Import Libraries

In [2]:
```
import pandas as pd
import numpy as np
import seaborn as sns
import matplotlib.pyplot as plt
import warnings
warnings.filterwarnings('ignore')
%matplotlib inline
```

Loading dataset

In [3]:
```
train = pd.read_csv('/kaggle/input/titanic/train.csv')
test = pd.read_csv('/kaggle/input/titanic/test.csv')
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]:
```
## statistical info
train.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

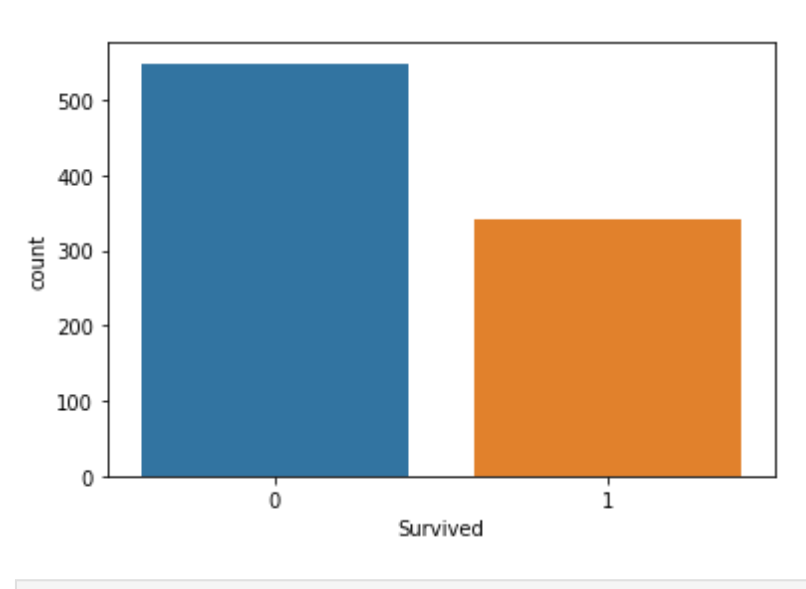
In [5]:
```
## datatype info
train.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 891 entries, 0 to 890
Data columns (total 12 columns):
 #   Column       Non-Null Count  Dtype  
---  ------       --------------  -----  
 0   PassengerId  891 non-null    int64  
 1   Survived     891 non-null    int64  
 2   Pclass       891 non-null    int64  
 3   Name         891 non-null    object 
 4   Sex          891 non-null    object 
 5   Age          714 non-null    float64
 6   SibSp        891 non-null    int64  
 7   Parch        891 non-null    int64  
 8   Ticket       891 non-null    object 
 9   Fare         891 non-null    float64
 10  Cabin        204 non-null    object 
 11  Embarked     889 non-null    object 
dtypes: float64(2), int64(5), object(5)
memory usage: 83.7+ KB
```

Exploratory Data Analysis

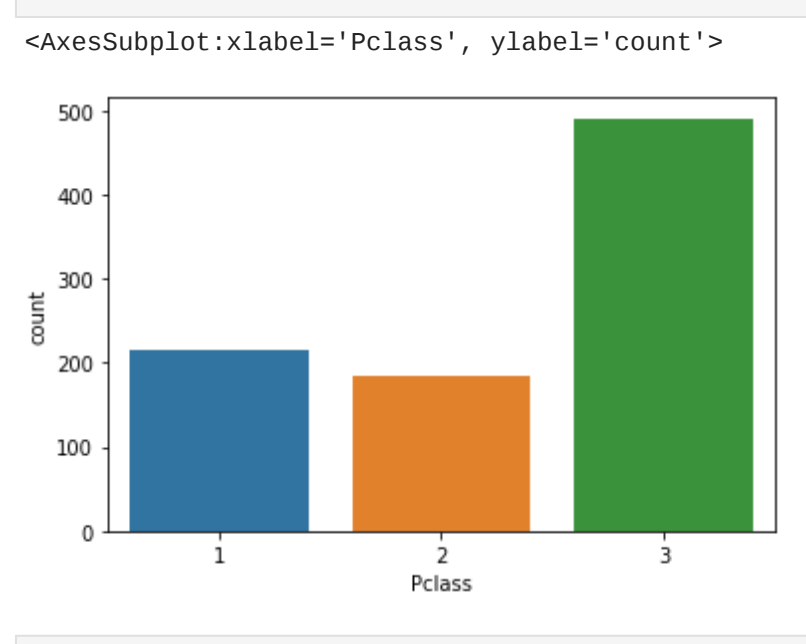
In [6]:
```
## categorical attributes
sns.countplot(train['Survived'])
```

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



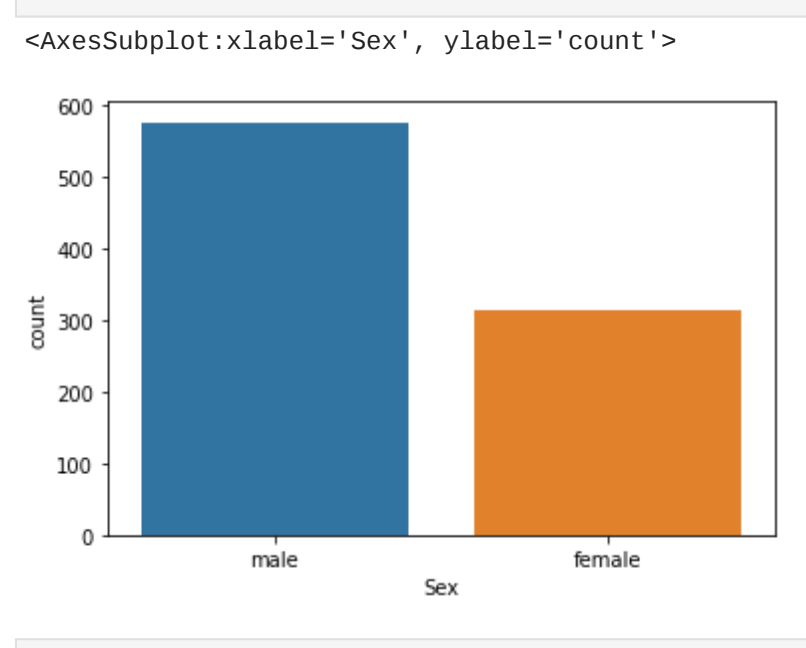
In [7]:
```
sns.countplot(train['Pclass'])
```

Out[7]:
```
<AxesSubplot:xlabel='Pclass', ylabel='count'>
```



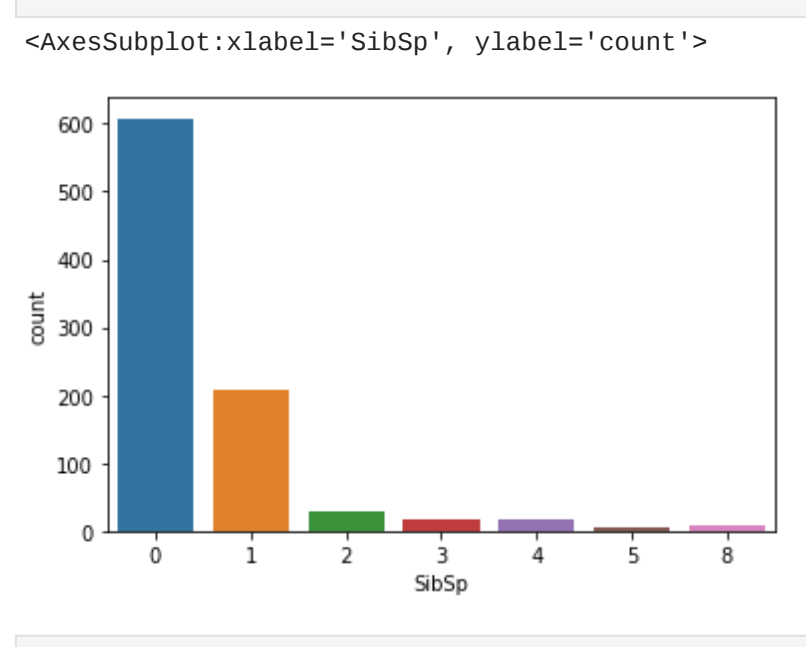
In [8]:
```
sns.countplot(train['Sex'])
```

Out[8]:
```
<AxesSubplot:xlabel='Sex', ylabel='count'>
```



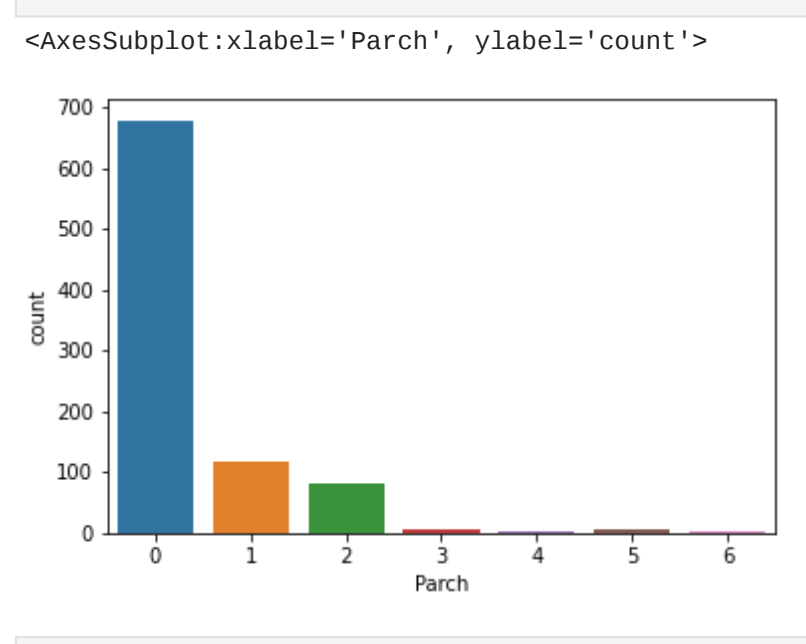
In [9]:
```
sns.countplot(train['SibSp'])
```

Out[9]:
```
<AxesSubplot:xlabel='SibSp', ylabel='count'>
```



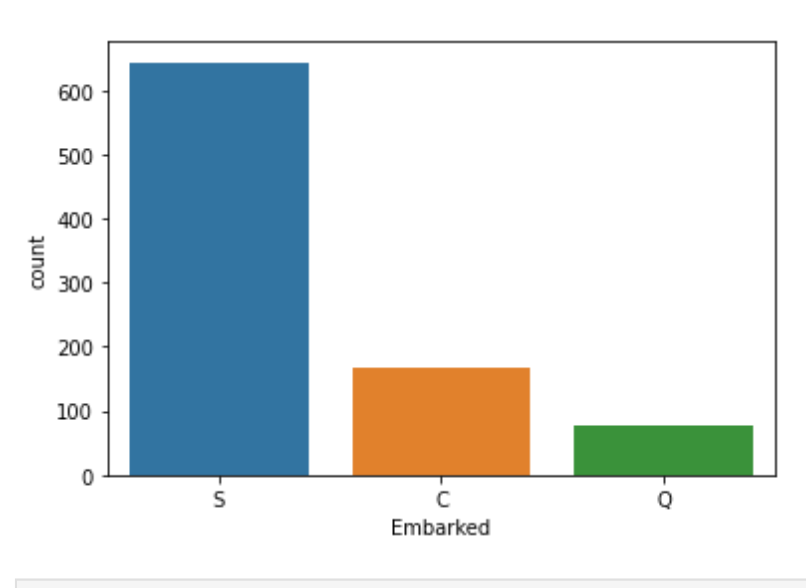
In [10]:
```
sns.countplot(train['Parch'])
```

Out[10]:
```
<AxesSubplot:xlabel='Parch', ylabel='count'>
```



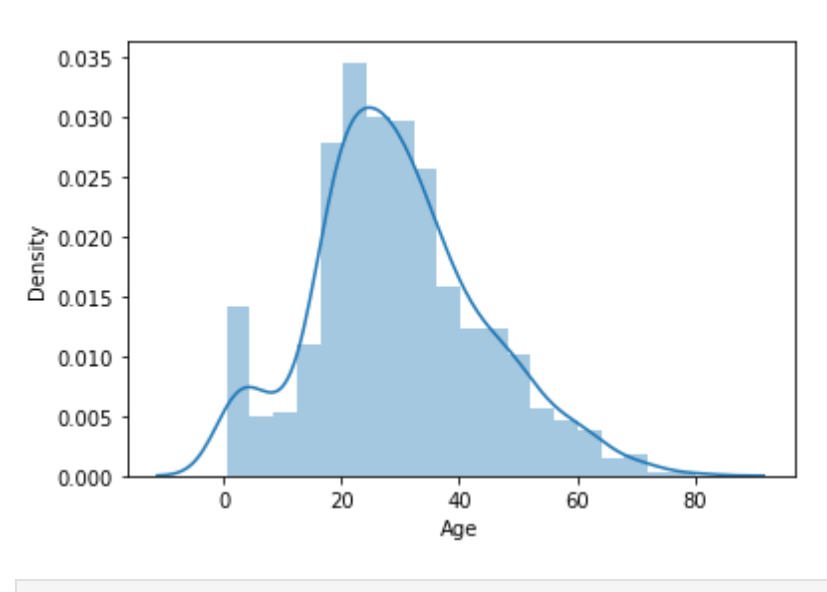
In [11]:
```
sns.countplot(train['Embarked'])
```

Out[11]:
```
<AxesSubplot:xlabel='Embarked', ylabel='count'>
```



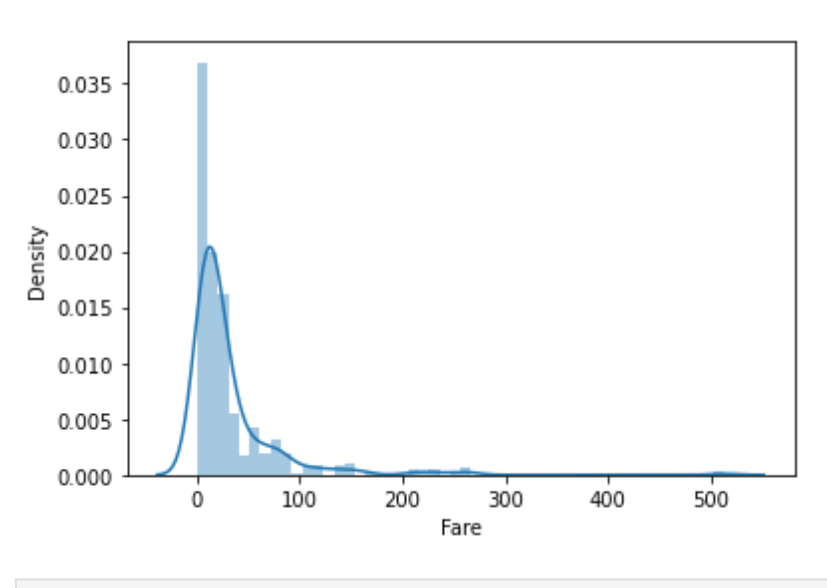
In [12]:
```
## numerical attributes
sns.distplot(train['Age'])
```

Out[12]:
```
<AxesSubplot:xlabel='Age', ylabel='Density'>
```

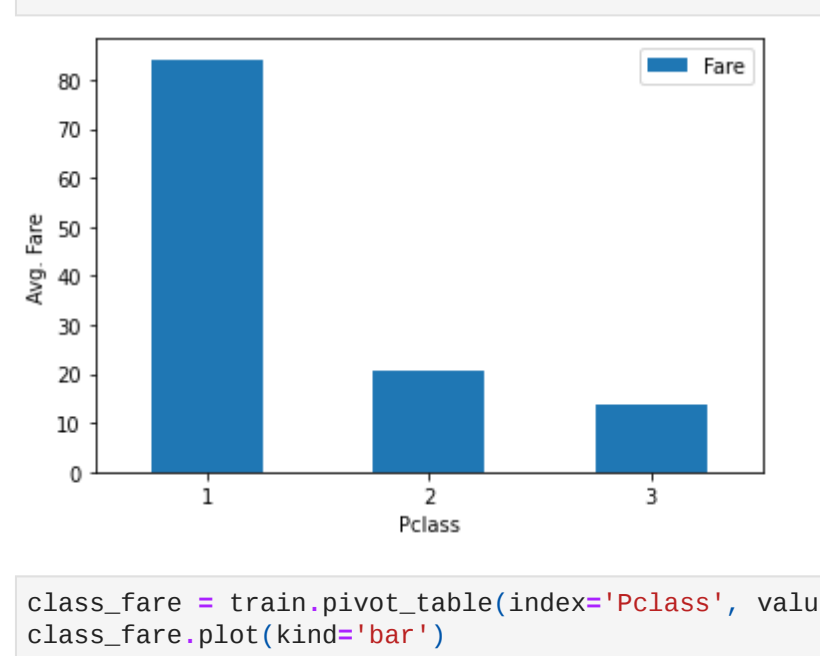


In [13]:
```
sns.distplot(train['Fare'])
```

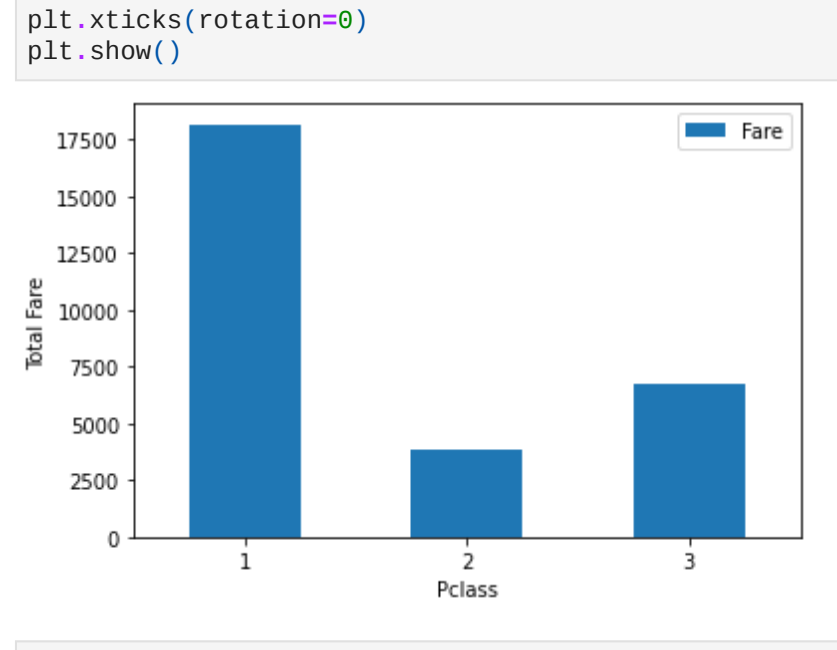
Out[13]:
```
<AxesSubplot:xlabel='Fare', ylabel='Density'>
```



In [14]:
```
class_fare = train.pivot_table(index='Pclass', values='Fare')
class_fare.plot(kind='bar')
plt.xlabel('Pclass')
plt.ylabel('Avg. Fare')
plt.xticks(rotation=0)
plt.show()
```

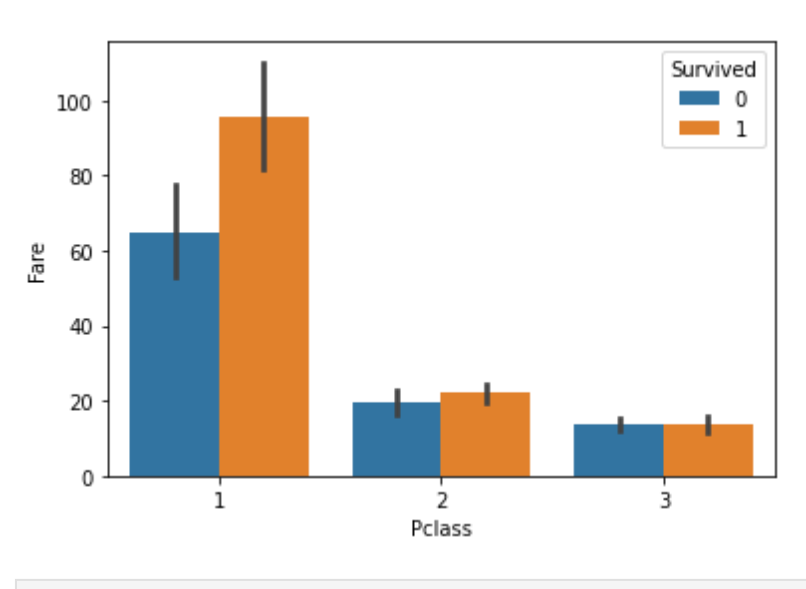


In [15]:
```
class_fare = train.pivot_table(index='Pclass', values='Fare', aggfunc=np.sum)
class_fare.plot(kind='bar')
plt.xlabel('Pclass')
plt.ylabel('Total Fare')
plt.xticks(rotation=0)
plt.show()
```



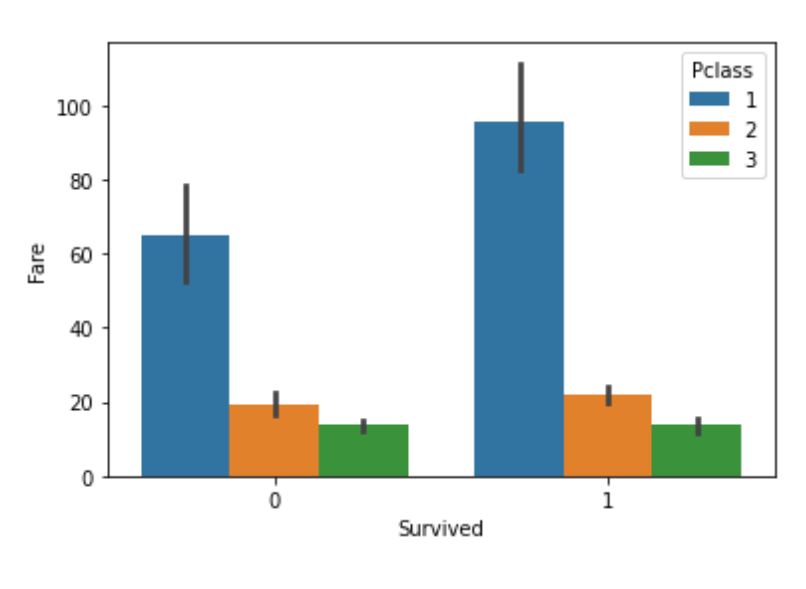
In [16]:
```
sns.barplot(data=train, x='Pclass', y='Fare', hue='Survived')
```

Out[16]:
```
<AxesSubplot:xlabel='Pclass', ylabel='Fare'>
```



In [17]:
```
sns.barplot(data=train, x='Survived', y='Fare', hue='Pclass')
```

Out[17]:
```
<AxesSubplot:xlabel='Survived', ylabel='Fare'>
```



Data Preprocessing

In [18]:
```
train_len = len(train)
# combine two dataframes
df = pd.concat([train, test], axis=0)
df = df.reset_index(drop=True)
df.head()
```

Out[18]:

	PassengerId	Survived	Pclass	Name	Sex	Age	SibSp	Parch	Ticket	Fare	Cabin	Embarked
0	1	0.0	3	Braund, Mr. Owen Harris	male	22.0	1	0	A/5 21171	7.2500	NaN	S
1	2	1.0	1	Cumings, Mrs. John Bradley (Florence Briggs Th...	female	38.0	1	0	PC 17599	71.2833	C85	C
2	3	1.0	3	Heikkinen, Miss. Laina	female	26.0	0	0	STON/O2. 3101282	7.9250	NaN	S
3	4	1.0	1	Futrelle, Mrs. Jacques Heath (Lily May Peel)	female	35.0	1	0	113803	53.1000	C123	S
4	5	0.0	3	Allen, Mr. William Henry	male	35.0	0	0	373450	8.0500	NaN	S

In [19]:
```
df.tail()
```

Out[19]:

	PassengerId	Survived	Pclass	Name	Sex	Age	SibSp	Parch	Ticket	Fare	Cabin	Embarked
1304	1305	NaN	3	Spector, Mr. Woolf	male	NaN	0	0	A.5. 3236	8.0500	NaN	S
1305	1306	NaN	1	Oliva y Ocana, Dona. Fermina	female	39.0	0	0	PC 17758	108.9000	C105	C
1306	1307	NaN	3	Saether, Mr. Simon Sivertsen	male	38.5	0	0	SOTON/O.Q. 3101262	7.2500	NaN	S
1307	1308	NaN	3	Ware, Mr. Frederick	male	NaN	0	0	359309	8.0500	NaN	S
1308	1309	NaN	3	Peter, Master. Michael J	male	NaN	1	1	2668	22.3583	NaN	C

In [20]:
```
## find the null values
df.isnull().sum()
```

Out[20]:
```
PassengerId       0
Survived        418
Pclass            0
Name              0
Sex               0
Age             263
SibSp             0
Parch             0
Ticket            0
Fare              1
Cabin          1014
Embarked          2
dtype: int64
```

In [21]:
```
# drop or delete the column
df = df.drop(columns=['Cabin'], axis=1)
```

In [22]:
```
df['Age'].mean()
```

Out[22]:
```
29.881137667304014
```

In [23]:
```
# fill missing values using mean of the numerical column
df['Age'] = df['Age'].fillna(df['Age'].mean())
df['Fare'] = df['Fare'].fillna(df['Fare'].mean())
```

In [24]:
```
df['Embarked'].mode()[0]
```

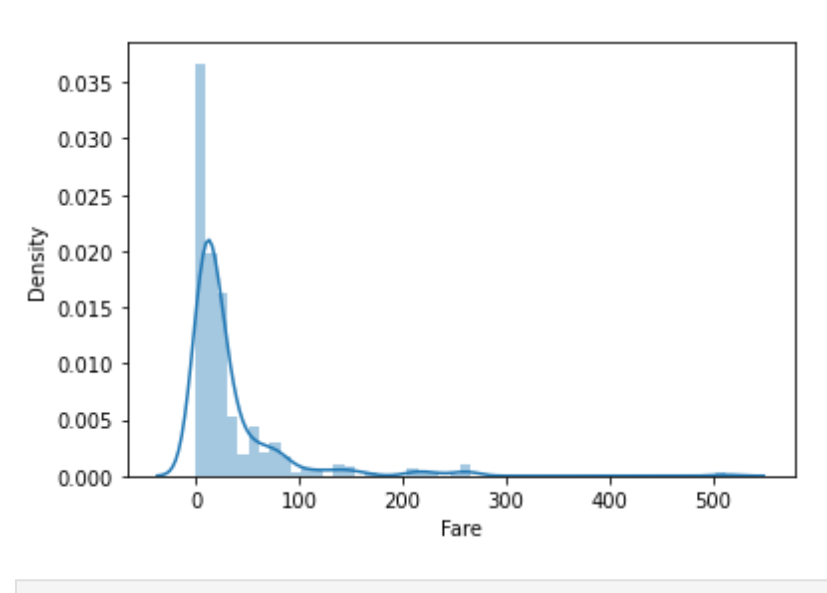
Out[24]:
```
'S'
```

In [25]:
```
# fill missing values using mode of the categorical column
df['Embarked'] = df['Embarked'].fillna(df['Embarked'].mode()[0])
```

Log transformation for uniform data distribution

In [26]:
```
sns.distplot(df['Fare'])
```

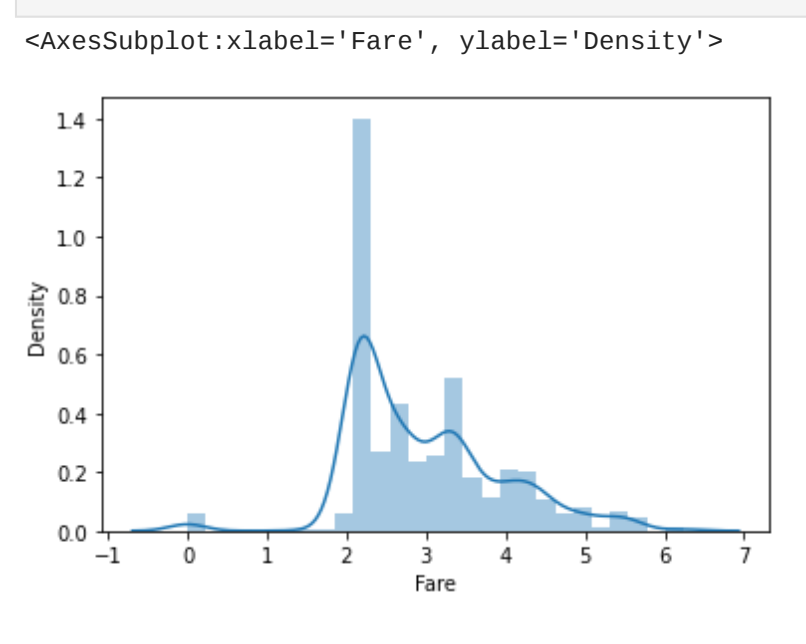
Out[26]:
```
<AxesSubplot:xlabel='Fare', ylabel='Density'>
```



In [27]:
```
df['Fare'] = np.log(df['Fare']+1)
```

In [28]:
```
sns.distplot(df['Fare'])
```

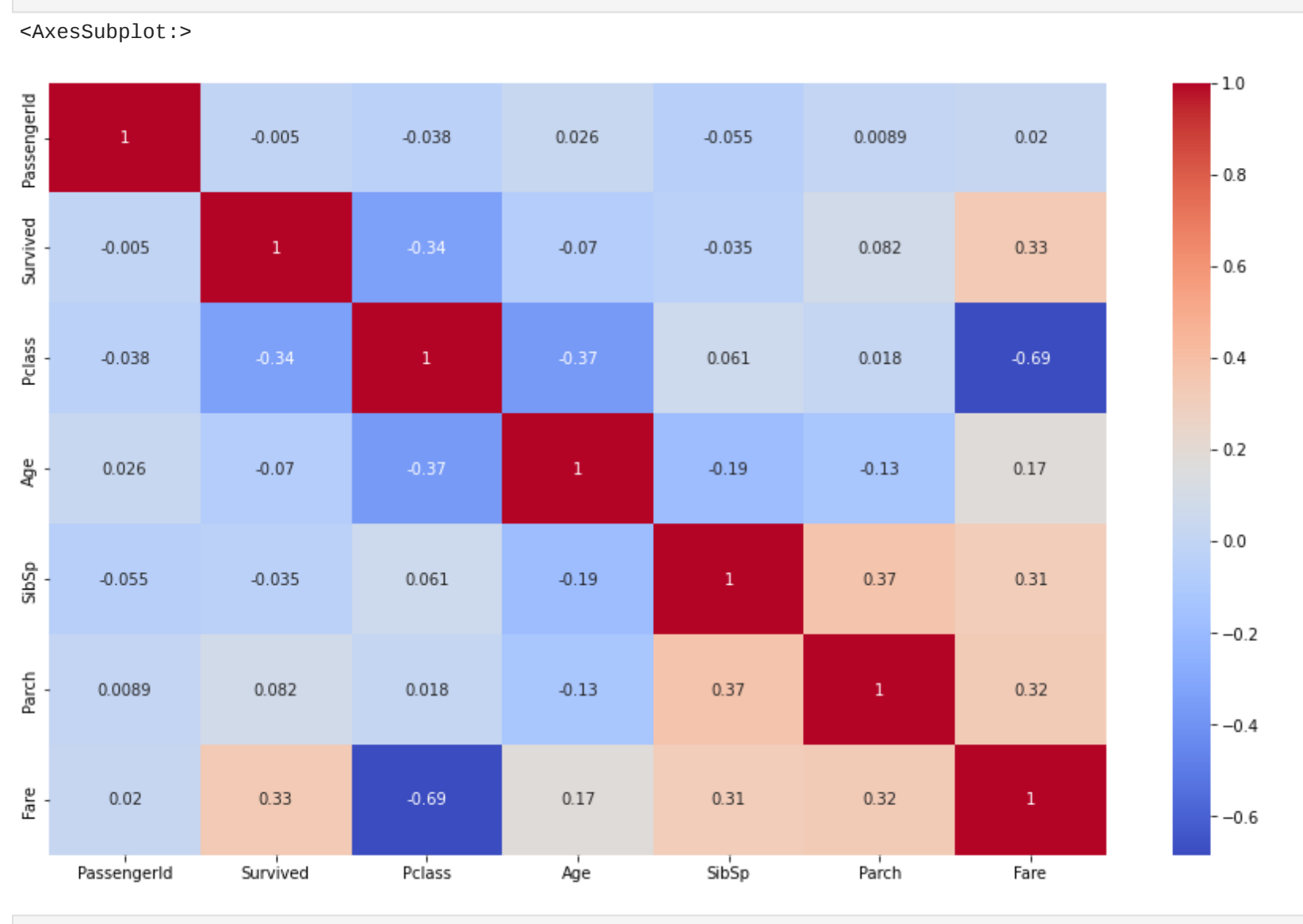
Out[28]:
```
<AxesSubplot:xlabel='Fare', ylabel='Density'>
```



Correlation Matrix

In [29]:
```
corr = df.corr()
plt.figure(figsize=(15, 9))
sns.heatmap(corr, annot=True, cmap='coolwarm')
```

Out[29]:
```
<AxesSubplot:>
```



In [30]:
```
df.head()
```

Out[30]:

	PassengerId	Survived	Pclass	Name	Sex	Age	SibSp	Parch	Ticket	Fare	Embarked
0	1	0.0	3	Braund, Mr. Owen Harris	male	22.0	1	0	A/5 21171	2.110213	S
1	2	1.0	1	Cumings, Mrs. John Bradley (Florence Briggs Th...	female	38.0	1	0	PC 17599	4.280593	C
2	3	1.0	3	Heikkinen, Miss. Laina	female	26.0	0	0	STON/O2. 3101282	2.188856	S
3	4	1.0	1	Futrelle, Mrs. Jacques Heath (Lily May Peel)	female	35.0	1	0	113803	3.990834	S
4	5	0.0	3	Allen, Mr. William Henry	male	35.0	0	0	373450	2.202765	S

In [31]:
```
## drop unnecessary columns
df = df.drop(columns=['Name', 'Ticket'], axis=1)
df.head()
```

Out[31]:

	PassengerId	Survived	Pclass	Sex	Age	SibSp	Parch	Fare	Embarked
0	1	0.0	3	male	22.0	1	0	2.110213	S
1	2	1.0	1	female	38.0	1	0	4.280593	C
2	3	1.0	3	female	26.0	0	0	2.188856	S
3	4	1.0	1	female	35.0	1	0	3.990834	S
4	5	0.0	3	male	35.0	0	0	2.202765	S

Label Encoding

In [32]:
```
from sklearn.preprocessing import LabelEncoder
cols = ['Sex', 'Embarked']
le = LabelEncoder()

for col in cols:
    df[col] = le.fit_transform(df[col])
df.head()
```

Out[32]:

	PassengerId	Survived	Pclass	Sex	Age	SibSp	Parch	Fare	Embarked
0	1	0.0	3	1	22.0	1	0	2.110213	2
1	2	1.0	1	0	38.0	1	0	4.280593	0
2	3	1.0	3	0	26.0	0	0	2.188856	2
3	4	1.0	1	0	35.0	1	0	3.990834	2
4	5	0.0	3	1	35.0	0	0	2.202765	2

Train-Test Split

In [33]:
```
train = df.iloc[:train_len, :]
test = df.iloc[train_len:, :]
```

In [34]:
```
train.head()
```

Out[34]:

	PassengerId	Survived	Pclass	Sex	Age	SibSp	Parch	Fare	Embarked
0	1	0.0	3	1	22.0	1	0	2.110213	2
1	2	1.0	1	0	38.0	1	0	4.280593	0
2	3	1.0	3	0	26.0	0	0	2.188856	2
3	4	1.0	1	0	35.0	1	0	3.990834	2
4	5	0.0	3	1	35.0	0	0	2.202765	2

In [35]:
```
test.head()
```

Out[35]:

	PassengerId	Survived	Pclass	Sex	Age	SibSp	Parch	Fare	Embarked
891	892	NaN	3	1	34.5	0	0	2.178064	1
892	893	NaN	3	0	47.0	1	0	2.079442	2
893	894	NaN	2	1	62.0	0	0	2.369075	1
894	895	NaN	3	1	27.0	0	0	2.268252	2
895	896	NaN	3	0	22.0	1	1	2.586824	2

In [36]:
```
# input split
X = train.drop(columns=['PassengerId', 'Survived'], axis=1)
y = train['Survived']
```

In [37]:
```
X.head()
```

Out[37]:

	Pclass	Sex	Age	SibSp	Parch	Fare	Embarked
0	3	1	22.0	1	0	2.110213	2
1	1	0	38.0	1	0	4.280593	0
2	3	0	26.0	0	0	2.188856	2
3	1	0	35.0	1	0	3.990834	2
4	3	1	35.0	0	0	2.202765	2

Model Training

In [38]:
```
from sklearn.model_selection import train_test_split, cross_val_score
# classify column
def classify(model):
    x_train, x_test, y_train, y_test = train_test_split(X, y, test_size=0.25, random_state=42)
    model.fit(x_train, y_train)
    print('Accuracy:', model.score(x_test, y_test))

    score = cross_val_score(model, X, y, cv=5)
    print('CV Score:', np.mean(score))
```

In [39]:
```
from sklearn.linear_model import LogisticRegression
model = LogisticRegression()
classify(model)
```

```
Accuracy: 0.8071748878923767
CV Score: nan
```

In [40]:
```
from sklearn.tree import DecisionTreeClassifier
model = DecisionTreeClassifier()
classify(model)
```

```
Accuracy: 0.7174887892376681
CV Score: 0.7744460485845208
```

In [41]:
```
from sklearn.ensemble import RandomForestClassifier
model = RandomForestClassifier()
classify(model)
```

```
Accuracy: 0.8026905829596412
CV Score: 0.8081036971941498
```

In [42]:
```
from sklearn.ensemble import ExtraTreesClassifier
model = ExtraTreesClassifier()
classify(model)
```

```
Accuracy: 0.7937219730941704
CV Score: 0.7890465130876907
```

In [43]:
```
from xgboost import XGBClassifier
model = XGBClassifier()
classify(model)
```

```
[14:40:05] WARNING: ../src/learner.cc:1095: Starting in XGBoost 1.3.0, the default evaluation metric used with the objective 'binary:logistic' was changed from 'error' to 'loglos
s'. Explicitly set eval_metric if you'd like to restore the old behavior.
Accuracy: 0.7892376681614349
[14:40:05] WARNING: ../src/learner.cc:1095: Starting in XGBoost 1.3.0, the default evaluation metric used with the objective 'binary:logistic' was changed from 'error' to 'loglos
s'. Explicitly set eval_metric if you'd like to restore the old behavior.
[14:40:05] WARNING: ../src/learner.cc:1095: Starting in XGBoost 1.3.0, the default evaluation metric used with the objective 'binary:logistic' was changed from 'error' to 'loglos
s'. Explicitly set eval_metric if you'd like to restore the old behavior.
[14:40:05] WARNING: ../src/learner.cc:1095: Starting in XGBoost 1.3.0, the default evaluation metric used with the objective 'binary:logistic' was changed from 'error' to 'loglos
s'. Explicitly set eval_metric if you'd like to restore the old behavior.
[14:40:05] WARNING: ../src/learner.cc:1095: Starting in XGBoost 1.3.0, the default evaluation metric used with the objective 'binary:logistic' was changed from 'error' to 'loglos
s'. Explicitly set eval_metric if you'd like to restore the old behavior.
[14:40:05] WARNING: ../src/learner.cc:1095: Starting in XGBoost 1.3.0, the default evaluation metric used with the objective 'binary:logistic' was changed from 'error' to 'loglos
s'. Explicitly set eval_metric if you'd like to restore the old behavior.
CV Score: 0.8125980792166217
```

In [44]:
```
from lightgbm import LGBMClassifier
model = LGBMClassifier()
classify(model)
```

```
Accuracy: 0.8116591928251121
CV Score: 0.8238277572029377
```

In [45]:
```
from catboost import CatBoostClassifier
model = CatBoostClassifier(verbose=0)
classify(model)
```

```
Accuracy: 0.8295964125560538
CV Score: 0.8226790534178645
```

Complete Model Training with Full Data

In [46]:
```
model = LGBMClassifier()
model.fit(X, y)
```

Out[46]:
```
LGBMClassifier()
```

In [47]:
```
test.head()
```

Out[47]:

	PassengerId	Survived	Pclass	Sex	Age	SibSp	Parch	Fare	Embarked
891	892	NaN	3	1	34.5	0	0	2.178064	1
892	893	NaN	3	0	47.0	1	0	2.079442	2
893	894	NaN	2	1	62.0	0	0	2.369075	1
894	895	NaN	3	1	27.0	0	0	2.268252	2
895	896	NaN	3	0	22.0	1	1	2.586824	2

In [48]:
```
# input split for test data
X_test = test.drop(columns=['PassengerId', 'Survived'], axis=1)
```

In [49]:
```
X_test.head()
```

Out[49]:

	Pclass	Sex	Age	SibSp	Parch	Fare	Embarked
891	3	1	34.5	0	0	2.178064	1
892	3	0	47.0	1	0	2.079442	2
893	2	1	62.0	0	0	2.369075	1
894	3	1	27.0	0	0	2.268252	2
895	3	0	22.0	1	1	2.586824	2

In [50]:
```
pred = model.predict(X_test)
pred
```

Out[50]:
```
array([0., 0., 0., 1., 0., 0., 0., 0., 1., 0., 0., 0., 1., 0., 1., 1., 0.,
       1., 1., 1., 0., 0., 1., 1., 1., 0., 1., 1., 1., 0., 0., 0., 0., 0.,
       1., 0., 0., 0., 0., 1., 0., 1., 0., 1., 1., 0., 0., 0., 1., 1., 1.,
       0., 1., 1., 0., 0., 0., 0., 0., 1., 0., 0., 0., 1., 1., 1., 1., 0.,
       0., 1., 1., 0., 0., 0., 1., 1., 0., 1., 0., 1., 1., 0., 0., 0., 0.,
       0., 1., 1., 1., 1., 0., 0., 1., 0., 1., 0., 1., 0., 0., 0., 1., 0.,
       0., 0., 1., 0., 0., 0., 0., 0., 0., 1., 1., 1., 1., 0., 0., 1., 1.,
       1., 1., 0., 1., 0., 0., 1., 0., 1., 0., 0., 0., 0., 0., 0., 0., 0.,
       0., 0., 0., 0., 0., 1., 0., 0., 1., 0., 0., 0., 1., 0., 1., 0., 0.,
       0., 0., 0., 1., 0., 1., 1., 1., 1., 1., 0., 0., 0., 0., 0., 1., 0.,
       0., 1., 0., 0., 0., 1., 1., 0., 1., 1., 0., 0., 1., 0., 1., 0., 1.,
       0., 0., 0., 0., 0., 0., 0., 1., 0., 1., 0., 0., 0., 1., 1., 0., 1.,
       0., 0., 0., 0., 1., 0., 0., 0., 0., 1., 0., 0., 1., 0., 1., 0., 1.,
       0., 1., 0., 1., 0., 0., 1., 0., 0., 0., 1., 0., 0., 1., 0., 0., 1.,
       1., 1., 1., 1., 0., 0., 0., 0., 1., 0., 1., 0., 1., 0., 0., 0., 0.,
       0., 0., 0., 1., 0., 0., 0., 1., 1., 0., 0., 0., 0., 0., 0., 0., 0.,
       1., 1., 0., 1., 0., 0., 0., 0., 0., 1., 1., 0., 1., 0., 0., 0., 0.,
       0., 0., 0., 0., 0., 0., 0., 1., 0., 0., 0., 0., 0., 0., 0., 1., 1.,
       0., 1., 0., 0., 0., 1., 0., 0., 1., 1., 0., 0., 0., 0., 0., 0., 0.,
       1., 1., 0., 1., 0., 0., 0., 1., 0., 0., 1., 0., 0., 1., 0., 0., 0.,
       0., 0., 0., 1., 0., 1., 0., 1., 0., 1., 1., 0., 0., 0., 1., 0., 1.,
       0., 0., 1., 0., 1., 1., 1., 1., 0., 0., 0., 1., 0., 0., 1., 0., 0.,
       1., 1., 0., 0., 0., 1., 0., 0., 0., 1., 0., 1., 0., 0., 0., 0., 0.,
       1., 0., 0., 0., 1., 0., 1., 0., 0., 1., 0., 1., 0., 0., 0., 0., 0.,
       1., 1., 1., 1., 0., 0., 1., 0., 0., 1.])
```

Test Submission

In [51]:
```
sub = pd.read_csv('/kaggle/input/titanic/gender_submission.csv')
sub.head()
```

Out[51]:

	PassengerId	Survived
0	892	0
1	893	1
2	894	0
3	895	0
4	896	1

In [52]:
```
sub.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 418 entries, 0 to 417
Data columns (total 2 columns):
 #   Column       Non-Null Count  Dtype
---  ------       --------------  -----
 0   PassengerId  418 non-null    int64
 1   Survived     418 non-null    int64
dtypes: int64(2)
memory usage: 6.7 KB
```

In [53]:
```
sub['Survived'] = pred
sub['Survived'] = sub['Survived'].astype('int')
```

In [54]:
```
sub.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 418 entries, 0 to 417
Data columns (total 2 columns):
 #   Column       Non-Null Count  Dtype
---  ------       --------------  -----
 0   PassengerId  418 non-null    int64
 1   Survived     418 non-null    int64
dtypes: int64(2)
memory usage: 6.7 KB
```

In [55]:
```
sub.head()
```

Out[55]:

	PassengerId	Survived
0	892	0
1	893	0
2	894	0
3	895	1
4	896	0

In [56]:
```
sub.to_csv('submission.csv', index=False)
```

In [ ]: