Task 5: Exploratory Data Analysis (EDA)

- **Objective:** Extract insights using visual and statistical exploration.
- **Tools:** Python (Pandas, Matplotlib, Seaborn)
- **Deliverables:** Jupyter Notebook + PDF report of findings
- **Hints/Mini Guide:**
  a. Use .describe(), .info(), .value_counts()
  b. Use sns.pairplot(), sns.heatmap() for visualization
  c. Identify relationships and trends
  d. Plot histograms, boxplots, scatterplots
  e. Write observations for each visual
  f. Provide summary of findings

```
#we have to perform all the above operations on the titanic dataset
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
import seaborn as sns

df=pd.read_csv('titanic.csv')

df.head()
```

```
   PassengerId  Survived  Pclass  \
0            1         0       3
1            2         1       1
2            3         1       3
3            4         1       1
4            5         0       3

                                                Name     Sex   Age
SibSp  \
0                            Braund, Mr. Owen Harris    male  22.0
1
1  Cumings, Mrs. John Bradley (Florence Briggs Th...  female  38.0
1
2                             Heikkinen, Miss. Laina  female  26.0
```

```
0
3       Futrelle, Mrs. Jacques Heath (Lily May Peel)  female  35.0
1
4                            Allen, Mr. William Henry    male  35.0
0

   Parch            Ticket     Fare Cabin Embarked
0      0         A/5 21171   7.2500   NaN        S
1      0          PC 17599  71.2833   C85        C
2      0  STON/O2. 3101282   7.9250   NaN        S
3      0            113803  53.1000  C123        S
4      0            373450   8.0500   NaN        S
```

```
df.shape
```

```
(891, 12)
```

```
#lets perform some basic preprocesssing operations on the dataset

df.isna().sum() #there are null values in the age ,cabin , embarked
#lets drop the null values from the dataset
```

```
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
```

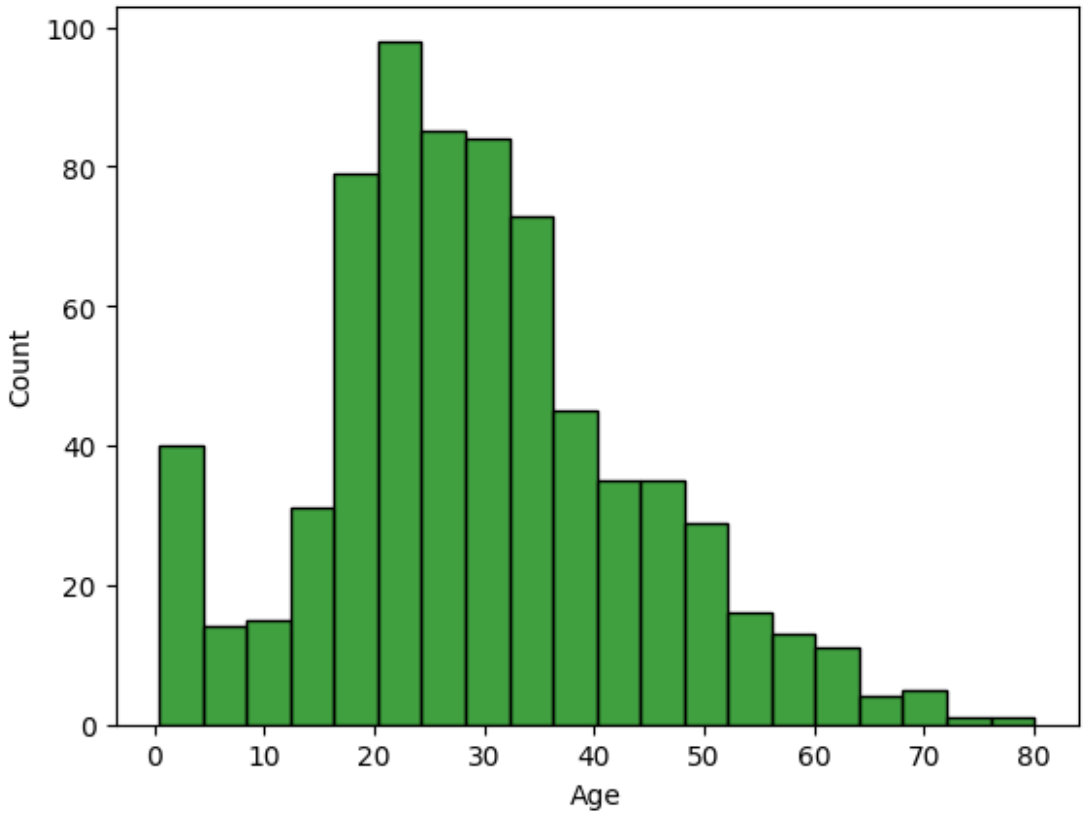
```
df['Cabin'].value_counts()
```

```
Cabin
B96 B98        4
G6             4
C23 C25 C27    4
C22 C26        3
F33            3
              ..
E34            1
C7             1
C54            1
E36            1
C148           1
Name: count, Length: 147, dtype: int64
```

```
# df.dropna(inplace=True)
#but dropping is not the correct way because
#due to dropping null we can lose around ~80% of the dataset
#so lets make a new feature name is_cabin and output is yes and no
df['is_cabin']=df['Cabin'].notnull().astype('int')

#so we have made it
#lets drop the cabin column
df.drop(columns=['Cabin'],inplace=True)

df.shape
```

```
(891, 12)
```

```
df.isnull().sum()
#we also have to handle the  null avlues in the age lets impute them
#because it is also a 30% of the dataset
#

#lets check the distribution of the age then we impute the null values
in the age column

sns.histplot(df['Age'],color='green')
plt.show()
#so the distribution is right skewed
#so filling with the median value is the best option that we have
```




```
df['Age']=df['Age'].fillna(df['Age'].median())

df.isnull().sum()
```

```
PassengerId    0
Survived       0
Pclass         0
Name           0
Sex            0
Age            0
SibSp          0
Parch          0
Ticket         0
Fare           0
Embarked       2
is_cabin       0
dtype: int64
```

```
df['Embarked'].value_counts()
#lets fill it with the s because it is the most frequent value
df['Embarked']=df['Embarked'].fillna('S')

df.isnull().sum()
```

```
PassengerId    0
Survived       0
Pclass         0
Name           0
Sex            0
Age            0
SibSp          0
Parch          0
Ticket         0
Fare           0
Embarked       0
is_cabin       0
dtype: int64
```

```
#SO WE HAVE SUCCESSFULLY HANDLED ALL THE NULL VALUES PRESENT IN THE
DATASET
```

```
df.head()
```

```
   PassengerId  Survived  Pclass  \
0            1         0       3
1            2         1       1
2            3         1       3
3            4         1       1
4            5         0       3

                                                Name     Sex   Age
SibSp  \
0                            Braund, Mr. Owen Harris    male  22.0
1
1  Cumings, Mrs. John Bradley (Florence Briggs Th...  female  38.0
1
2                             Heikkinen, Miss. Laina  female  26.0
0
3       Futrelle, Mrs. Jacques Heath (Lily May Peel)  female  35.0
1
4                           Allen, Mr. William Henry    male  35.0
0

   Parch            Ticket     Fare Embarked  is_cabin
0      0         A/5 21171   7.2500        S         0
1      0          PC 17599  71.2833        C         1
2      0  STON/O2. 3101282   7.9250        S         0
3      0            113803  53.1000        S         1
4      0            373450   8.0500        S         0
```

```
#LETS PERFORM REQUIRED EDA OPERATION ON THE DATASET
df.describe() #it returns the 5 number summary of the numerical
columns
```

```
       PassengerId    Survived      Pclass         Age       SibSp  \
count   891.000000  891.000000  891.000000  891.000000  891.000000
mean    446.000000    0.383838    2.308642   29.361582    0.523008
std     257.353842    0.486592    0.836071   13.019697    1.102743
min       1.000000    0.000000    1.000000    0.420000    0.000000
25%     223.500000    0.000000    2.000000   22.000000    0.000000
50%     446.000000    0.000000    3.000000   28.000000    0.000000
75%     668.500000    1.000000    3.000000   35.000000    1.000000
max     891.000000    1.000000    3.000000   80.000000    8.000000

             Parch        Fare    is_cabin
count  891.000000  891.000000  891.000000
mean     0.381594   32.204208    0.228956
std      0.806057   49.693429    0.420397
min      0.000000    0.000000    0.000000
25%      0.000000    7.910400    0.000000
50%      0.000000   14.454200    0.000000
75%      0.000000   31.000000    0.000000
max      6.000000  512.329200    1.000000

df.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          891 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  Embarked     891 non-null    object
 11  is_cabin     891 non-null    int32
dtypes: float64(2), int32(1), int64(5), object(4)
memory usage: 80.2+ KB
```

PAIRPLOT

```
#we have to plot only the numerical columns into this plot
columns=['Age','Fare','SibSp','Parch','Pclass']
sns.pairplot(df[columns+
['Survived']],kind='scatter',diag_kws={'color':'red'},hue='Survived',d
iag_kind='kde')
plt.show()
```

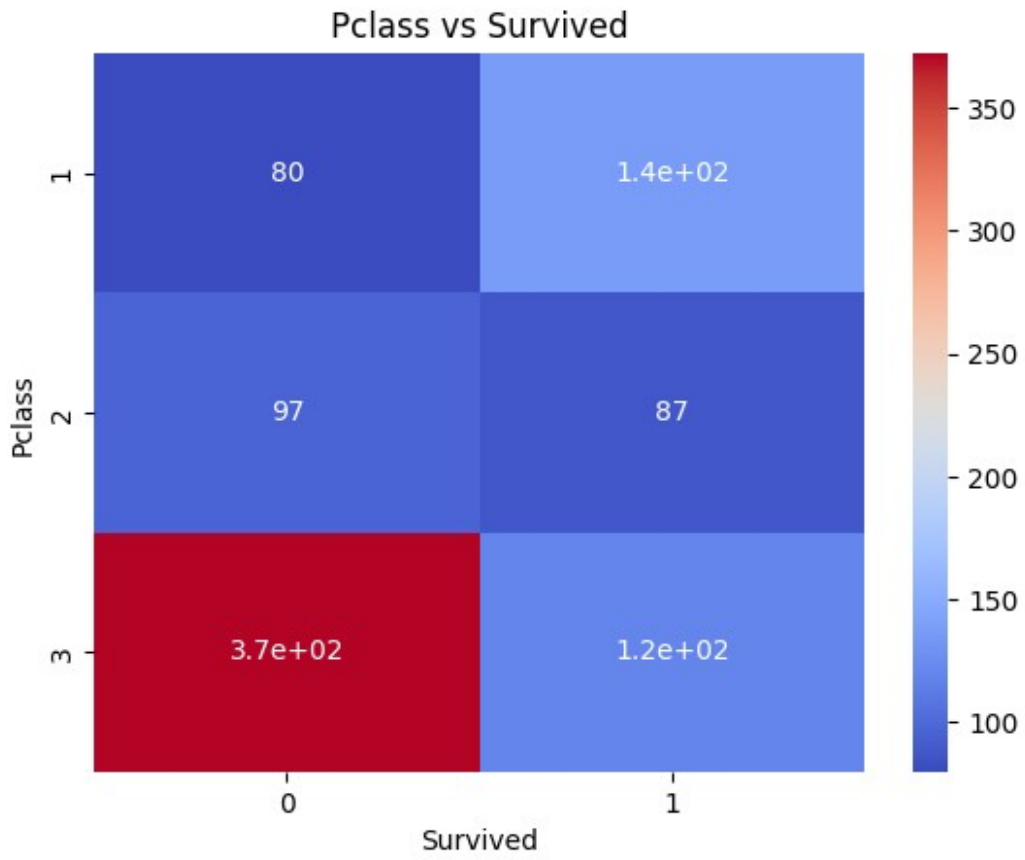

```
df.head()
```

```
   PassengerId  Survived  Pclass  \
0            1         0       3
1            2         1       1
2            3         1       3
3            4         1       1
4            5         0       3

                                                Name     Sex   Age
SibSp  \
0                            Braund, Mr. Owen Harris    male  22.0
1
1  Cumings, Mrs. John Bradley (Florence Briggs Th...  female  38.0
1
```

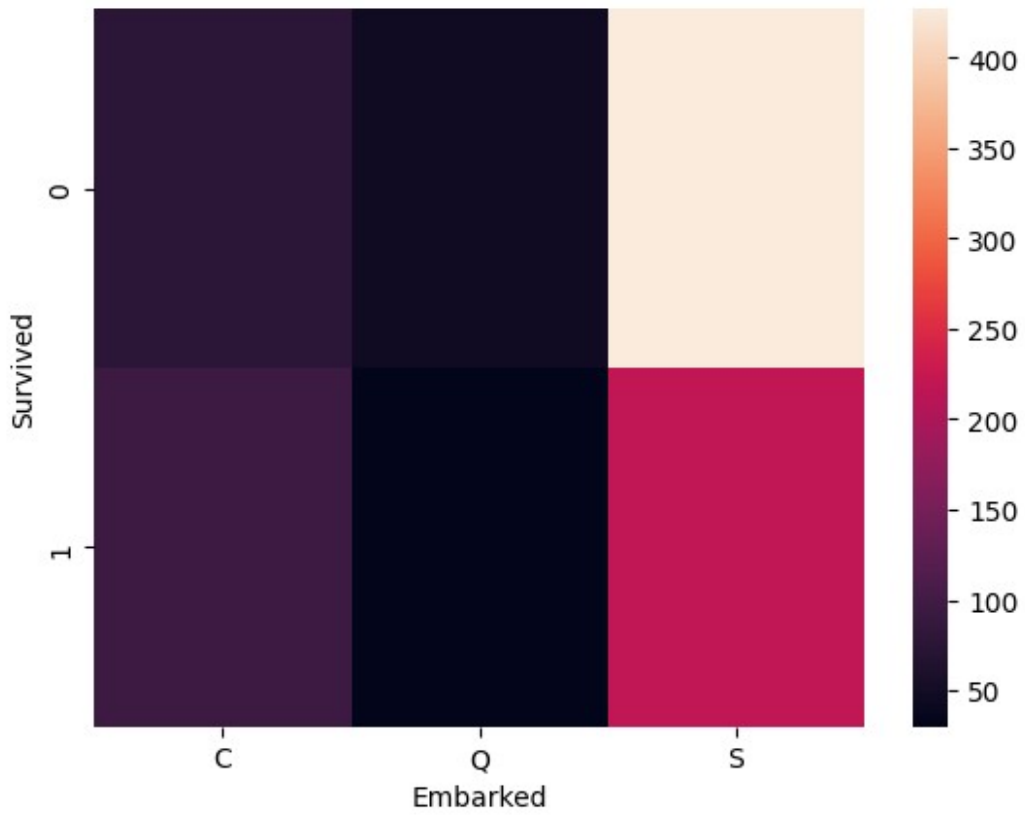
```
2                              Heikkinen, Miss. Laina  female  26.0
0
3       Futrelle, Mrs. Jacques Heath (Lily May Peel)  female  35.0
1
4                            Allen, Mr. William Henry    male  35.0
0

   Parch            Ticket     Fare Embarked  is_cabin
0      0         A/5 21171   7.2500        S         0
1      0          PC 17599  71.2833        C         1
2      0  STON/O2. 3101282   7.9250        S         0
3      0            113803  53.1000        S         1
4      0            373450   8.0500        S         0
```

Heatmap

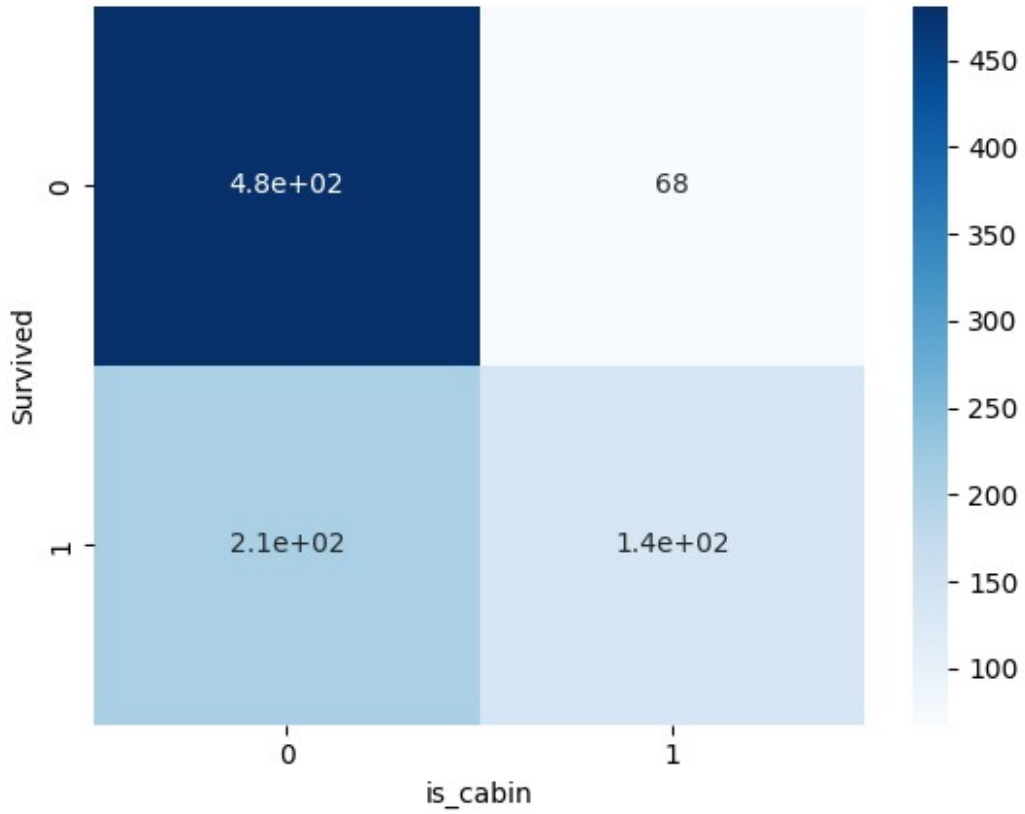
```
# categorical columnns=['Sex','is_cabin','Survived','Embarked']

#relationship between the input and output columns

#for this we required a contigency table
t1=pd.crosstab(df['Pclass'],df['Survived'])
sns.heatmap(t1,cmap='coolwarm',annot=True)
plt.title('Pclass vs Survived')
plt.show()
```



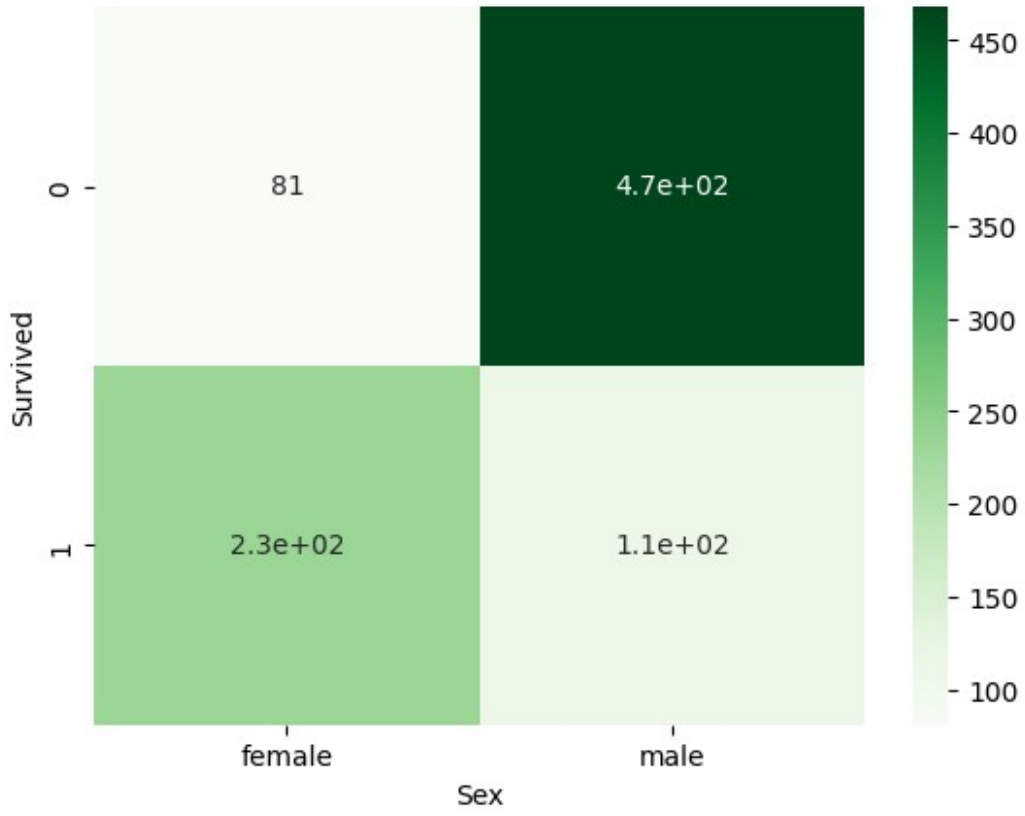

```
t2=pd.crosstab(df['Survived'],df['Embarked'])
sns.heatmap(t2)
plt.show()
```




```
Available Seaborn colormaps: ['deep', 'deep6', 'muted', 'muted6',
'pastel', 'pastel6', 'bright', 'bright6', 'dark', 'dark6',
'colorblind', 'colorblind6']

t3=pd.crosstab(df['Survived'],df['is_cabin'])
sns.heatmap(t3,cmap='Blues',annot=True)
plt.show()

<Axes: xlabel='is_cabin', ylabel='Survived'>
```



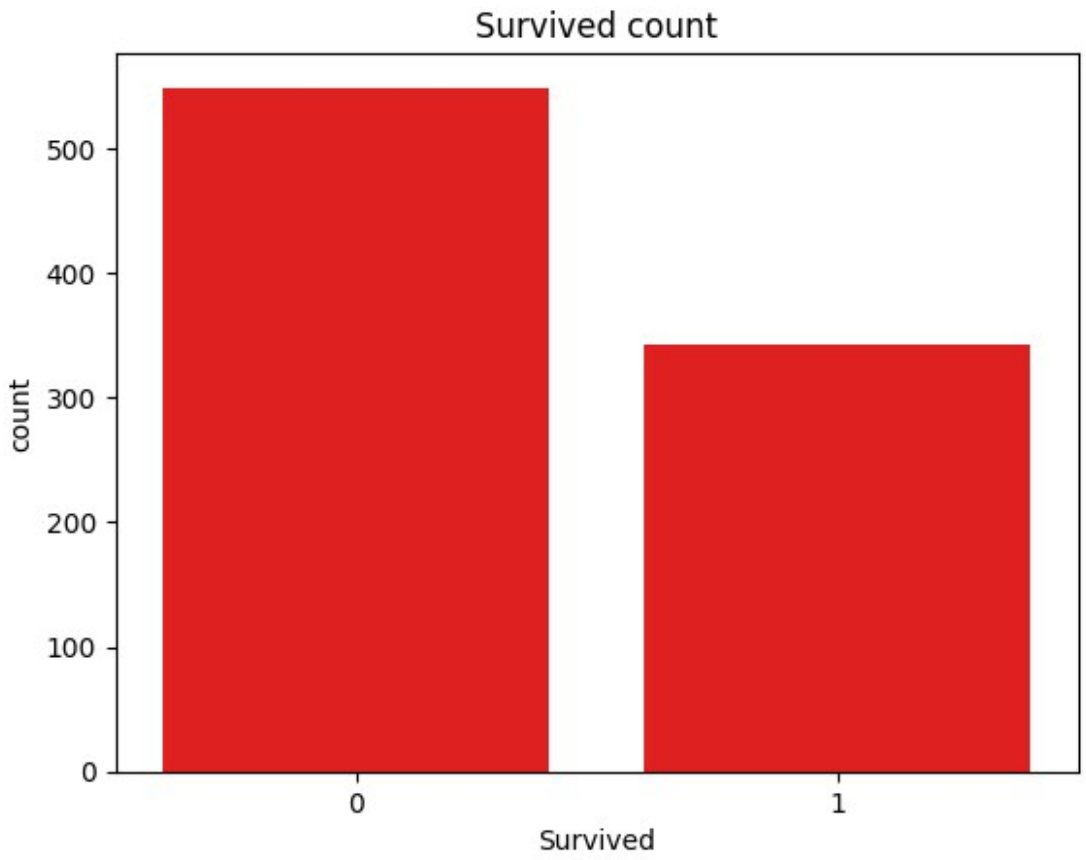

```
t4=pd.crosstab(df['Survived'],df['Sex'])
sns.heatmap(t4,cmap='Greens',annot=True)
plt.show()
```



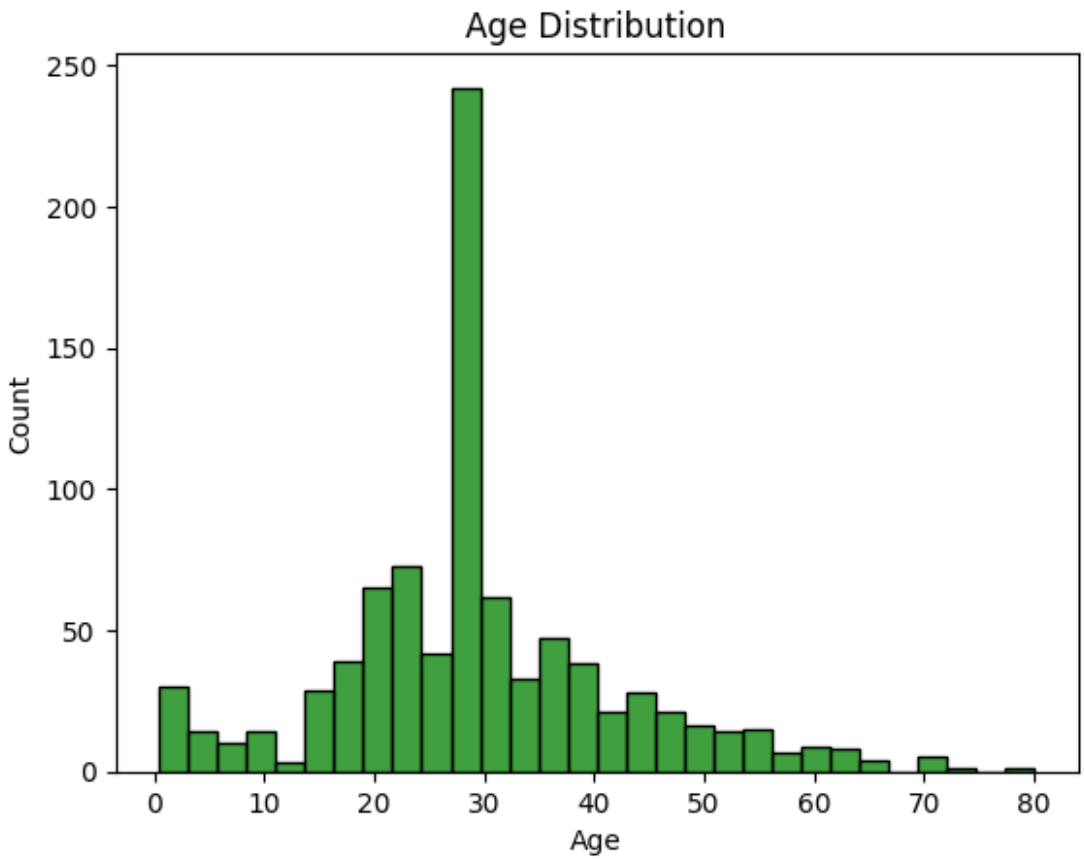
Lets find out the relationships and trends

1. Univariate analysis

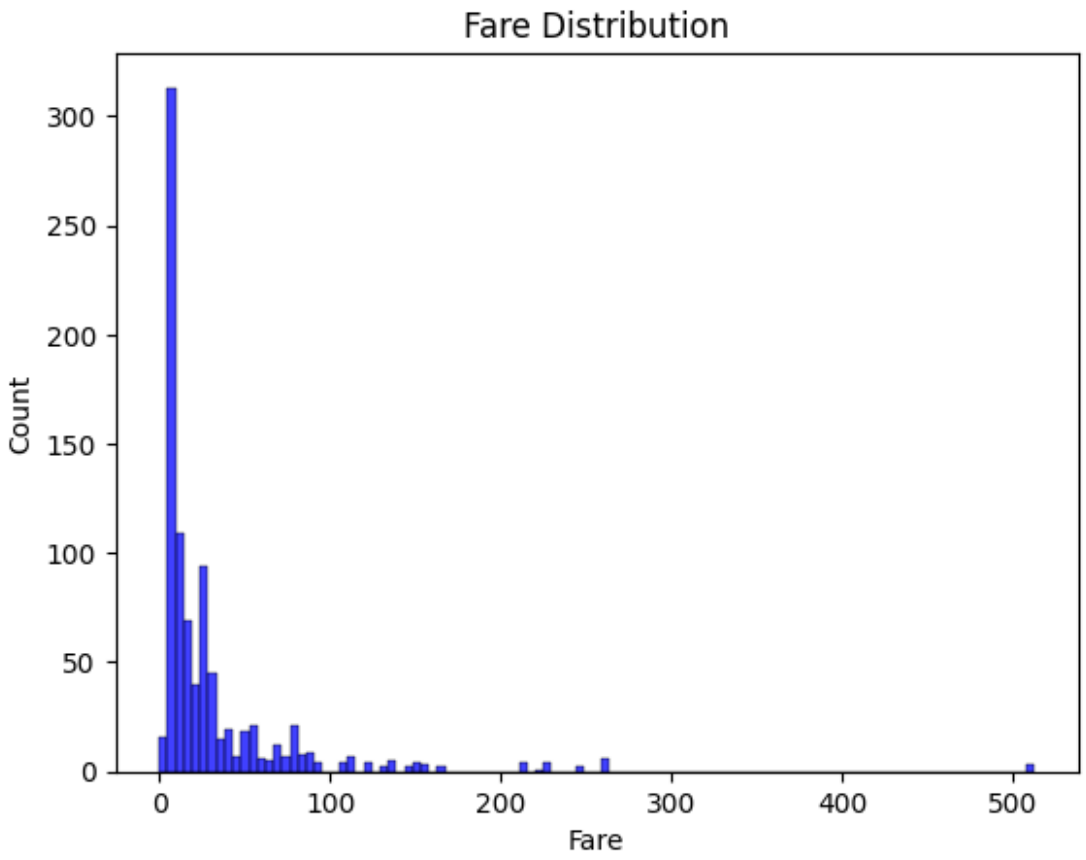
```
sns.countplot(x='Survived',data=df,color='red')
plt.title('Survived count')
plt.show()
#as we can see the their is the imbalance in the categories of
Survived column
```




```
sns.histplot(data=df,x='Age',color='green')
plt.title('Age Distribution')
plt.show()
#it is looking like the normal distribution
```

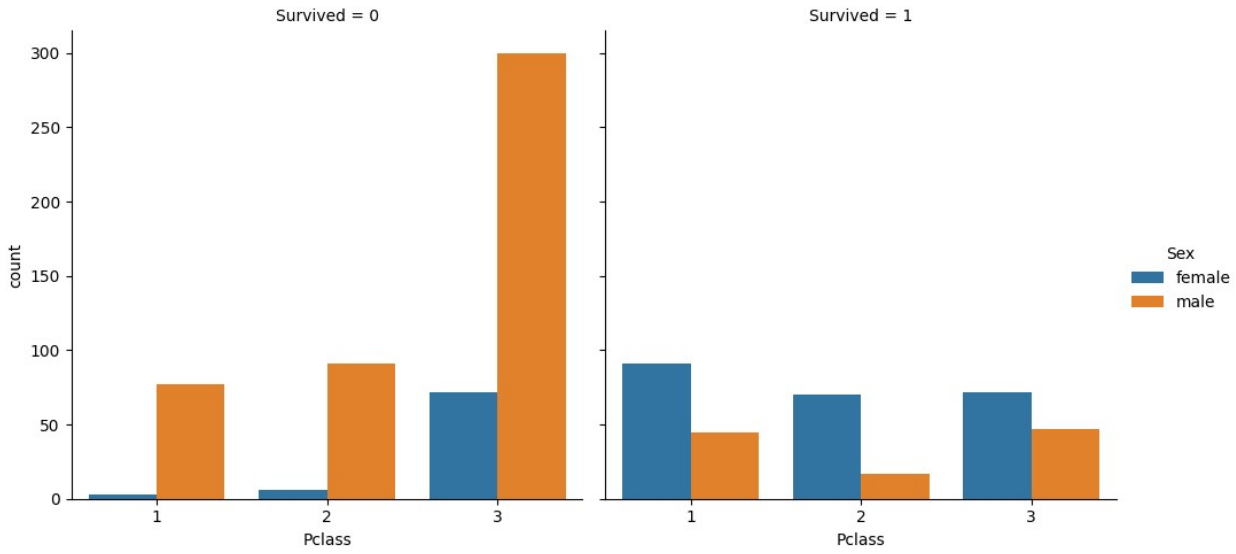



```
sns.histplot(data=df,x='Fare',color='blue')
plt.title('Fare Distribution')
#it is right skedwed
plt.show()
```

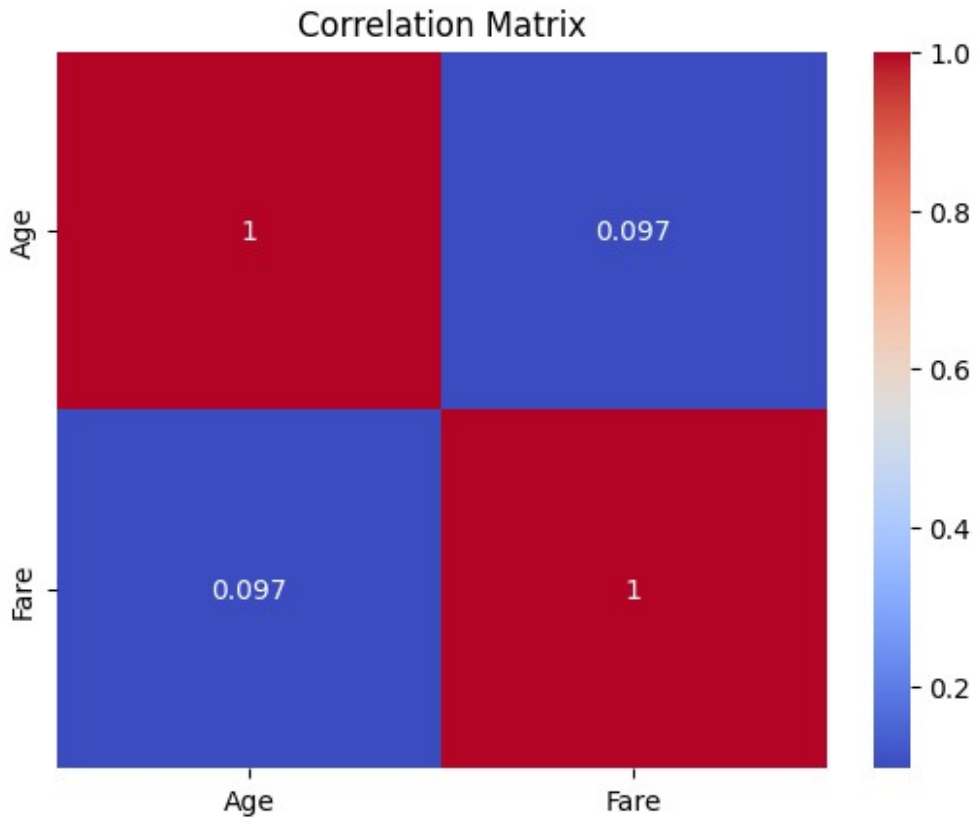


2. Bivariate analysis

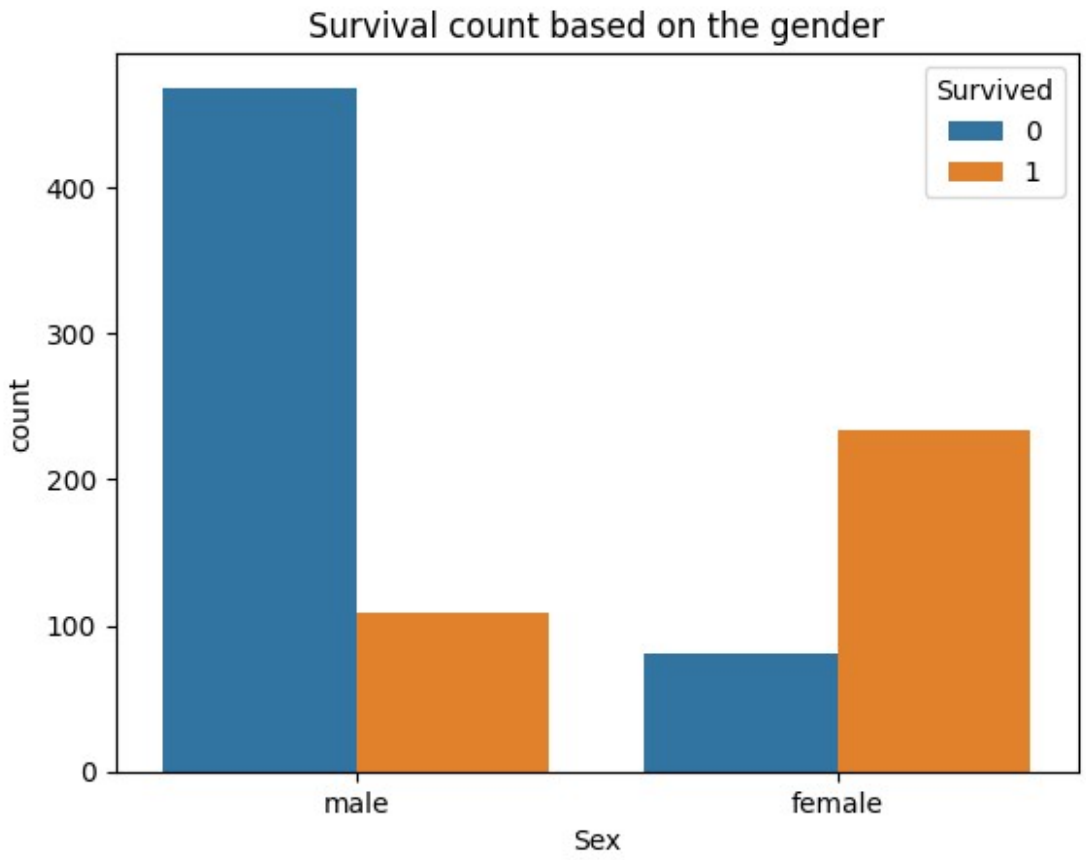
```
sns.catplot(x='Pclass', hue='Sex', col='Survived', kind='count',
data=df)
plt.show()
```



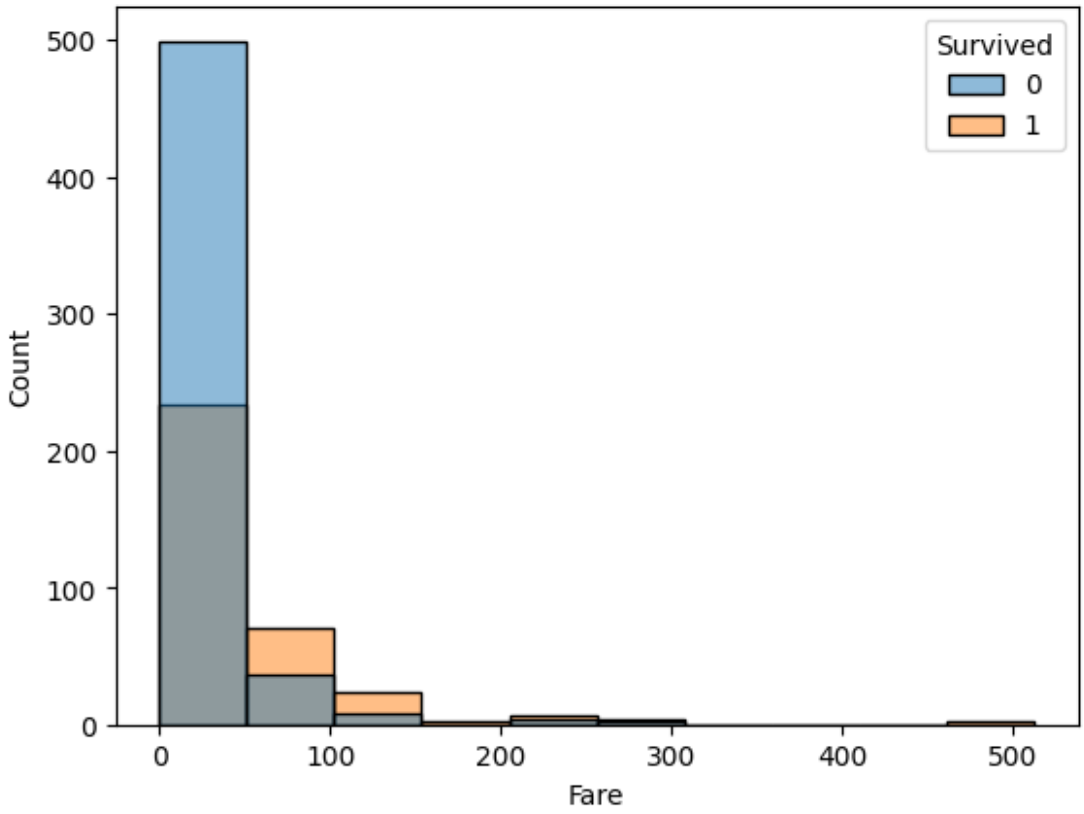
```
#finding the correlation between the numerical columns

correlation = df[['Age', 'Fare']].corr()
sns.heatmap(correlation, annot=True, cmap='coolwarm')
plt.title('Correlation Matrix')
plt.show()
#they are not highly correlated so no problem
```



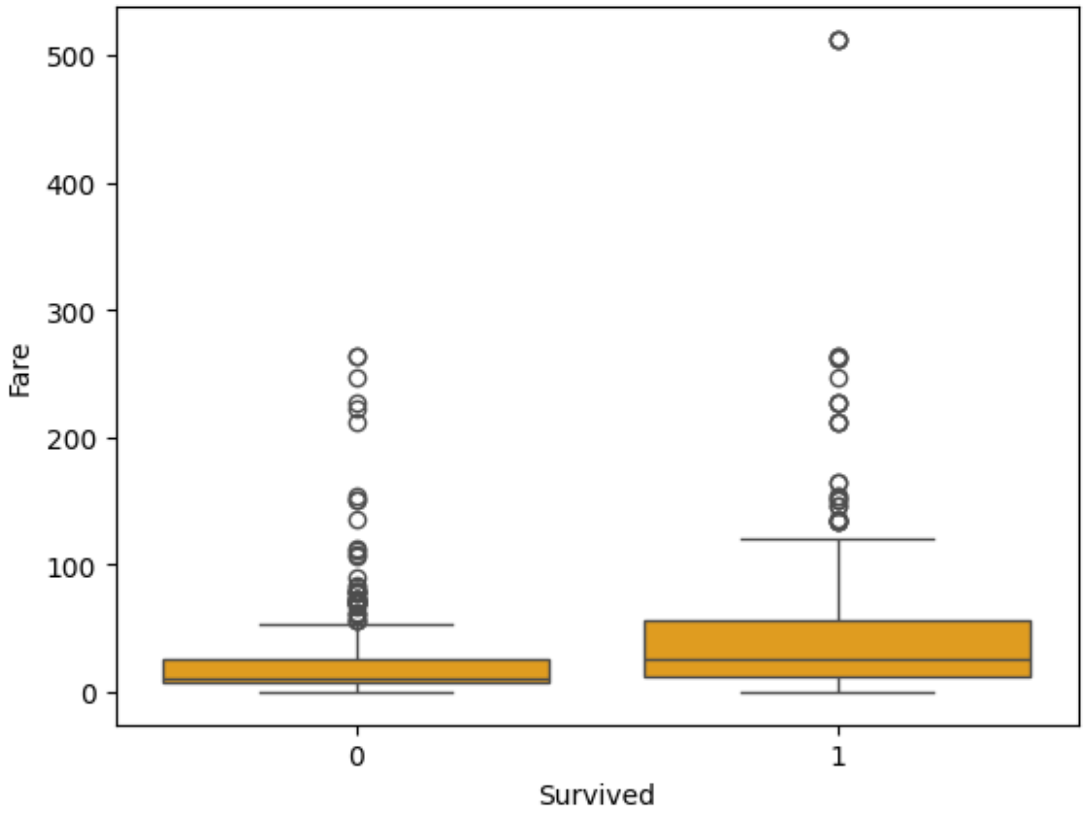

```
sns.countplot(x='Sex',data=df,hue='Survived')
plt.title('Survival count based on the gender')
plt.show()
```



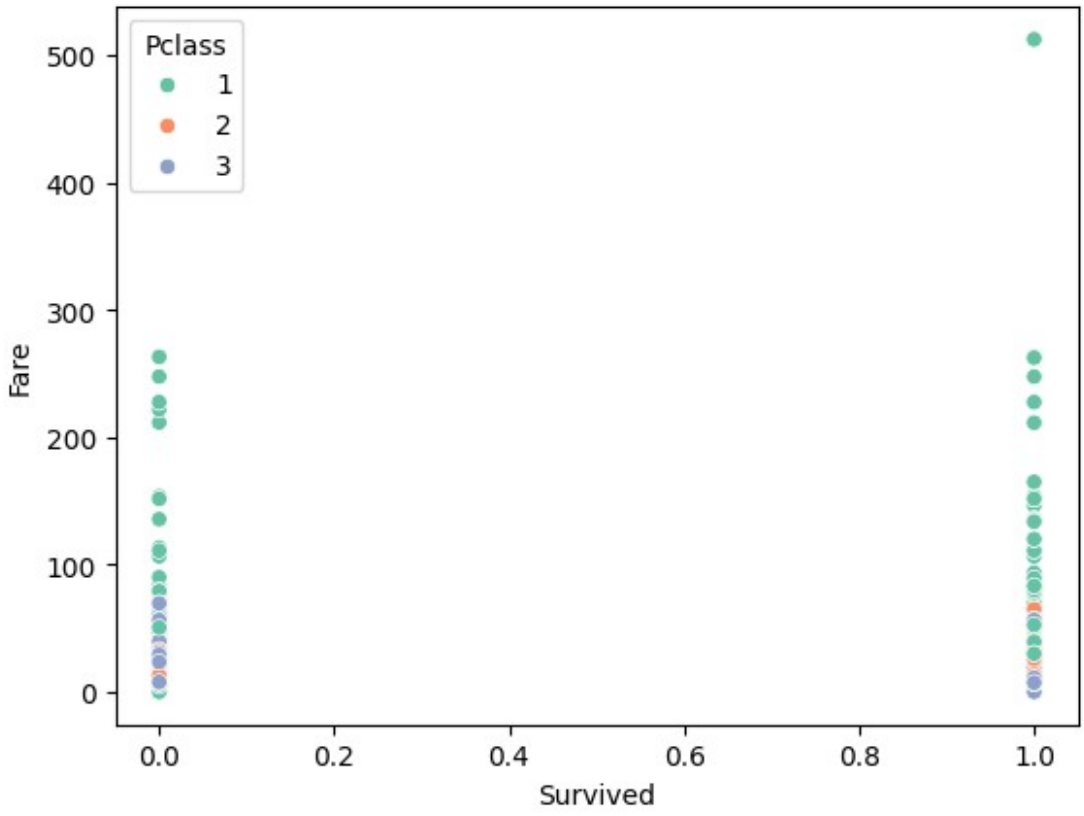

```
sns.histplot(data=df,x='Fare',hue='Survived',color='red',bins=10)
plt.show()
```




```
sns.boxplot(data=df,x='Survived',y='Fare',color='orange')
plt.show()
```




```
sns.scatterplot(data=df,x='Survived',y='Fare',hue='Pclass',palette='Set2')
#as we can see that the people with the higher fare are in first classs
#and they have more chances of survival
plt.show()
```

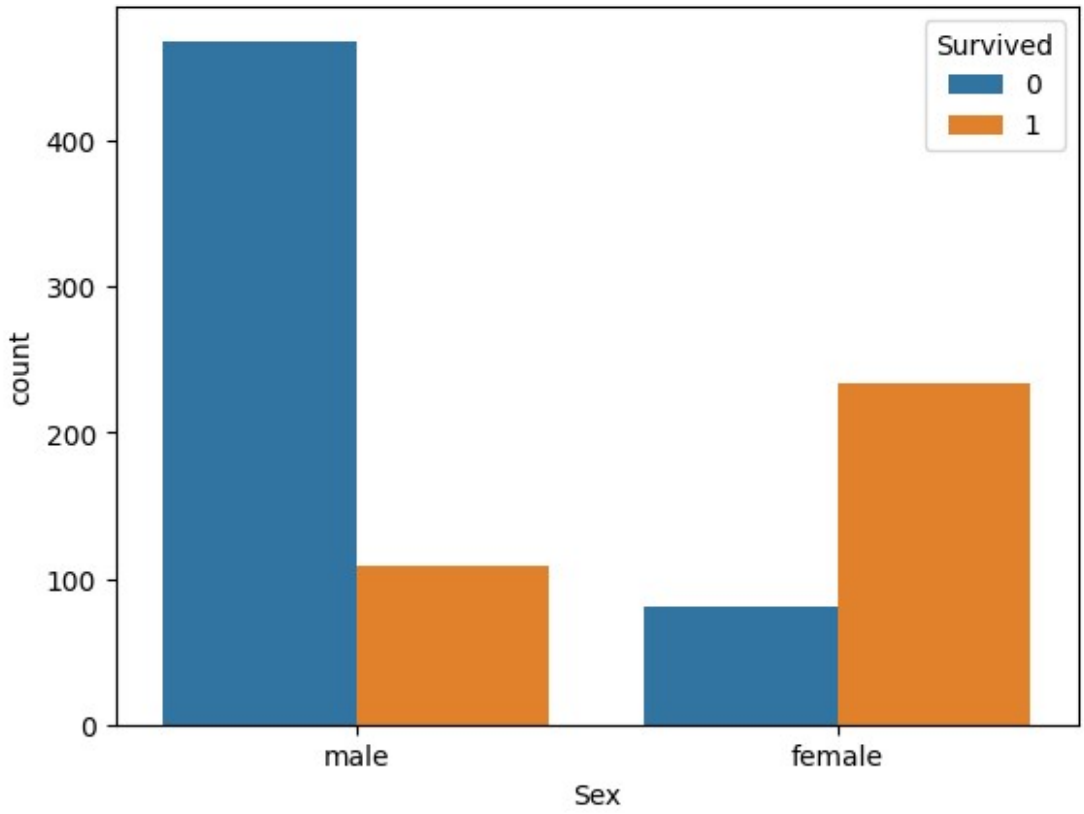


3. Multivariate Analysis

```
sns.pairplot(df[columns+['Survived']],hue='Survived') #by default it
will plot the scatter plot fo all the columns that are given to it

plt.show()
```


```
sns.countplot(x='Sex',data=df,hue='Survived')
plt.title('Survival count based on the gender')
plt.show()
```

```
<Axes: xlabel='Sex', ylabel='count'>
```



Insights and the summary

1. Gender and survival: Female had high survival rate then men

2. Passenger class and Survival: 1st class had more survival rate

3. Age and Survival: Children had high survival rate.

4. Fare and Pclass: Person who paid more or person in a first class have high survival rate

```
#command for converting the jupyter notebook to pdf
#!pip install nbconvert
# jupyter nbconvert --to pdf your_notebook.ipynb
```

```
Requirement already satisfied: nbconvert in c:\users\aashi\appdata\
local\programs\python\python312\lib\site-packages (7.16.4)
Requirement already satisfied: beautifulsoup4 in c:\users\aashi\
appdata\local\programs\python\python312\lib\site-packages (from
nbconvert) (4.12.3)
Requirement already satisfied: bleach!=5.0.0 in c:\users\aashi\
appdata\local\programs\python\python312\lib\site-packages (from
nbconvert) (6.1.0)
Requirement already satisfied: defusedxml in c:\users\aashi\appdata\
local\programs\python\python312\lib\site-packages (from nbconvert)
```

```
(0.7.1)
Requirement already satisfied: jinja2>=3.0 in c:\users\aashi\appdata\
local\programs\python\python312\lib\site-packages (from nbconvert)
(3.1.4)
Requirement already satisfied: jupyter-core>=4.7 in c:\users\aashi\
appdata\roaming\python\python312\site-packages (from nbconvert)
(5.7.2)
Requirement already satisfied: jupyterlab-pygments in c:\users\aashi\
appdata\local\programs\python\python312\lib\site-packages (from
nbconvert) (0.3.0)
Requirement already satisfied: markupsafe>=2.0 in c:\users\aashi\
appdata\local\programs\python\python312\lib\site-packages (from
nbconvert) (2.1.5)
Requirement already satisfied: mistune<4,>=2.0.3 in c:\users\aashi\
appdata\local\programs\python\python312\lib\site-packages (from
nbconvert) (3.0.2)
Requirement already satisfied: nbclient>=0.5.0 in c:\users\aashi\
appdata\local\programs\python\python312\lib\site-packages (from
nbconvert) (0.10.0)
Requirement already satisfied: nbformat>=5.7 in c:\users\aashi\
appdata\local\programs\python\python312\lib\site-packages (from
nbconvert) (5.10.4)
Requirement already satisfied: packaging in c:\users\aashi\appdata\
roaming\python\python312\site-packages (from nbconvert) (24.0)
Requirement already satisfied: pandocfilters>=1.4.1 in c:\users\aashi\
appdata\local\programs\python\python312\lib\site-packages (from
nbconvert) (1.5.1)
Requirement already satisfied: pygments>=2.4.1 in c:\users\aashi\
appdata\roaming\python\python312\site-packages (from nbconvert)
(2.18.0)
Requirement already satisfied: tinycss2 in c:\users\aashi\appdata\
local\programs\python\python312\lib\site-packages (from nbconvert)
(1.3.0)
Requirement already satisfied: traitlets>=5.1 in c:\users\aashi\
appdata\roaming\python\python312\site-packages (from nbconvert)
(5.14.3)
Requirement already satisfied: six>=1.9.0 in c:\users\aashi\appdata\
local\programs\python\python312\lib\site-packages (from bleach!=5.0.0-
>nbconvert) (1.16.0)
Requirement already satisfied: webencodings in c:\users\aashi\appdata\
local\programs\python\python312\lib\site-packages (from bleach!=5.0.0-
>nbconvert) (0.5.1)
Requirement already satisfied: platformdirs>=2.5 in c:\users\aashi\
appdata\roaming\python\python312\site-packages (from jupyter-
core>=4.7->nbconvert) (4.2.2)
Requirement already satisfied: pywin32>=300 in c:\users\aashi\appdata\
local\programs\python\python312\lib\site-packages (from jupyter-
core>=4.7->nbconvert) (306)
Requirement already satisfied: jupyter-client>=6.1.12 in c:\users\
```

```
aashi\appdata\roaming\python\python312\site-packages (from
nbclient>=0.5.0->nbconvert) (8.6.2)
Requirement already satisfied: fastjsonschema>=2.15 in c:\users\aashi\
appdata\local\programs\python\python312\lib\site-packages (from
nbformat>=5.7->nbconvert) (2.20.0)
Requirement already satisfied: jsonschema>=2.6 in c:\users\aashi\
appdata\local\programs\python\python312\lib\site-packages (from
nbformat>=5.7->nbconvert) (4.23.0)
Requirement already satisfied: soupsieve>1.2 in c:\users\aashi\
appdata\local\programs\python\python312\lib\site-packages (from
beautifulsoup4->nbconvert) (2.5)
Requirement already satisfied: attrs>=22.2.0 in c:\users\aashi\
appdata\local\programs\python\python312\lib\site-packages (from
jsonschema>=2.6->nbformat>=5.7->nbconvert) (24.1.0)
Requirement already satisfied: jsonschema-specifications>=2023.03.6 in
c:\users\aashi\appdata\local\programs\python\python312\lib\site-
packages (from jsonschema>=2.6->nbformat>=5.7->nbconvert) (2023.12.1)
Requirement already satisfied: referencing>=0.28.4 in c:\users\aashi\
appdata\local\programs\python\python312\lib\site-packages (from
jsonschema>=2.6->nbformat>=5.7->nbconvert) (0.35.1)
Requirement already satisfied: rpds-py>=0.7.1 in c:\users\aashi\
appdata\local\programs\python\python312\lib\site-packages (from
jsonschema>=2.6->nbformat>=5.7->nbconvert) (0.20.0)
Requirement already satisfied: python-dateutil>=2.8.2 in c:\users\
aashi\appdata\local\programs\python\python312\lib\site-packages (from
jupyter-client>=6.1.12->nbclient>=0.5.0->nbconvert) (2.9.0.post0)
Requirement already satisfied: pyzmq>=23.0 in c:\users\aashi\appdata\
roaming\python\python312\site-packages (from jupyter-client>=6.1.12-
>nbclient>=0.5.0->nbconvert) (26.0.3)
Requirement already satisfied: tornado>=6.2 in c:\users\aashi\appdata\
roaming\python\python312\site-packages (from jupyter-client>=6.1.12-
>nbclient>=0.5.0->nbconvert) (6.4)


[notice] A new release of pip is available: 25.0 -> 25.1
[notice] To update, run: python.exe -m pip install --upgrade pip
```