        nan 0.78138065]
  warnings.warn(
C:\Users\kunal perane\anaconda3\Lib\site-packages\sklearn\linear_model\_logistic.py:458:
ConvergenceWarning: lbfgs failed to converge (status=1):
```
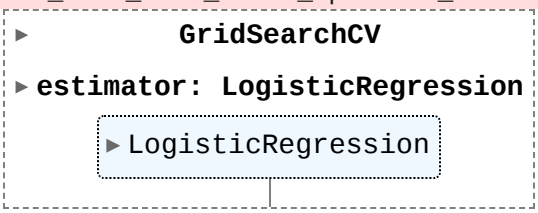

Loading [MathJax]/extensions/Safe.js

```
STOP: TOTAL NO. of ITERATIONS REACHED LIMIT.

Increase the number of iterations (max_iter) or scale the data as shown in:
    https://scikit-learn.org/stable/modules/preprocessing.html
Please also refer to the documentation for alternative solver options:
    https://scikit-learn.org/stable/modules/linear_model.html#logistic-regression
  n_iter_i = _check_optimize_result(
```

Out[42]:



In [43]:
```
best_param = grid.best_params_
best_model = grid.best_estimator_
```

In [44]:
```
y_pred = best_model.predict(X_test)
```

In [45]:
```
from sklearn.metrics import accuracy_score, precision_score, recall_score, f1_score, roc
```

In [46]:
```
acc = accuracy_score(y_test, y_pred)
pre = precision_score(y_test, y_pred)
rec = recall_score(y_test, y_pred)
f1 = f1_score(y_test, y_pred)
roc_auc = roc_auc_score(y_test, y_pred)
```

In [47]:
```
print('Best Param: ', best_param)
print('Accuracy: ', acc)
print('Recall: ', rec)
print('Precision: ', pre)
print('F1 Score: ', f1)
print('AUC-ROC: ', roc_auc)
```

```
Best Param:  {'C': 10, 'penalty': 'l2'}
Accuracy:  0.8052434456928839
Recall:  0.625
Precision:  0.8333333333333334
F1 Score:  0.7142857142857143
AUC-ROC:  0.7726226993865031
```

In [ ]:
```

```