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

```
df = pd.read_csv("train.csv")
```

```
df.head()
```

	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	female	35.0	1	0	113803	53.1000	C123	S

```
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          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
```

```
df.shape
```

```
(891, 12)
```

```
df.describe()
```

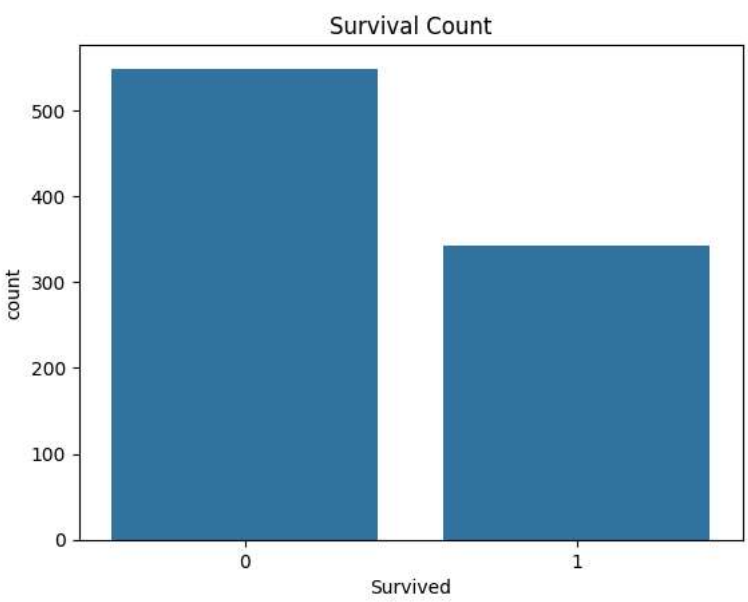
	PassengerId	Survived	Pclass	Age	SibSp	Parch	Fare
count	891.000000	891.000000	891.000000	714.000000	891.000000	891.000000	891.000000
mean	446.000000	0.383838	2.308642	29.699118	0.523008	0.381594	32.204208
std	257.353842	0.486592	0.836071	14.526497	1.102743	0.806057	49.693429
min	1.000000	0.000000	1.000000	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

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

	0
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

```
sns.countplot(x='Survived', data=df)
plt.title("Survival Count")
plt.show()
```

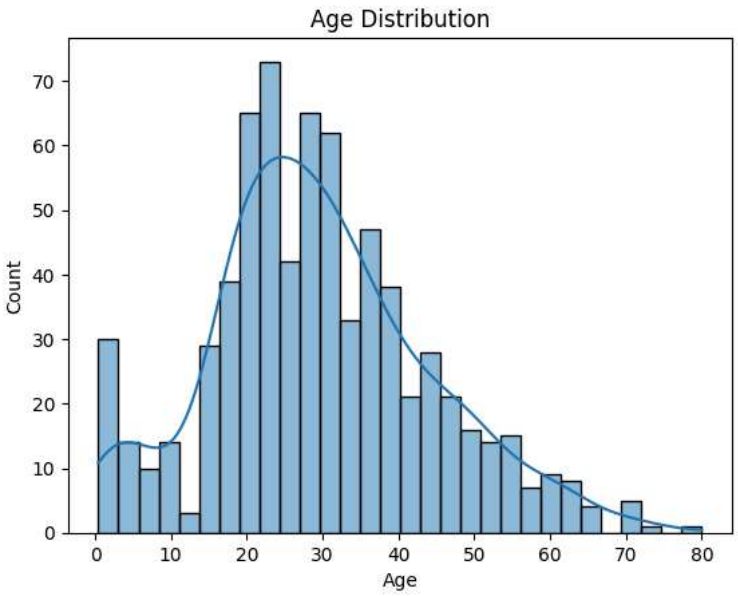


Survival Count

Observation: Around 62% of passengers did not survive, while about 38% survived.

Insight: The dataset is imbalanced toward non-survivors.

```
sns.histplot(df['Age'].dropna(), kde=True, bins=30)
plt.title("Age Distribution")
plt.show()
```

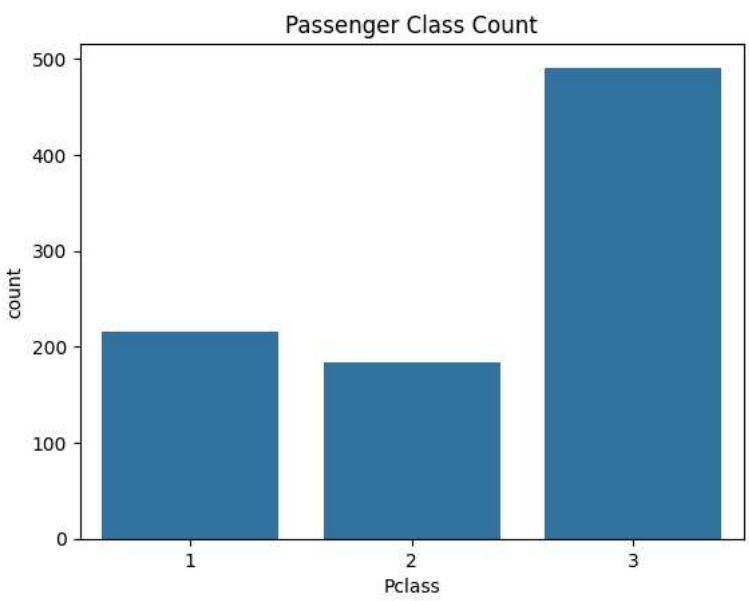


Age Distribution

Observation: Most passengers were aged between 20–40 years, with a peak in the 20–30 range.

Insight: Younger adults formed the largest passenger group.

```
sns.countplot(x='Pclass', data=df)
plt.title("Passenger Class Count")
plt.show()
```

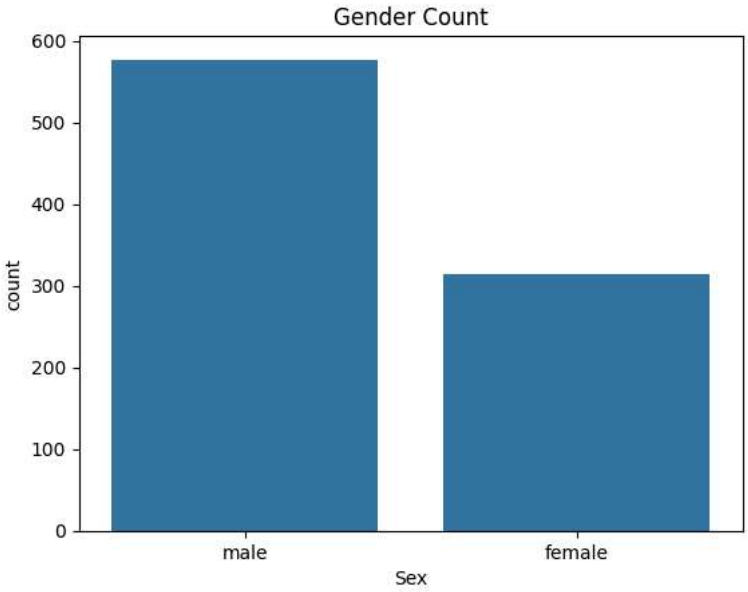


Passenger Class Count

Observation: 3rd class passengers were the largest group, followed by 1st class, then 2nd class.

Insight: Many passengers were from lower socio-economic backgrounds.

```
sns.countplot(x='Sex', data=df)
plt.title("Gender Count")
plt.show()
```

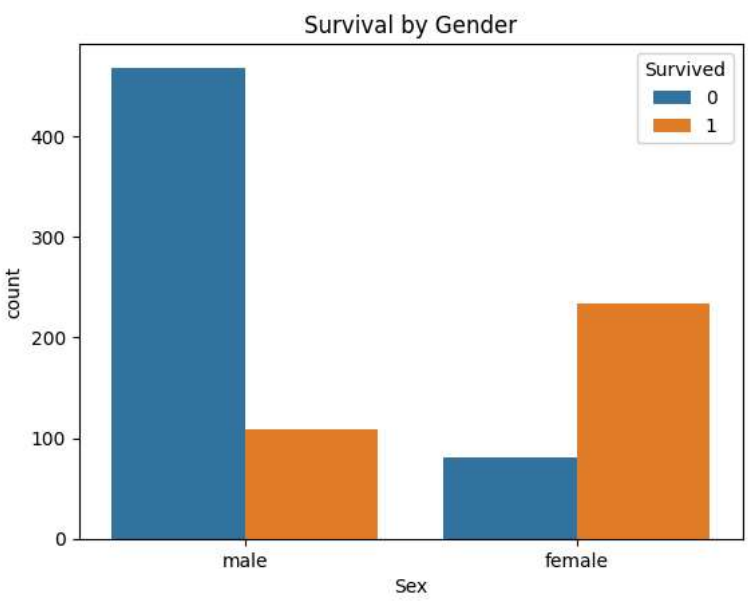


Gender Distribution

Observation: There were more males than females on board.

Insight: Gender distribution may influence survival chances.

```
sns.countplot(x='Sex', hue='Survived', data=df)
plt.title("Survival by Gender")
plt.show()
```

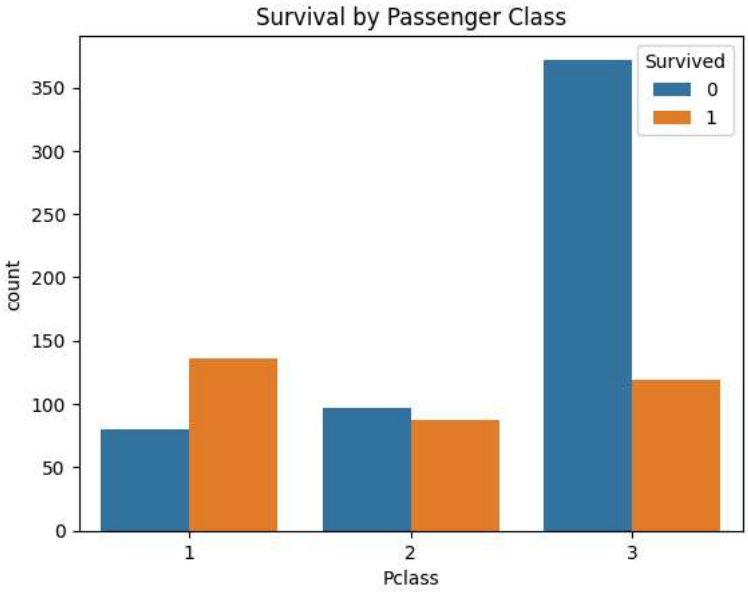


Survival by Gender

Observation: A higher percentage of females survived compared to males.

Insight: Gender played a significant role in survival probability (likely due to “women and children first” evacuation policy).

```
sns.countplot(x='Pclass', hue='Survived', data=df)
plt.title("Survival by Passenger Class")
plt.show()
```

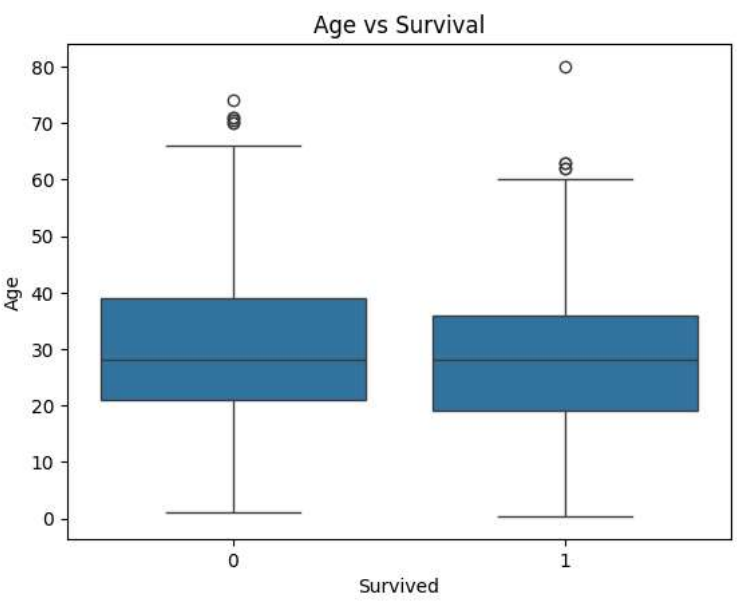


Survival by Passenger Class

Observation: 1st class passengers had the highest survival rate, followed by 2nd class, while 3rd class had the lowest.

Insight: Class strongly influenced survival chances — possibly due to better access to lifeboats.

```
sns.boxplot(x='Survived', y='Age', data=df)
plt.title("Age vs Survival")
plt.show()
```

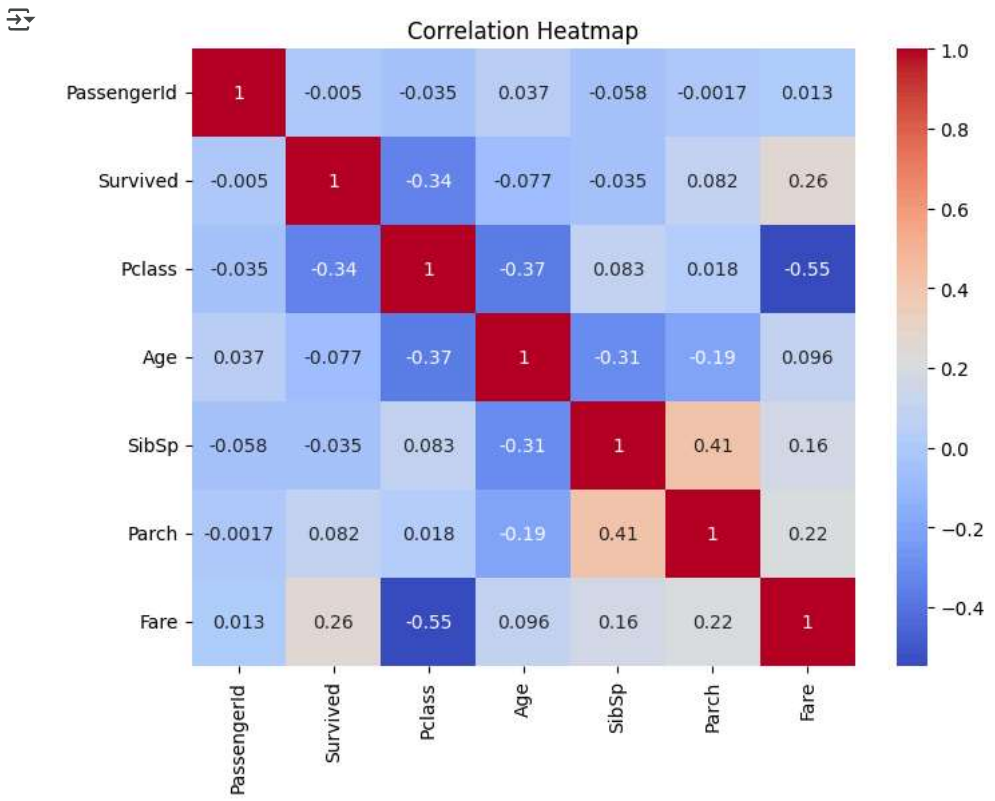


Age vs Survival (Boxplot)

Observation: Survivors tend to have a slightly lower median age compared to non-survivors.

Insight: Younger passengers had a slight survival advantage.

```
plt.figure(figsize=(8,6))
# Select only numeric columns before calculating correlation
numeric_df = df.select_dtypes(include=np.number)
sns.heatmap(numeric_df.corr(), annot=True, cmap='coolwarm')
plt.title("Correlation Heatmap")
plt.show()
```

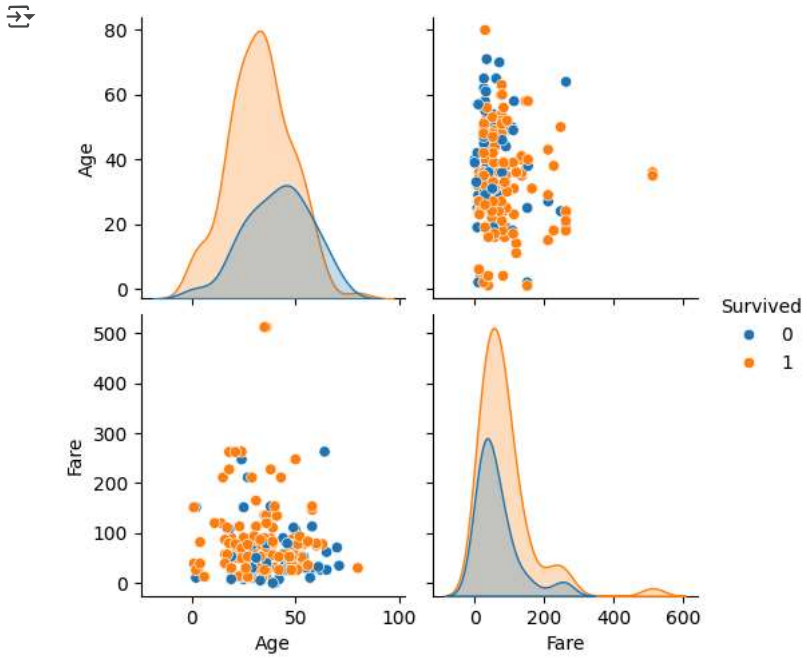


Correlation Heatmap

Observation: Fare is positively correlated with Survived, while Pclass is negatively correlated with Survived.

Insight: Higher ticket prices (often linked to higher class) increased chances of survival.

```
sns.pairplot(df.dropna(), vars=['Age', 'Fare'], hue='Survived')
plt.show()
```



Pairplot (Age & Fare)

Observation: Survivors often paid higher fares and were more represented in younger age groups.

Insight: Socio-economic status and age combined played a role in survival.

```
# Fill missing Age with median
df['Age'] = df['Age'].fillna(df['Age'].median())

# Fill missing Embarked with most frequent value (mode)
df['Embarked'] = df['Embarked'].fillna(df['Embarked'].mode()[0])

# Check if missing values remain
print(df.isnull().sum())

# Display the first few rows to verify (no dtype info shown)
display(df.head())
```

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

	PassengerId	Survived	Pclass	Name	Sex	Age	SibSp	Parch	Ticket	Fare	Embarked	AgeGroup	HasCabin
0	1	0	3	Braund, Mr. Owen Harris	male	22.0	1	0	A/5 21171	7.2500	S	≥18 years	0
1	2	1	1	Cumings, Mrs. John Bradley (Florence Briggs Th...	female	38.0	1	0	PC 17599	71.2833	C	≥18 years	1
2	3	1	3	Heikkinen, Miss. Laina	female	26.0	0	0	STON/O2. 3101282	7.9250	S	≥18 years	0
3	4	1	1	Futrelle, Mrs. Jacques	female	35.0	1	0	113803	53.1000	S	≥18 years	1

Titanic Survival Statistics

Feature	Category	Survival Rate (%)	Count
Overall	All Passengers	**38.38%**	342 / 891
Gender	Female	**74.20%**	233 / 314
	Male	**18.89%**	109 / 577
Passenger Class	1st Class	**62.96%**	136 / 216
	2nd Class	**47.28%**	87 / 184
	3rd Class	**24.24%**	119 / 491
Age Group	<18 years	**51.08%**	61 / 119