In [80]:

```
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
import seaborn as sns
```

In [81]:

```
plt.style.use('fivethirtyeight')
import warnings
warnings.filterwarnings('ignore')
%matplotlib inline
```

In [82]:

```
train_data=pd.read_csv('train.csv')
test_data=pd.read_csv('test.csv')
```

In [83]:

```
train_data.shape
```

Out[83]:

```
(891, 12)
```

```
In [84]: train_data.head(10)
```

Out[84]:

	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
5	6	0	3	Moran, Mr. James	male	NaN	0	0	330877	8.4583	NaN	Q
6	7	0	1	McCarthy, Mr. Timothy J	male	54.0	0	0	17463	51.8625	E46	S
7	8	0	3	Palsson, Master. Gosta Leonard	male	2.0	3	1	349909	21.0750	NaN	S
8	9	1	3	Johnson, Mrs. Oscar W (Elisabeth Vilhelmina Berg)	female	27.0	0	2	347742	11.1333	NaN	S
9	10	1	2	Nasser, Mrs. Nicholas (Adele Achem)	female	14.0	1	0	237736	30.0708	NaN	C

In [85]:

```
test_data.head()
```

Out[85]:

	PassengerId	Pclass	Name	Sex	Age	SibSp	Parch	Ticket	Fare	Cabin	Embarked
0	892	3	Kelly, Mr. James	male	34.5	0	0	330911	7.8292	NaN	Q
1	893	3	Wilkes, Mrs. James (Ellen Needs)	female	47.0	1	0	363272	7.0000	NaN	S
2	894	2	Myles, Mr. Thomas Francis	male	62.0	0	0	240276	9.6875	NaN	Q
3	895	3	Wirz, Mr. Albert	male	27.0	0	0	315154	8.6625	NaN	S
4	896	3	Hirvonen, Mrs. Alexander (Helga E Lindqvist)	female	22.0	1	1	3101298	12.2875	NaN	S

In [86]:

```
train_data.isnull().sum()
```

Out[86]:

```
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
```

data visualization:

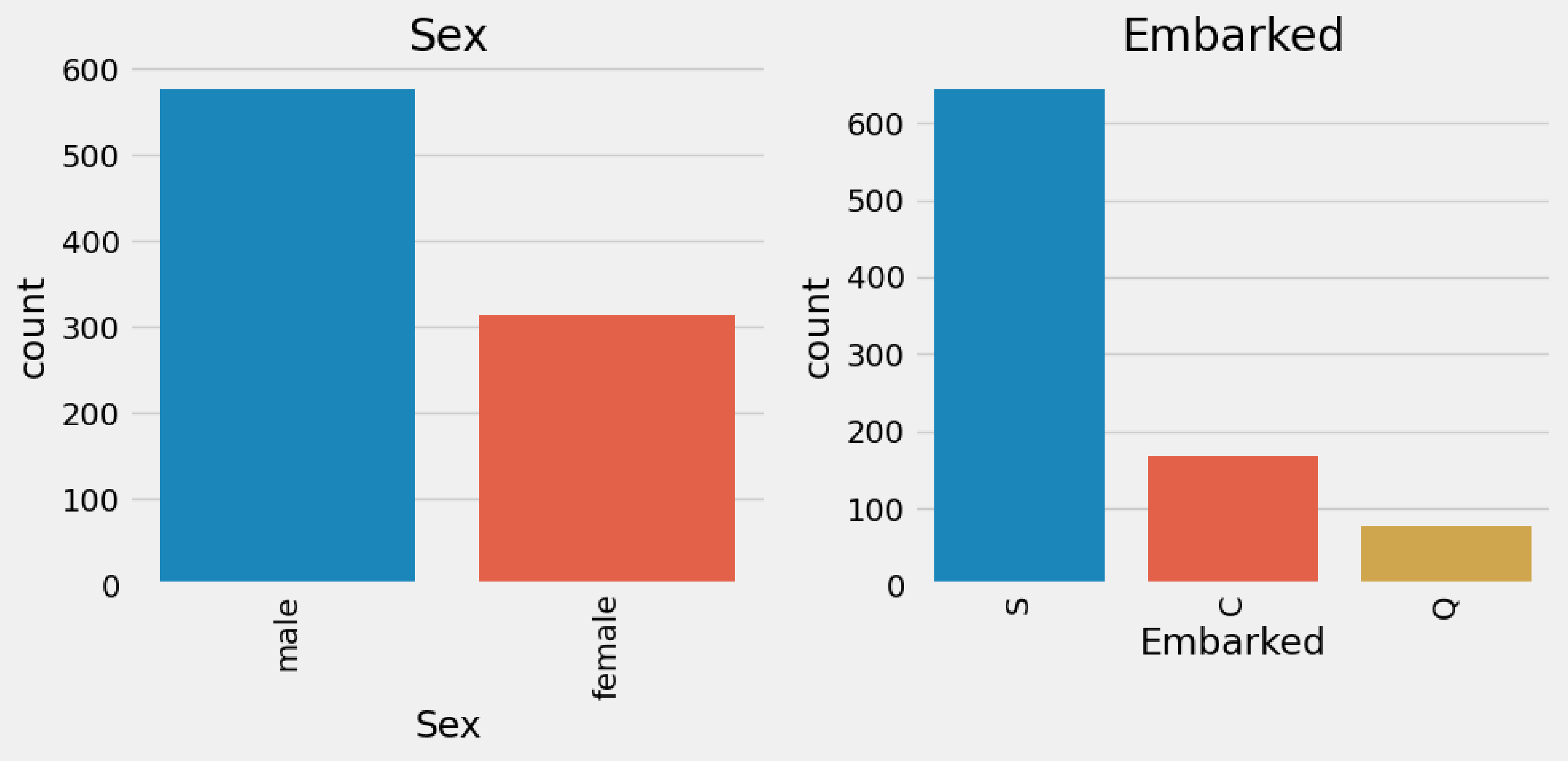
Plots For Categorical Variables

```
In [87]: cat_vars = train_data.select_dtypes(include='object').columns.tolist()
         cat_vars
```

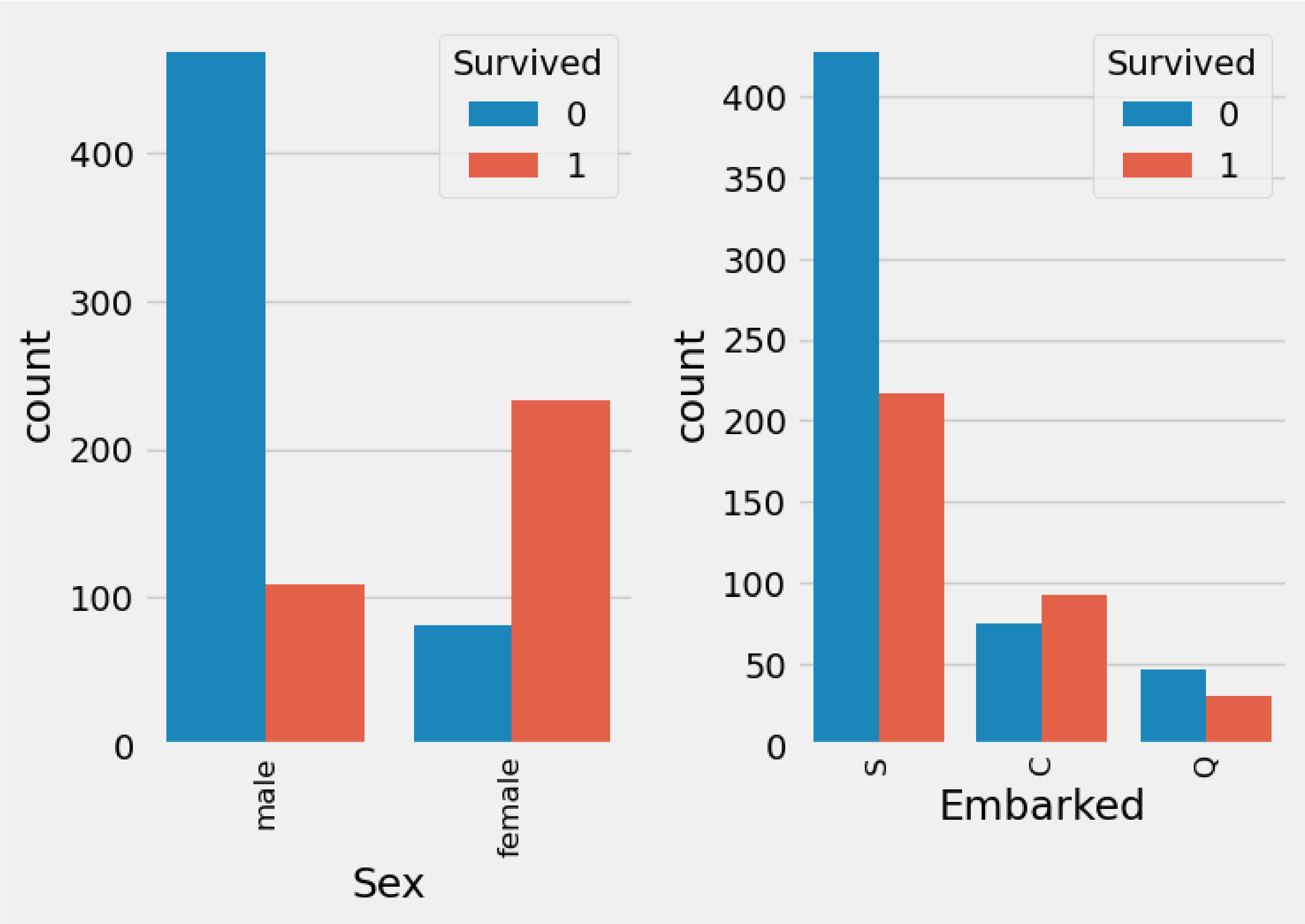
```
Out[87]: ['Name', 'Sex', 'Ticket', 'Cabin', 'Embarked']
```

In [88]:

```
# Get the names of all columns with data type 'object' (categorical columns)
cat_vars = ['Sex','Embarked']
# Create a figure with subplots
num_cols = len(cat_vars)
num_rows = (num_cols + 2) // 3
fig, axs = plt.subplots(nrows=num_rows, ncols=3, figsize=(15, 5*num_rows))
axs = axs.flatten()

# create a countplot with largest 12 values :
for i, var in enumerate(cat_vars):
    top_values = train_data[var].value_counts().nlargest(12).index
    filtered_df = train_data[train_data[var].isin(top_values)]
    sns.countplot(x=var, data=filtered_df, ax=axs[i])
    axs[i].set_title(var)
    axs[i].tick_params(axis='x', rotation=90)

# Remove any extra empty subplots needed
if num_cols < len(axs):
    for i in range(num_cols, len(axs)):
        fig.delaxes(axs[i])

# Adjust spacing between subplots
fig.tight_layout()

# Show plot
plt.show()
```

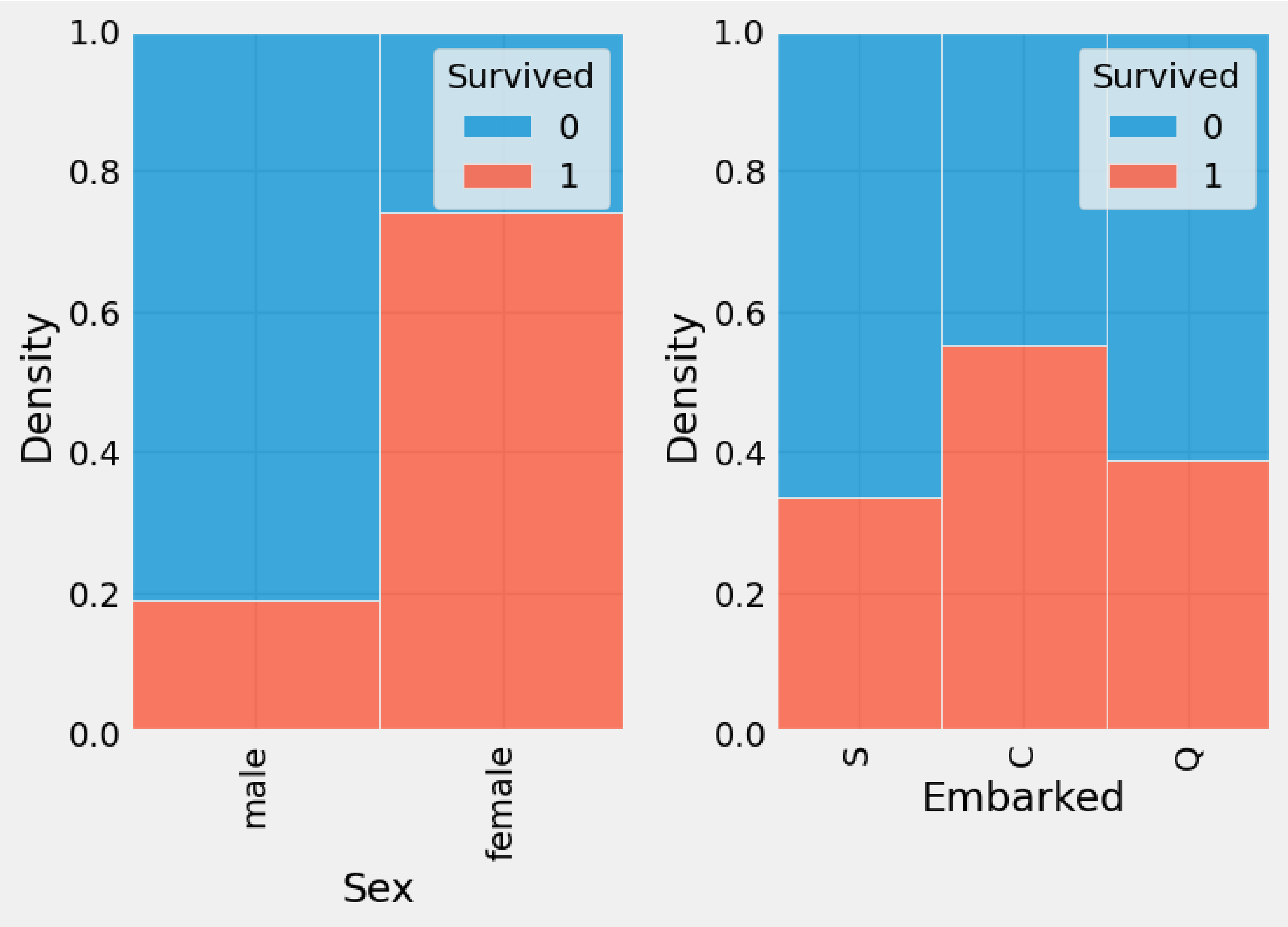

Sex
count
600
500
400
300
200
100
0
male
female
Sex
Embarked
count
600
500
400
300
200
100
0
S
C
Q
Embarked

In [89]:
```
# list of categorical variables to plot
cat_vars = ['Sex','Embarked']

# create figure with subplots
fig, axs = plt.subplots(nrows=3, ncols=4, figsize=(15, 15))
axs = axs.flatten()


# create barplot for each categorical variable
for i, var in enumerate(cat_vars):
    sns.countplot(x=var, hue='Survived', data=train_data, ax=axs[i])
    axs[i].set_xticklabels(axs[i].get_xticklabels(), rotation=90,size=12)

# Remove any extra empty subplots needed
if num_cols < len(axs):
    for i in range(num_cols, len(axs)):
        fig.delaxes(axs[i])

# adjust spacing between subplots
fig.tight_layout()

# show plot
plt.show()
```


Survived
0
1
count
0
100
200
300
400
male
female
Sex
Survived
0
1
count
0
50
100
150
200
250
300
350
400
S
C
Q
Embarked

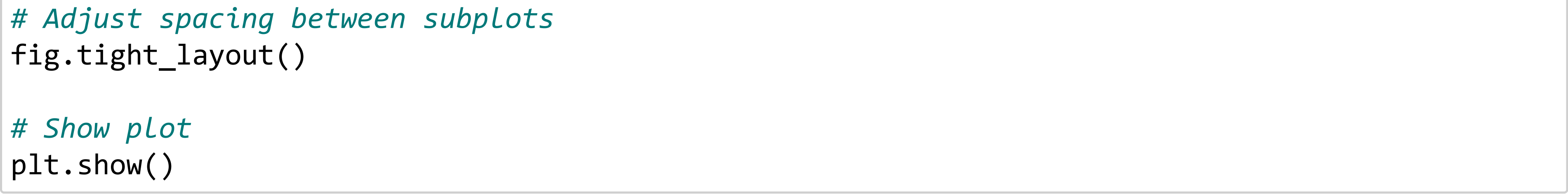
In [90]:

```
import warnings
warnings.filterwarnings("ignore")

# get list of categorical variables
cat_vars = ['Sex','Embarked']

# create figure with subplots
fig, axs = plt.subplots(nrows=3, ncols=4, figsize=(15, 15))
axs = axs.flatten()

# create histplot for each categorical variable
for i, var in enumerate(cat_vars):
    sns.histplot(x=var, hue='Survived', data=train_data, ax=axs[i], multiple="fill", kde=False
    axs[i].set_xticklabels(train_data[var].unique(), rotation=90)
    axs[i].set_xlabel(var)

# Remove any extra empty subplots needed
if num_cols < len(axs):
    for i in range(num_cols, len(axs)):
        fig.delaxes(axs[i])

# adjust spacing between subplots
fig.tight_layout()


# show plot
plt.show()
```

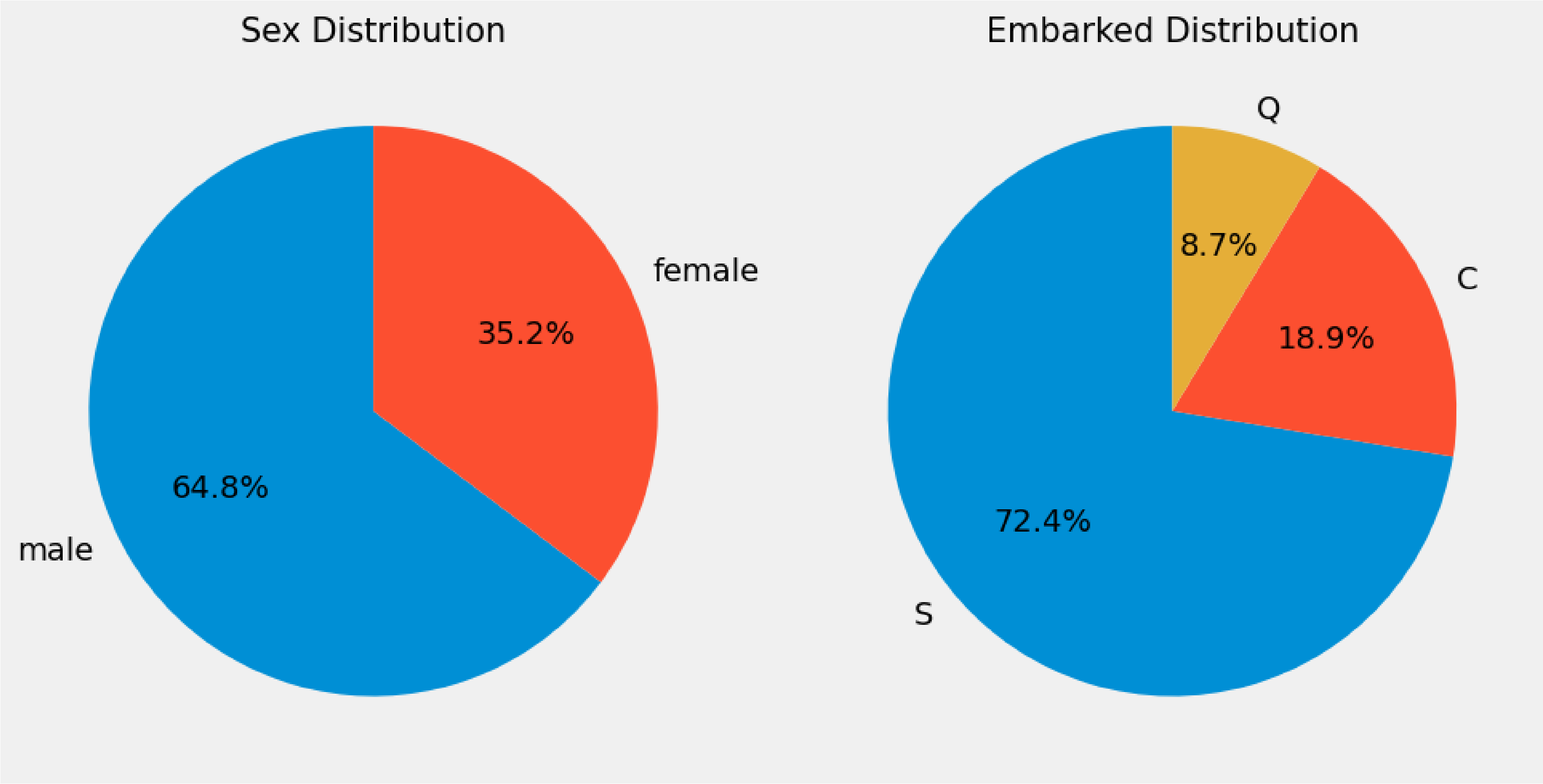

1.0
0.8
0.6
0.4
0.2
0.0
Density
Survived
0
1
male
female
Sex
1.0
0.8
0.6
0.4
0.2
0.0
Density
Survived
0
1
S
C
Q
Embarked

In [91]:

```
# Specify the maximum number of categories to show individually
max_categories = 5

# Filter categorical columns with 'object' data type
cat_cols = ['Sex','Embarked']

# Create a figure with subplots
num_cols = len(cat_cols)
num_rows = (num_cols + 2) // 3
fig, axs = plt.subplots(nrows=num_rows, ncols=3, figsize=(15, 5*num_rows))

# Flatten the axs array for easier indexing
axs = axs.flatten()

# Create a pie chart for each categorical column
for i, col in enumerate(cat_cols):
    if i < len(axs):  # Ensure we don't exceed the number of subplots
        # Count the number of occurrences for each category
        cat_counts = train_data[col].value_counts()

        # Group categories beyond the top max_categories as 'Other'
        if len(cat_counts) > max_categories:
            cat_counts_top = cat_counts[:max_categories]
            cat_counts_other = pd.Series(cat_counts[max_categories:].sum(), index=['Other'])
            cat_counts = cat_counts_top.append(cat_counts_other)

        # Create a pie chart
        axs[i].pie(cat_counts, labels=cat_counts.index, autopct='%1.1f%%', startangle=90)
        axs[i].set_title(f'{col} Distribution',size=15)

# Remove any extra empty subplots if needed
if num_cols < len(axs):
    for i in range(num_cols, len(axs)):
        fig.delaxes(axs[i])
```



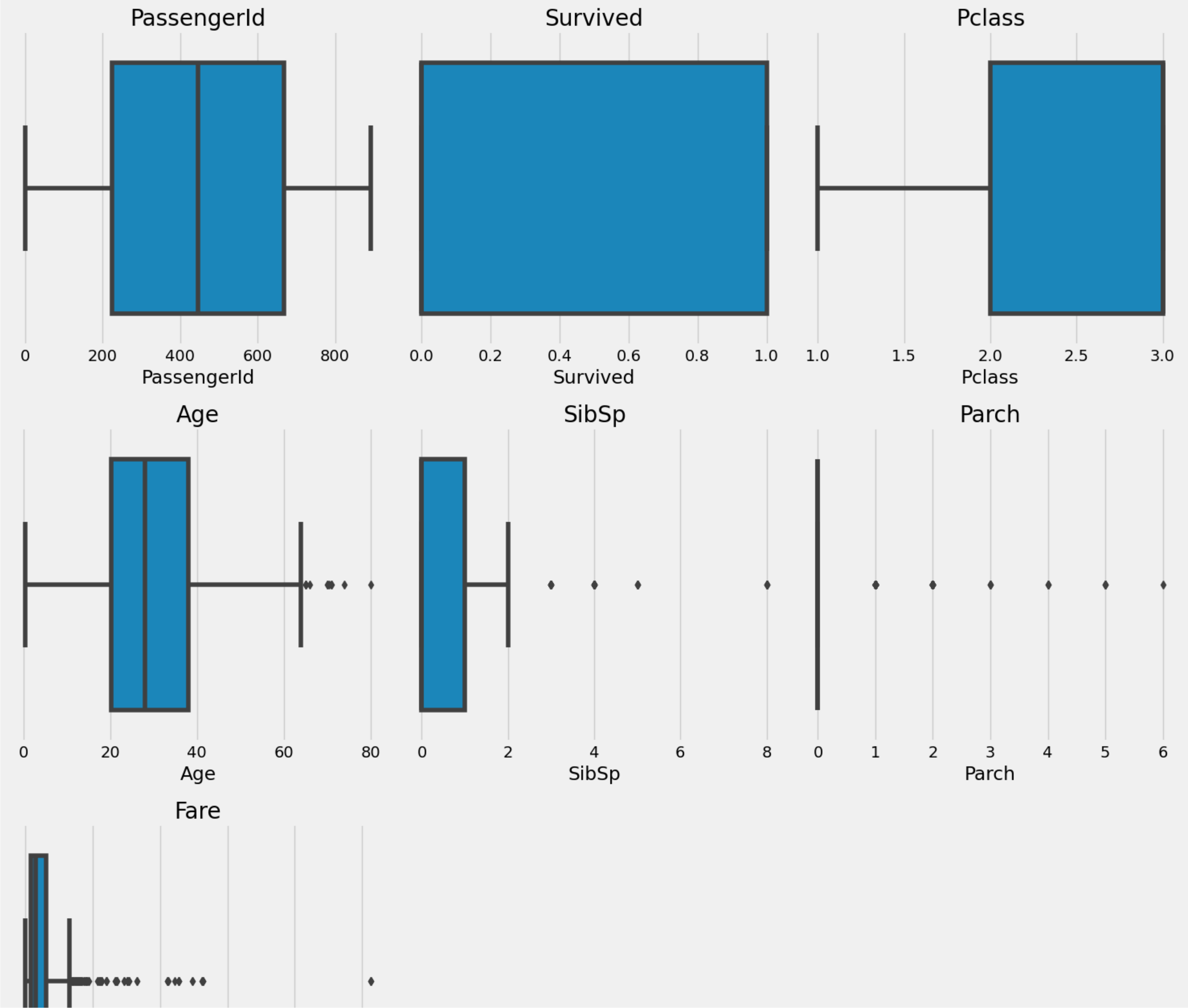
```
# Adjust spacing between subplots
fig.tight_layout()

# Show plot
plt.show()
```

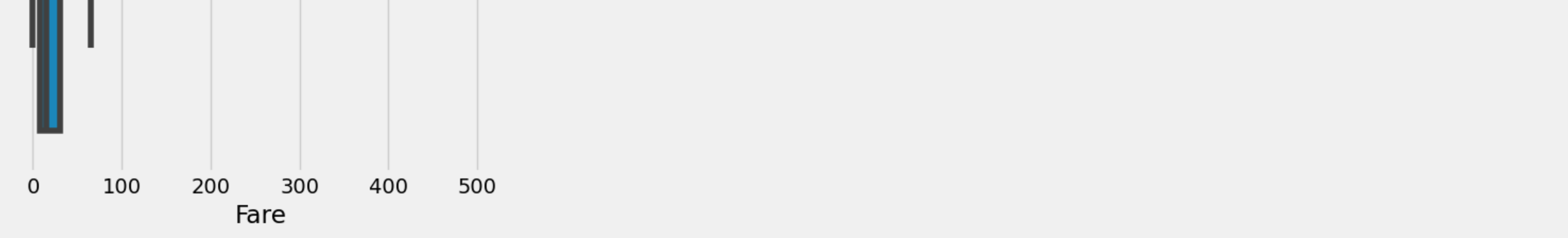


Plots For numerical Variables

In [92]:

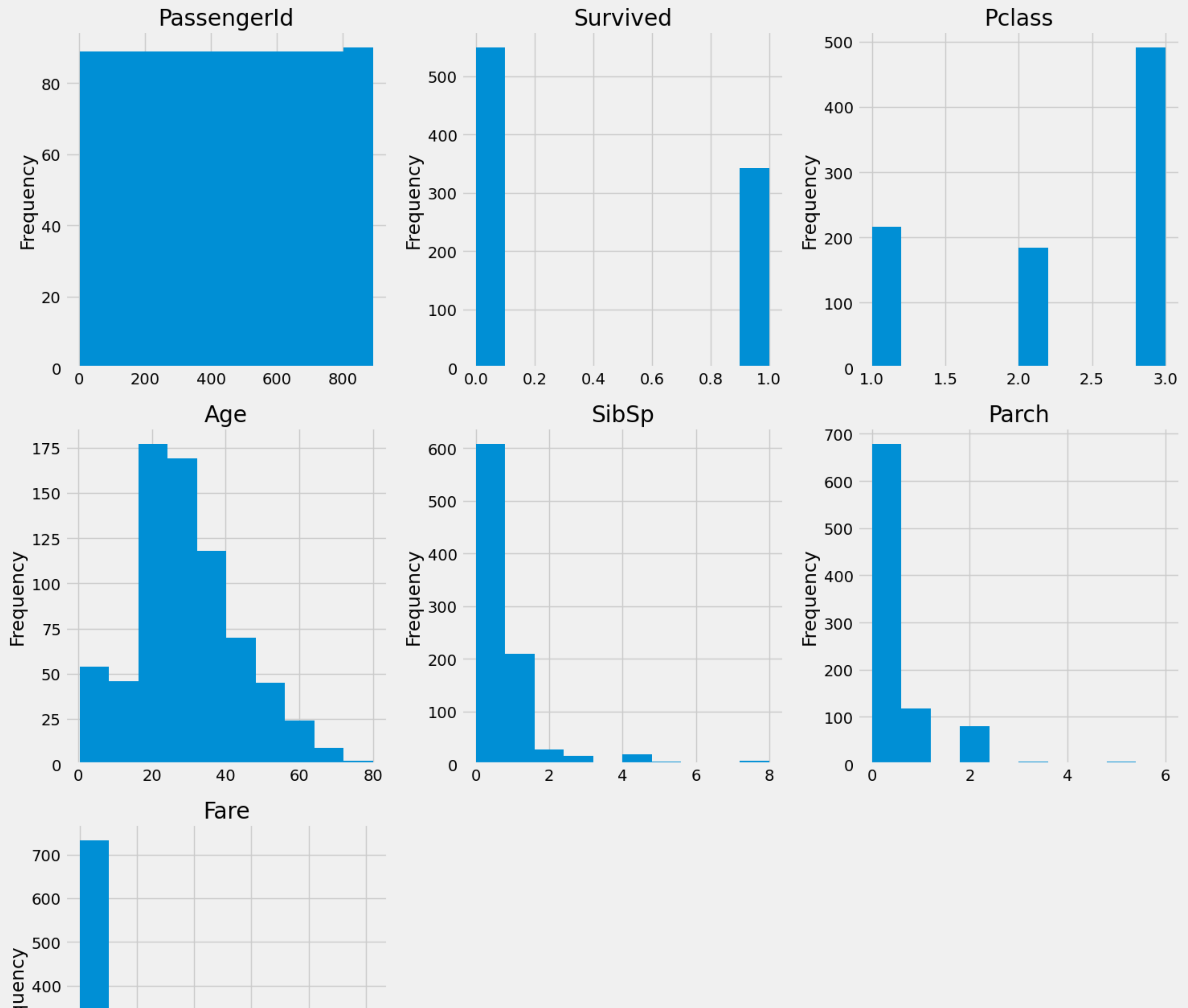
```
# Get the names of all columns with data type 'int' or 'float'
num_vars = train_data.select_dtypes(include=['int', 'float']).columns.tolist()

# Create a figure with subplots
num_cols = len(num_vars)
num_rows = (num_cols + 2) // 3
fig, axs = plt.subplots(nrows=num_rows, ncols=3, figsize=(15, 5*num_rows))
axs = axs.flatten()

# Create a box plot for each numerical variable using Seaborn
for i, var in enumerate(num_vars):
    sns.boxplot(x=train_data[var], ax=axs[i])
    axs[i].set_title(var)

# Remove any extra empty subplots if needed
if num_cols < len(axs):
    for i in range(num_cols, len(axs)):
        fig.delaxes(axs[i])

# Adjust spacing between subplots
fig.tight_layout()

# Show plot
plt.show()
```

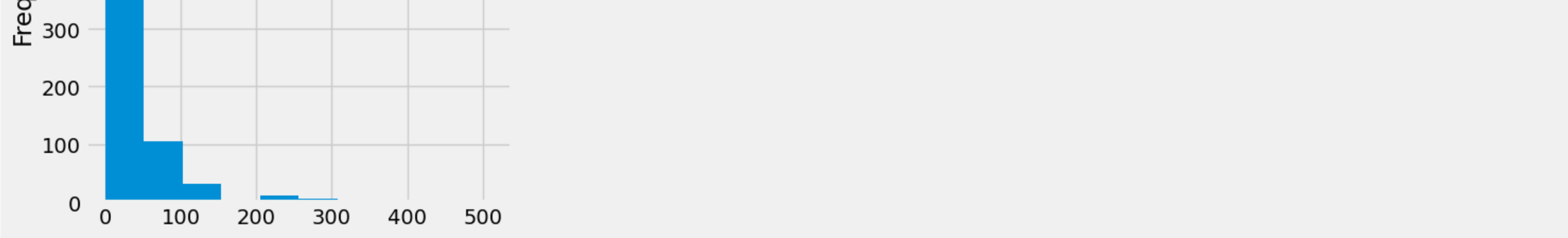

PassengerId
0
200
400
600
800
PassengerId
Survived
0.0
0.2
0.4
0.6
0.8
1.0
Survived
Pclass
1.0
1.5
2.0
2.5
3.0
Pclass
Age
0
20
40
60
80
Age
SibSp
0
2
4
6
8
SibSp
Parch
0
1
2
3
4
5
6
Parch
Fare


0
100
200
300
400
500
Fare

In [93]:

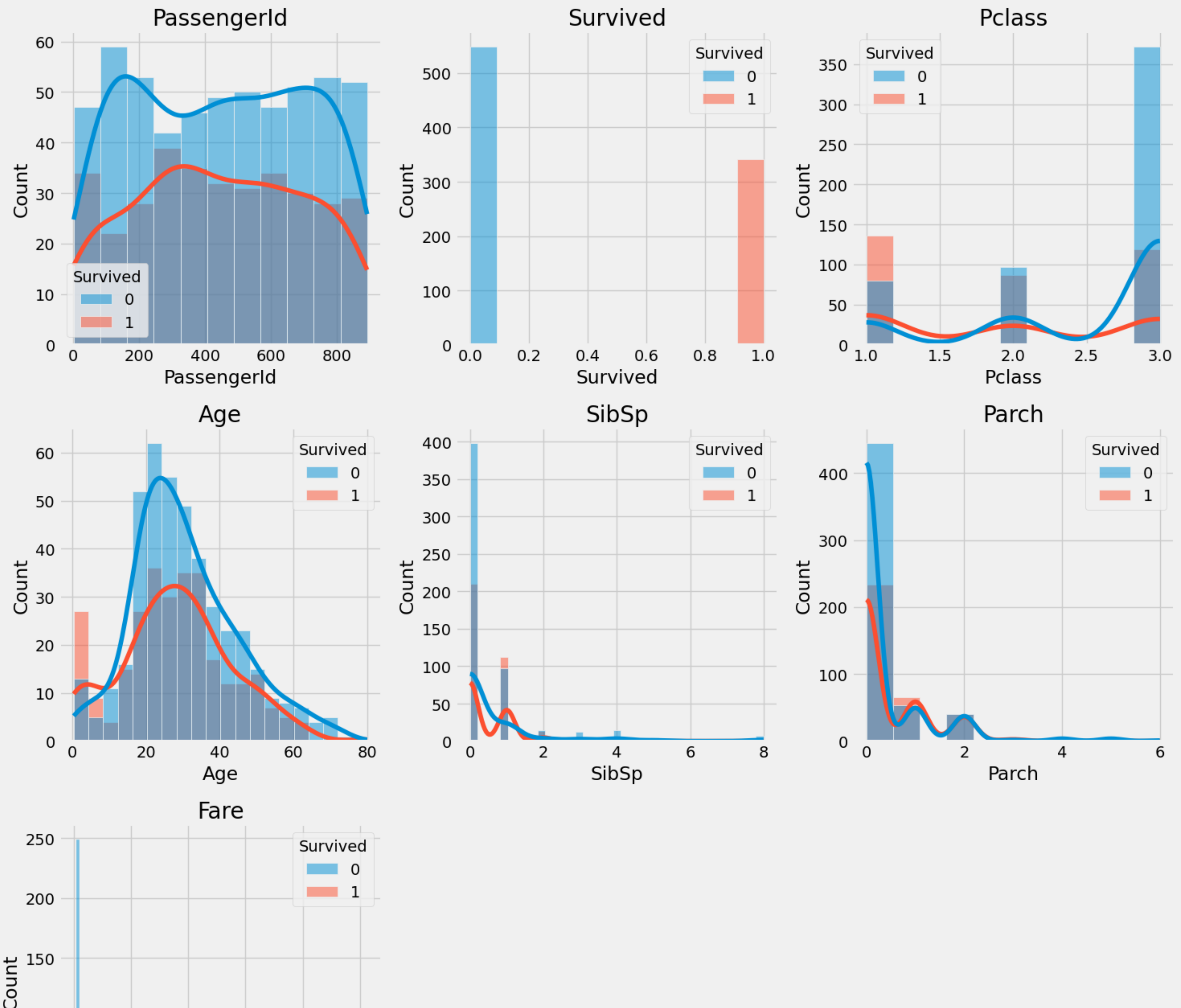
```
# Get the names of all columns with data type 'int'
int_vars = train_data.select_dtypes(include=['int', 'float']).columns.tolist()

# Create a figure with subplots
num_cols = len(int_vars)
num_rows = (num_cols + 2) // 3  # To make sure there are enough rows for the subplots
fig, axs = plt.subplots(nrows=num_rows, ncols=3, figsize=(15, 5*num_rows))
axs = axs.flatten()

# Create a histogram for each integer variable
for i, var in enumerate(int_vars):
    train_data[var].plot.hist(ax=axs[i])
    axs[i].set_title(var)

# Remove any extra empty subplots if needed
if num_cols < len(axs):
    for i in range(num_cols, len(axs)):
        fig.delaxes(axs[i])

# Adjust spacing between subplots
fig.tight_layout()

# Show plot
plt.show()
```

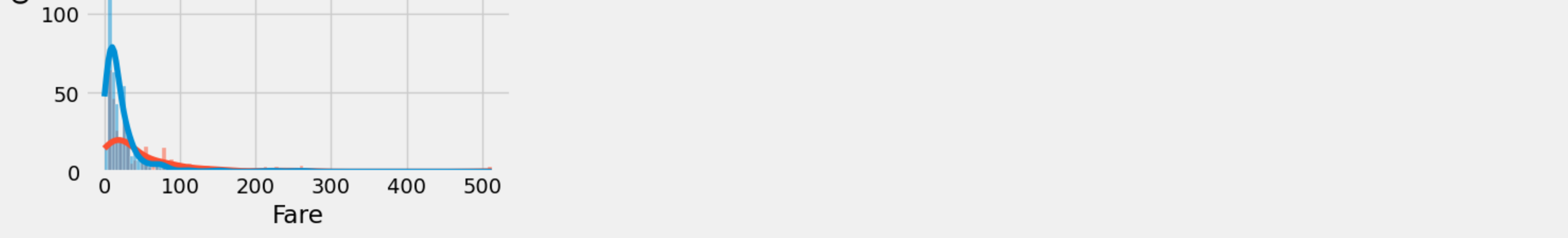

PassengerId
Frequency
0
20
40
60
80
0
200
400
600
800
Survived
Frequency
0
100
200
300
400
500
0.0
0.2
0.4
0.6
0.8
1.0
Pclass
Frequency
0
100
200
300
400
500
1.0
1.5
2.0
2.5
3.0
Age
Frequency
0
25
50
75
100
125
150
175
0
20
40
60
80
SibSp
Frequency
0
100
200
300
400
500
600
0
2
4
6
8
Parch
Frequency
0
100
200
300
400
500
600
700
0
2
4
6
Fare
uency
400
500
600
700


Freq
300
200
100
0
0
100
200
300
400
500

In [94]:

```
# Get the names of all columns with data type 'int'
int_vars = train_data.select_dtypes(include=['int', 'float']).columns.tolist()

# Create a figure with subplots
num_cols = len(int_vars)
num_rows = (num_cols + 2) // 3  # To make sure there are enough rows for the subplots
fig, axs = plt.subplots(nrows=num_rows, ncols=3, figsize=(15, 5*num_rows))
axs = axs.flatten()

# Create a histogram for each integer variable with hue='Attrition'
for i, var in enumerate(int_vars):
    sns.histplot(data=train_data, x=var, hue='Survived', kde=True, ax=axs[i])
    axs[i].set_title(var)

# Remove any extra empty subplots if needed
if num_cols < len(axs):
    for i in range(num_cols, len(axs)):
        fig.delaxes(axs[i])

# Adjust spacing between subplots
fig.tight_layout()

# Show plot
plt.show()
```


PassengerId
Count
0
10
20
30
40
50
60
0
200
400
600
800
PassengerId
Survived
0
1
Survived
Count
0
100
200
300
400
500
0.0
0.2
0.4
0.6
0.8
1.0
Survived
Survived
0
1
Pclass
Count
0
50
100
150
200
250
300
350
1.0
1.5
2.0
2.5
3.0
Pclass
Survived
0
1
Age
Count
0
10
20
30
40
50
60
0
20
40
60
80
Age
Survived
0
1
SibSp
Count
0
50
100
150
200
250
300
350
400
0
2
4
6
8
SibSp
Survived
0
1
Parch
Count
0
100
200
300
400
0
2
4
6
Parch
Survived
0
1
Fare
Count
150
200
250
Survived
0
1



In [95]:
```
train_data.groupby(['Sex', 'Survived'])['Survived'].count()
```

Out[95]:
```
Sex     Survived
female  0            81
        1           233
male    0           468
        1           109
Name: Survived, dtype: int64
```

In [96]:
```
pd.crosstab([train_data.Sex,train_data.Survived],train_data.Pclass,margins=True).style.backgro
```

Out[96]:

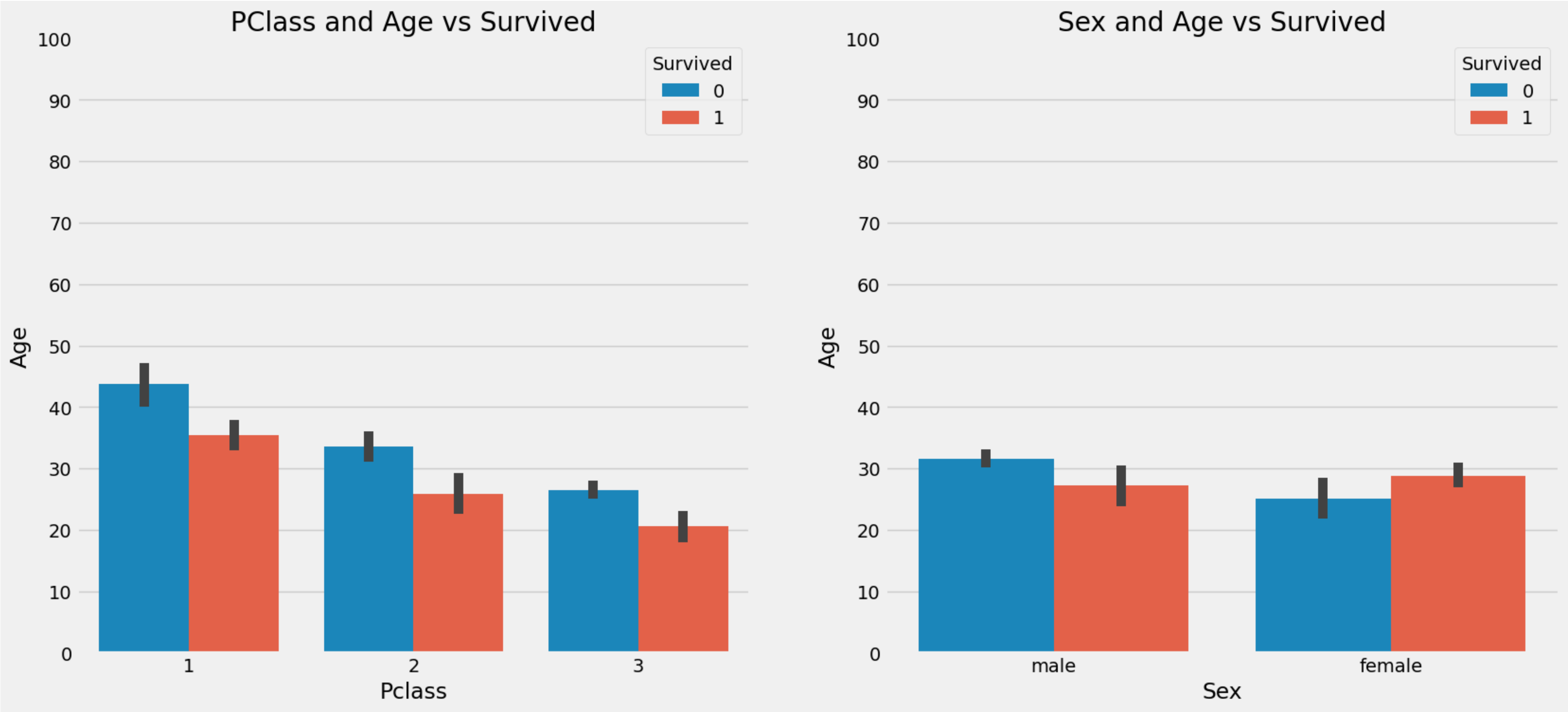
	Pclass	1	2	3	All
Sex	Survived				
female	0	3	6	72	81
	1	91	70	72	233
male	0	77	91	300	468
	1	45	17	47	109
All		216	184	491	891

In [98]:

```
print('Oldest person Survived was of:',train_data['Age'].max())
print('Youngest person Survived was of:',train_data['Age'].min())
print('Average person Survived was of:',train_data['Age'].mean())
```

```
Oldest person Survived was of: 80.0
Youngest person Survived was of: 0.42
Average person Survived was of: 29.69911764705882
```

```
In [99]: f, ax = plt.subplots(1, 2, figsize=(18, 8))

         # Bar plot for Pclass and Age vs Survived
         sns.barplot(x='Pclass', y='Age', hue='Survived', data=train_data, ax=ax[0])
         ax[0].set_title('PClass and Age vs Survived')
         ax[0].set_yticks(range(0, 110, 10))

         # Bar plot for Sex and Age vs Survived
         sns.barplot(x='Sex', y='Age', hue='Survived', data=train_data, ax=ax[1])
         ax[1].set_title('Sex and Age vs Survived')
         ax[1].set_yticks(range(0, 110, 10))

         plt.show()
```



In [100]:

```
train_data['Initial']=0
for i in train_data:
    train_data['Initial']=train_data.Name.str.extract('([A-Za-z]+)\.') #extracting Name initia
```

In [101]:

```
pd.crosstab(train_data.Initial,train_data.Sex).T.style.background_gradient(cmap='summer_r')
```

Out[101]:

Initial	Capt	Col	Countess	Don	Dr	Jonkheer	Lady	Major	Master	Miss	Mlle	Mme	Mr	Mrs	Ms	Rev	Sir
Sex																	
female	0	0	1	0	1	0	1	0	0	182	2	1	0	125	1	0	0
male	1	2	0	1	6	1	0	2	40	0	0	0	517	0	0	6	1

In [102]:

```
train_data['Initial'].replace(['Mlle','Mme','Ms','Dr','Major','Lady','Countess',
                               'Jonkheer','Col','Rev','Capt','Sir','Don'],['Miss',
                                'Miss','Miss','Mr','Mr','Mrs','Mrs','Other','Other','Other','Mi
```

In [103]:

```
train_data.groupby('Initial')['Age'].mean()
```

Out[103]:

```
Initial
Master     4.574167
Miss      21.860000
Mr        32.739609
Mrs       35.981818
Other     45.888889
Name: Age, dtype: float64
```

In [104]:

```
train_data.loc[(train_data.Age.isnull()) & (train_data.Initial=='Mr'),'Age']=33
train_data.loc[(train_data.Age.isnull()) & (train_data.Initial=='Mrs'),'Age']=36
train_data.loc[(train_data.Age.isnull()) & (train_data.Initial=='Master'),'Age']=5
train_data.loc[(train_data.Age.isnull()) & (train_data.Initial=='Miss'),'Age']=22
train_data.loc[(train_data.Age.isnull()) & (train_data.Initial=='Other'),'Age']=46
```

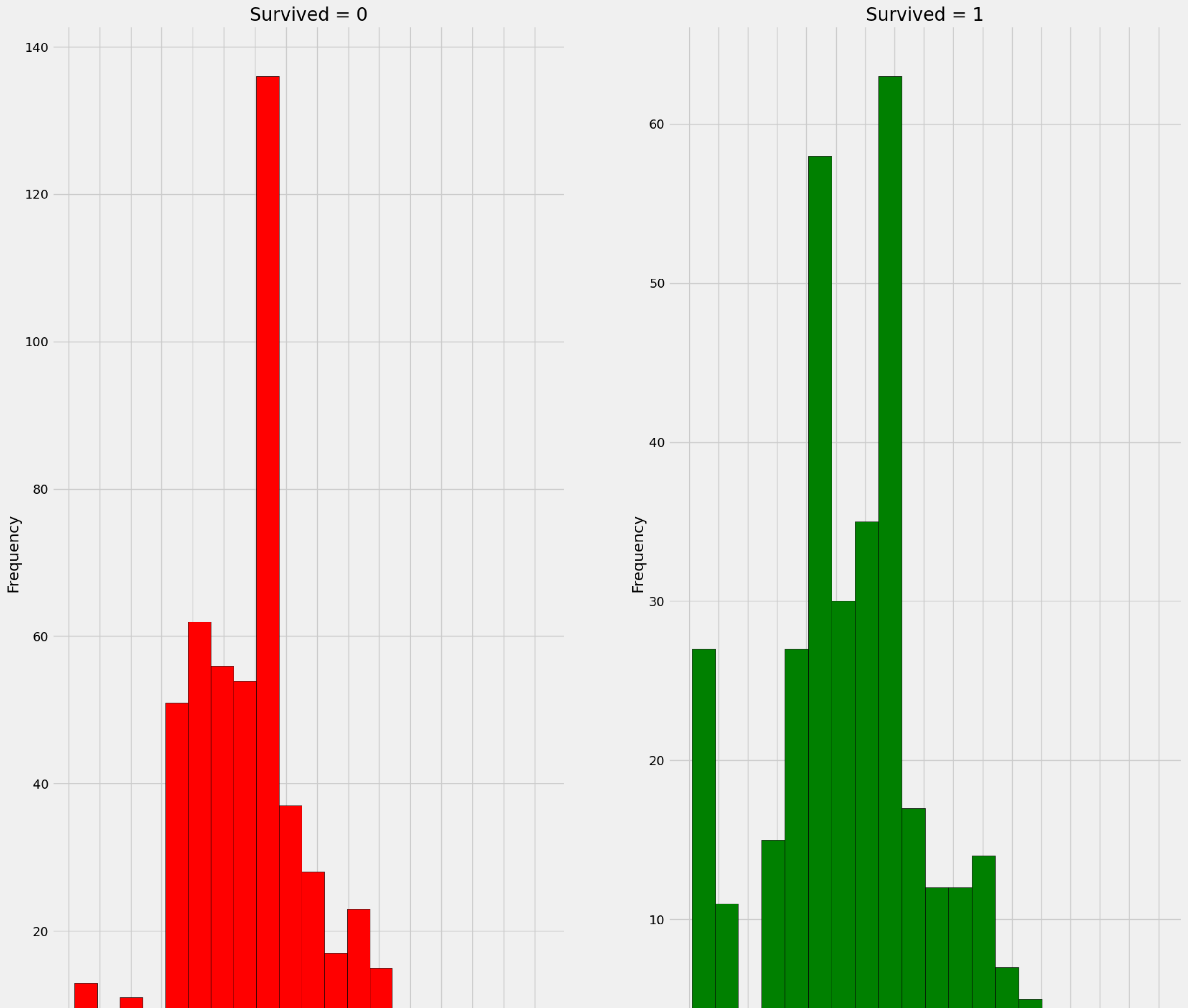
In [105]:

```
train_data.Age.isnull().any()
```

Out[105]:

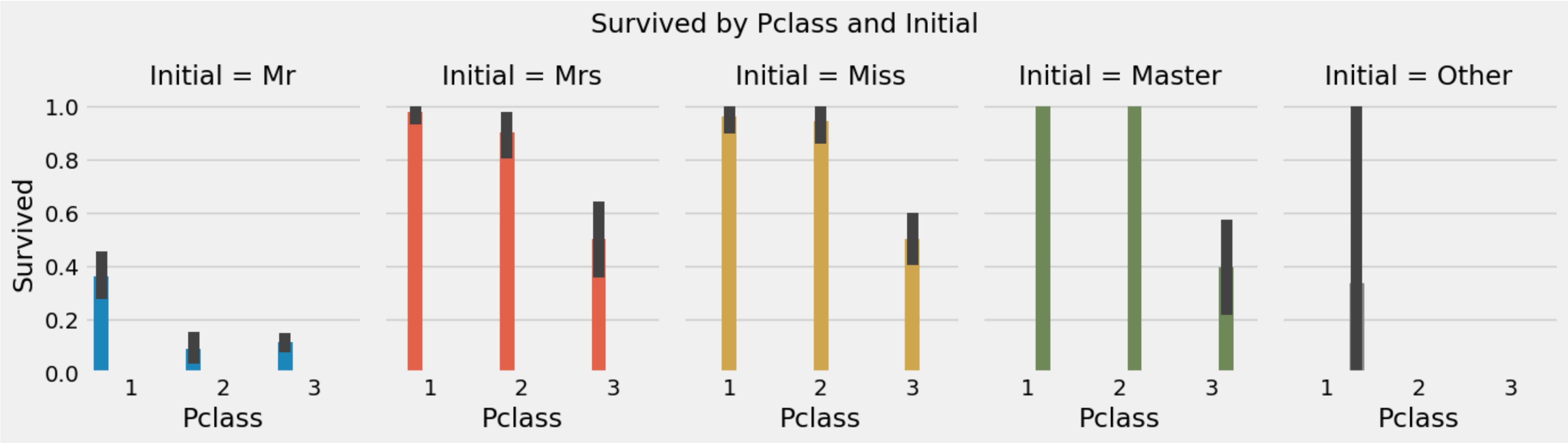
```
False
```

```
In [106]: f,ax=plt.subplots(1,2,figsize=(20,20))
          train_data[train_data['Survived']==0].Age.plot.hist(ax=ax[0],bins=20,edgecolor='black',color='
          ax[0].set_title('Survived = 0')
          x1=list(range(0,85,5))
          ax[0].set_xticks(x1)
          train_data[train_data['Survived']==1].Age.plot.hist(ax=ax[1],bins=20,edgecolor='black',color='
          x2=list(range(0,85,5))
          ax[1].set_xticks(x2)
          ax[1].set_title('Survived = 1')
          plt.show()
```


Survived = 0
Survived = 1
Frequency
Frequency
140
120
100
80
60
40
20
60
50
40
30
20
10

In [107]:

```
sns.catplot(x='Pclass', y='Survived', hue='Initial', kind='bar', data=train_data, col='Initial
plt.subplots_adjust(top=0.8)  # Adjust the top space to accommodate the title
plt.suptitle('Survived by Pclass and Initial')
plt.show()
```



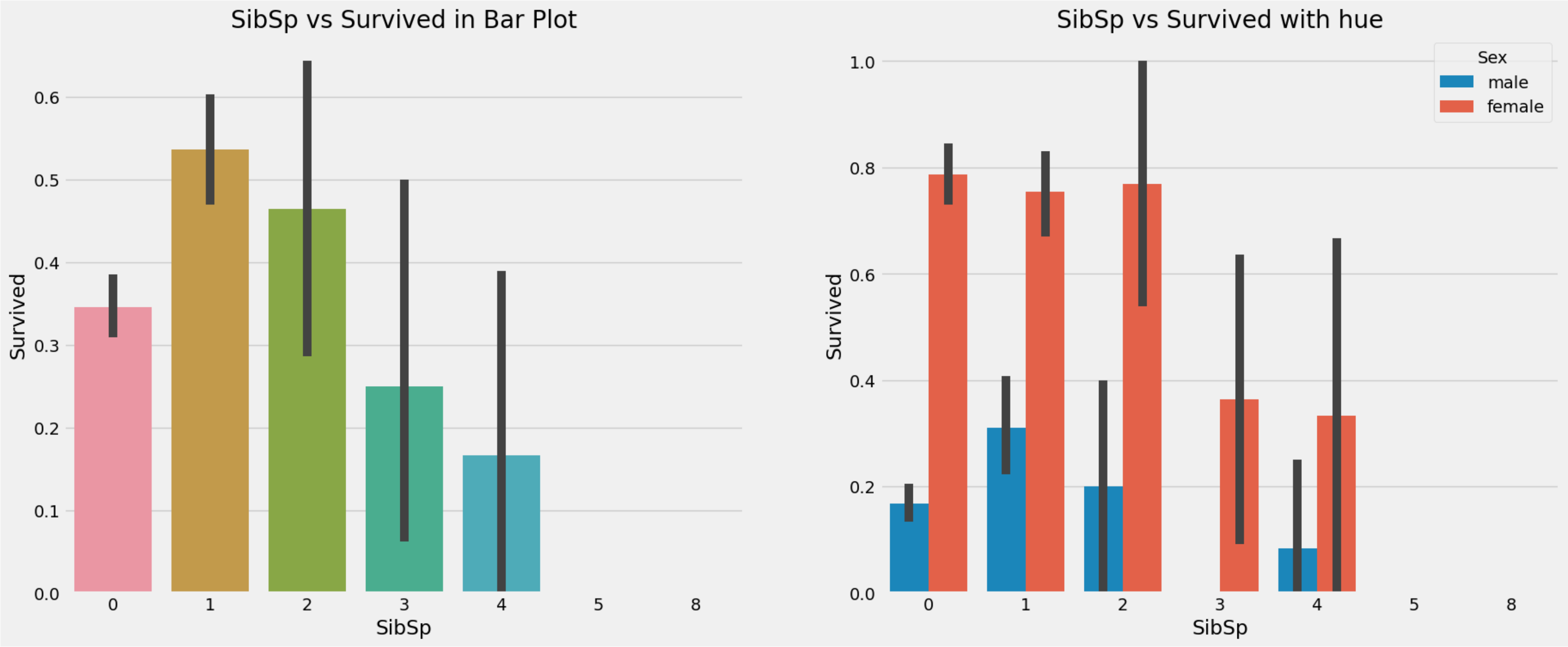
In [108]:

```
pd.crosstab([train_data.SibSp],train_data.Survived).style.background_gradient('summer_r')
```

Out[108]:

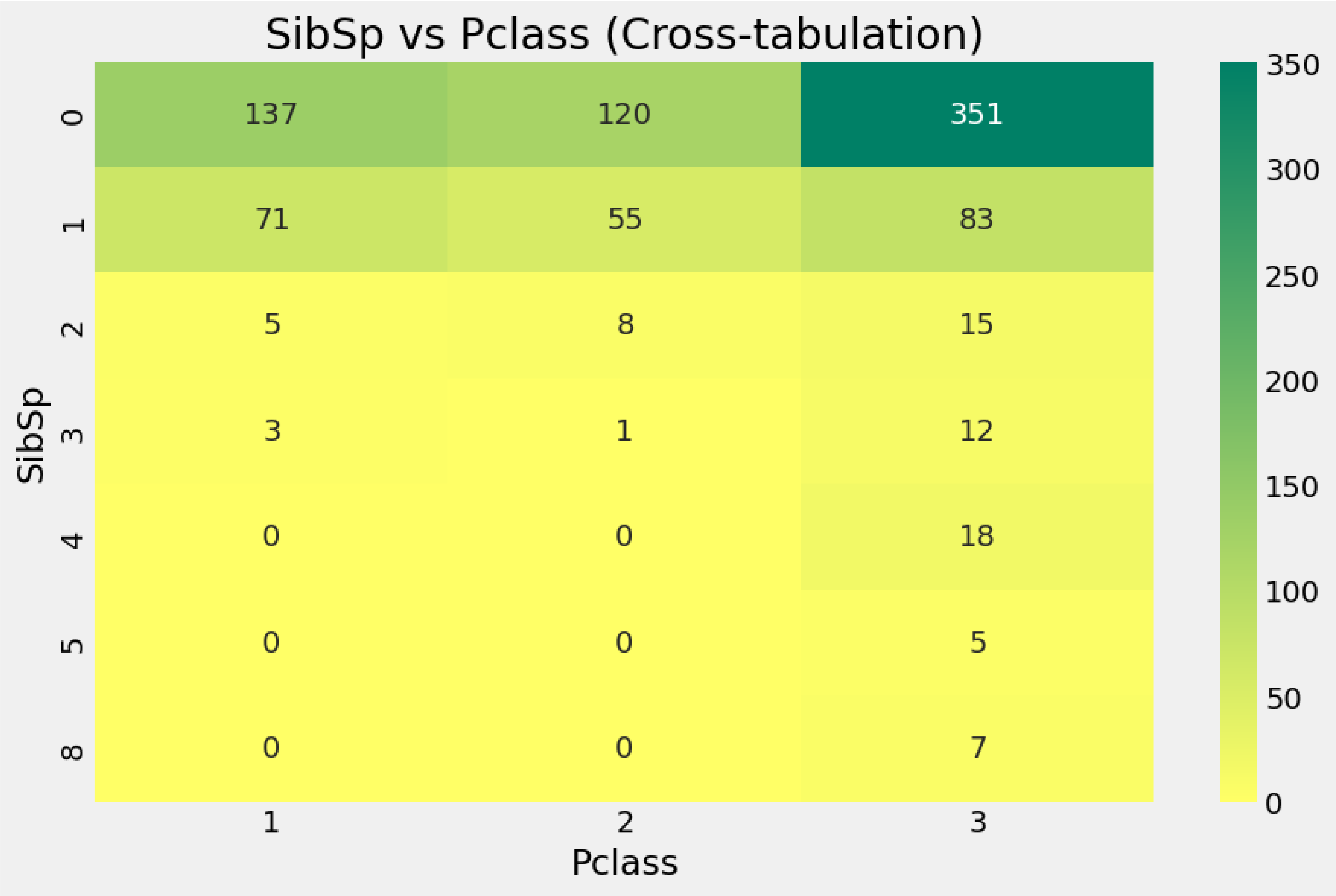
Survived	0	1
SibSp		
0	398	210
1	97	112
2	15	13
3	12	4
4	15	3
5	5	0
8	7	0

In [110]:
```
f, ax = plt.subplots(1, 2, figsize=(20, 8))

# Bar plot for SibSp vs Survived (without hue)
sns.barplot(x='SibSp', y='Survived', data=train_data, ax=ax[0])
ax[0].set_title('SibSp vs Survived in Bar Plot')

# Bar plot for SibSp vs Survived (with hue)
sns.barplot(x='SibSp', y='Survived', hue='Sex', data=train_data, ax=ax[1])
ax[1].set_title('SibSp vs Survived with hue')
plt.legend(title='Sex', loc='upper right')  # Add a legend for the hue

plt.show()
```



In [111]:

```
cross_tab = pd.crosstab(train_data.SibSp, train_data.Pclass)

# Create a heatmap
plt.figure(figsize=(10, 6))
sns.heatmap(cross_tab, annot=True, fmt='d', cmap='summer_r')
plt.title('SibSp vs Pclass (Cross-tabulation)')
plt.xlabel('Pclass')
plt.ylabel('SibSp')
plt.show()
```



Checking For Highly Correlated Columns

In [122]:

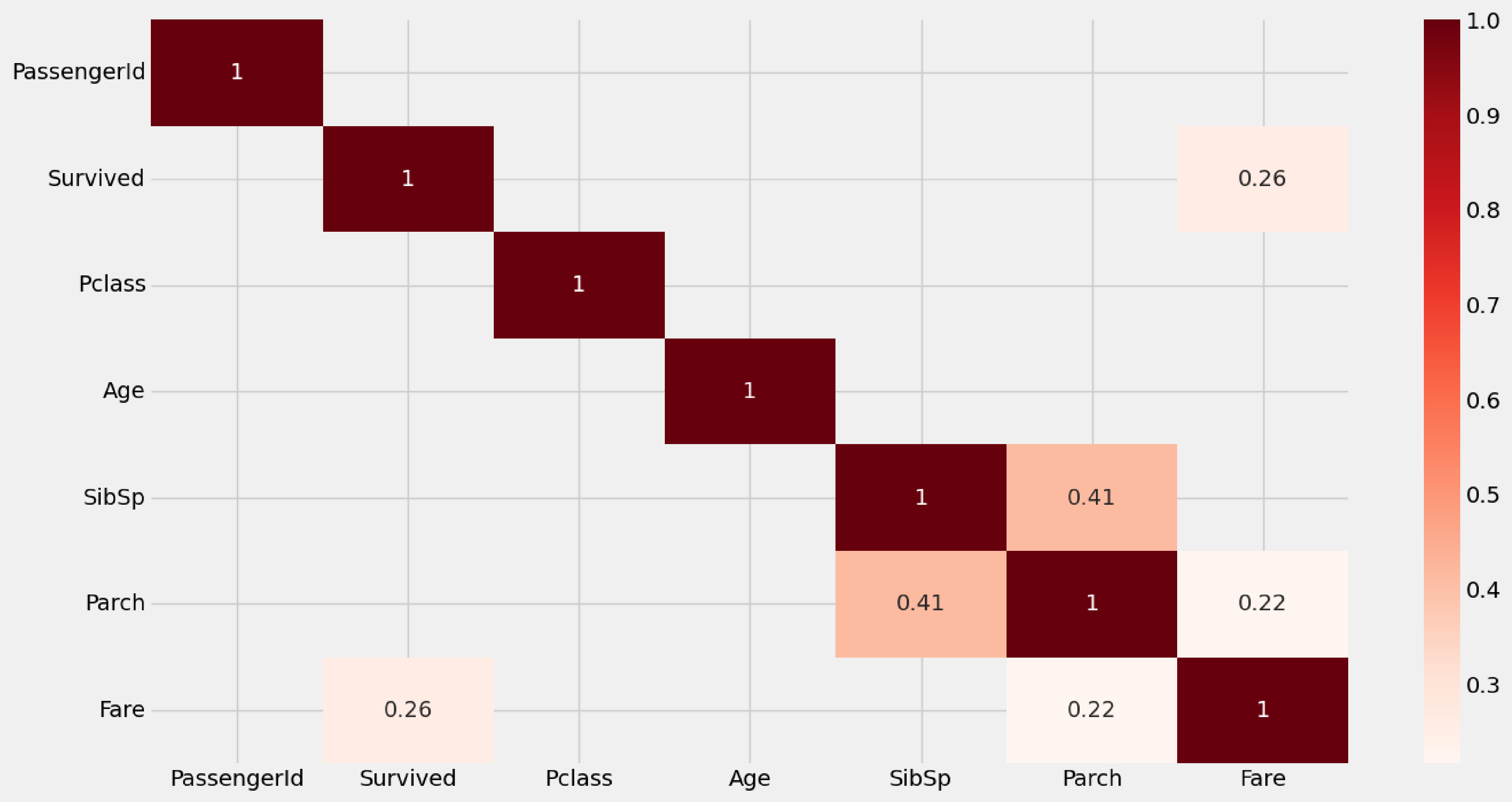
```
corr =train_data.corr()
corr_greater_than_20 = corr[corr>=.2]
corr_greater_than_20
```

Out[122]:

	PassengerId	Survived	Pclass	Age	SibSp	Parch	Fare
PassengerId	1.0	NaN	NaN	NaN	NaN	NaN	NaN
Survived	NaN	1.000000	NaN	NaN	NaN	NaN	0.257307
Pclass	NaN	NaN	1.0	NaN	NaN	NaN	NaN
Age	NaN	NaN	NaN	1.0	NaN	NaN	NaN
SibSp	NaN	NaN	NaN	NaN	1.000000	0.414838	NaN
Parch	NaN	NaN	NaN	NaN	0.414838	1.000000	0.216225
Fare	NaN	0.257307	NaN	NaN	NaN	0.216225	1.000000

```
In [123]: plt.figure(figsize=(15,8))
          sns.heatmap (corr_greater_than_20,annot=True,cmap='Reds')
```

```
Out[123]: <Axes: >
```



```
In [ ]:
```