```
# Cell: install packages (run once)
!pip install -q pandas numpy matplotlib seaborn scikit-learn statsmodels missingno kaggle
# missingno is optional but useful for missing-data visualizations
```

```
from google.colab import files
uploaded = files.upload()  # This will open a file chooser

import io
import pandas as pd

# Read the uploaded train.csv
df = pd.read_csv(io.BytesIO(uploaded['train.csv']))
print("Loaded train.csv, shape:", df.shape)

# Look at the first few rows
df.head()
```

Choose Files train.csv

train.csv(text/csv) - 61194 bytes, last modified: 9/29/2025 - 100% done

```
Saving train.csv to train.csv
Loaded train.csv, shape: (891, 12)
```

	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

Next steps: Generate code with df New interactive sheet

```
# Imports & settings
import os, sys
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import seaborn as sns
from scipy import stats
from statsmodels.stats.outliers_influence import variance_inflation_factor
%matplotlib inline
sns.set(style="whitegrid")
# folders for saving
os.makedirs('/content/figures', exist_ok=True)
```

```
# If you used Option A/B/C above, df should already be loaded.
# If not, load now (example):
# df = pd.read_csv('/content/data/train.csv')

print("Shape:", df.shape)
display(df.head())
display(df.info())
display(df.describe(include='all').T)
```

```
Shape: (891, 12)
```

	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

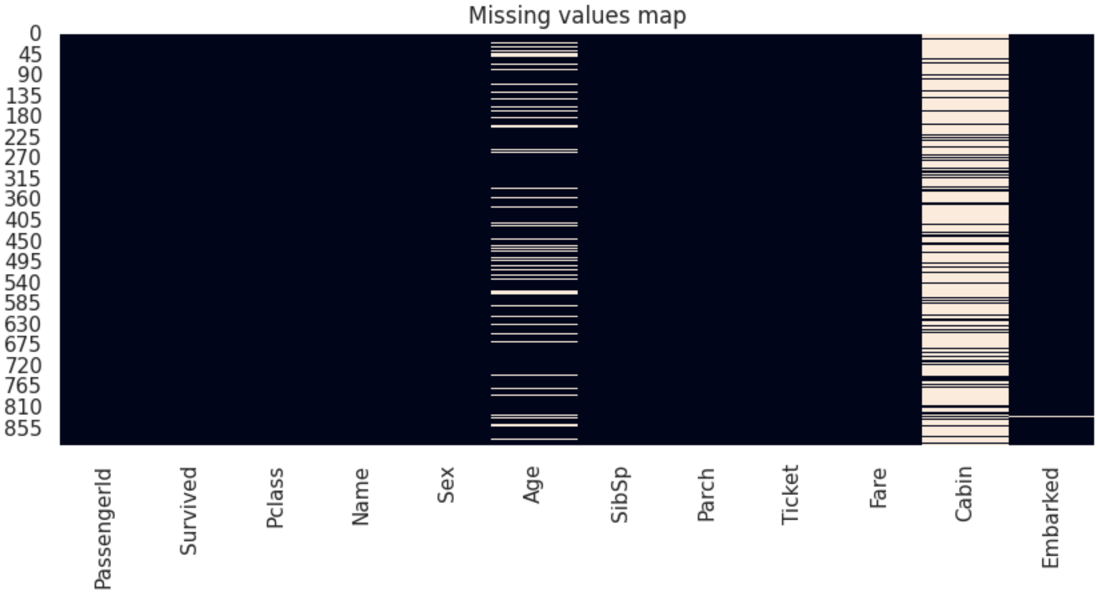
```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 891 entries, 0 to 890
Data columns (total 12 columns):
 #   Column       Non-Null Count  Dtype  
---  ------       --------------  -----  
 0   PassengerId  891 non-null    int64  
 1   Survived     891 non-null    int64  
 2   Pclass       891 non-null    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
None
```

	count	unique	top	freq	mean	std	min	25%	50%	75%	max
PassengerId	891.0	NaN	NaN	NaN	446.0	257.353842	1.0	223.5	446.0	668.5	891.0
Survived	891.0	NaN	NaN	NaN	0.383838	0.486592	0.0	0.0	0.0	1.0	1.0
Pclass	891.0	NaN	NaN	NaN	2.308642	0.836071	1.0	2.0	3.0	3.0	3.0
Name	891	891	Dooley, Mr. Patrick	1	NaN	NaN	NaN	NaN	NaN	NaN	NaN
Sex	891	2	male	577	NaN	NaN	NaN	NaN	NaN	NaN	NaN
Age	714.0	NaN	NaN	NaN	29.699118	14.526497	0.42	20.125	28.0	38.0	80.0
SibSp	891.0	NaN	NaN	NaN	0.523008	1.102743	0.0	0.0	0.0	1.0	8.0
Parch	891.0	NaN	NaN	NaN	0.381594	0.806057	0.0	0.0	0.0	0.0	6.0
Ticket	891	681	347082	7	NaN	NaN	NaN	NaN	NaN	NaN	NaN
Fare	891.0	NaN	NaN	NaN	32.204208	49.693429	0.0	7.9104	14.4542	31.0	512.3292
Cabin	204	147	G6	4	NaN	NaN	NaN	NaN	NaN	NaN	NaN

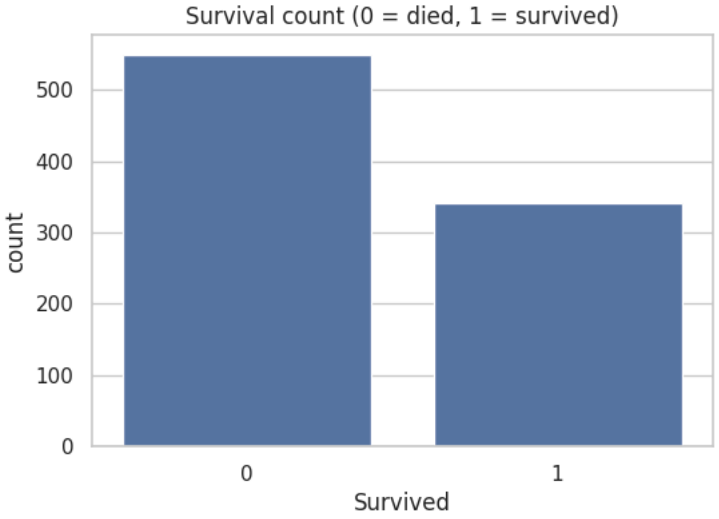
```
# Missing summary
missing = df.isnull().sum().sort_values(ascending=False)
display(missing[missing>0])

# Simple heatmap of missingness
plt.figure(figsize=(10,4))
sns.heatmap(df.isnull(), cbar=False)
plt.title("Missing values map")
plt.savefig('/content/figures/missing_map.png', bbox_inches='tight')
plt.show()
```

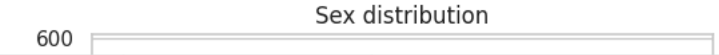
	0
Cabin	687
Age	177
Embarked	2

dtype: int64

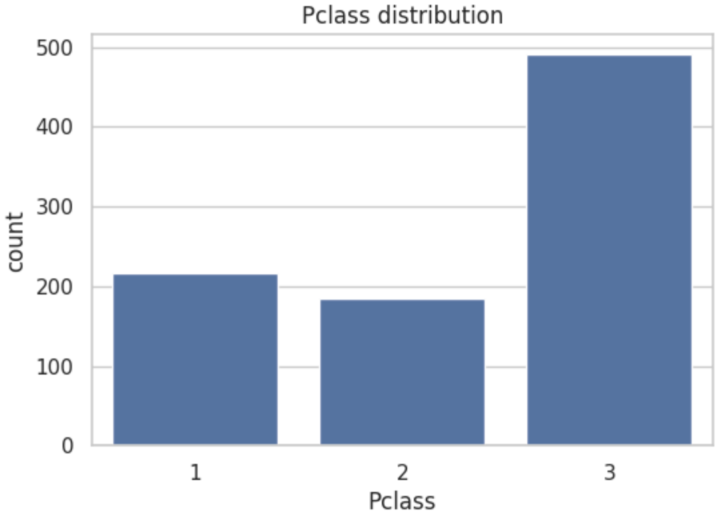


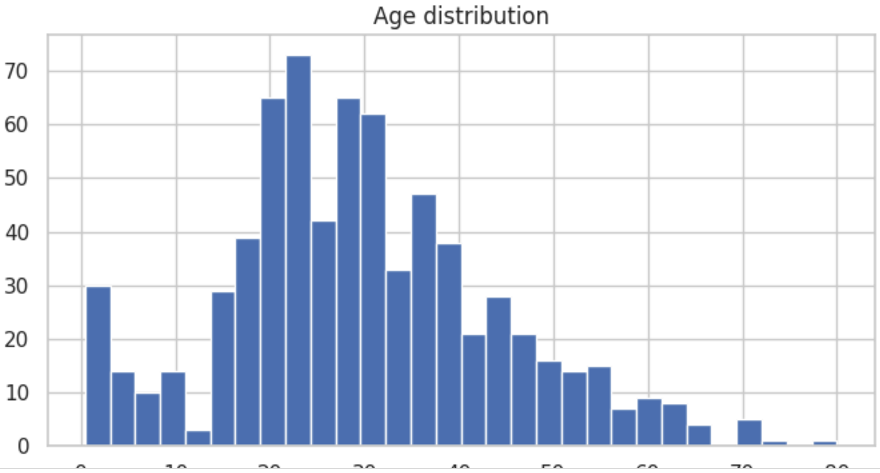
```
# Survived
plt.figure(figsize=(6,4))
sns.countplot(x='Survived', data=df)
plt.title('Survival count (0 = died, 1 = survived)')
plt.savefig('/content/figures/survived_count.png', bbox_inches='tight')
plt.show()

# Sex
plt.figure(figsize=(6,4))
sns.countplot(x='Sex', data=df)
plt.title('Sex distribution')
plt.savefig('/content/figures/sex_count.png', bbox_inches='tight')
plt.show()

# Pclass
plt.figure(figsize=(6,4))
sns.countplot(x='Pclass', data=df)
plt.title('Pclass distribution')
plt.savefig('/content/figures/pclass_count.png', bbox_inches='tight')
plt.show()

# Age distribution
plt.figure(figsize=(8,4))
df['Age'].hist(bins=30)
plt.xlabel('Age')
plt.title('Age distribution')
plt.savefig('/content/figures/age_hist.png', bbox_inches='tight')
plt.show()

# Fare distribution (skewed)
plt.figure(figsize=(8,4))
df['Fare'].hist(bins=50)
plt.xlabel('Fare')
plt.title('Fare distribution')
plt.savefig('/content/figures/fare_hist.png', bbox_inches='tight')
plt.show()
```



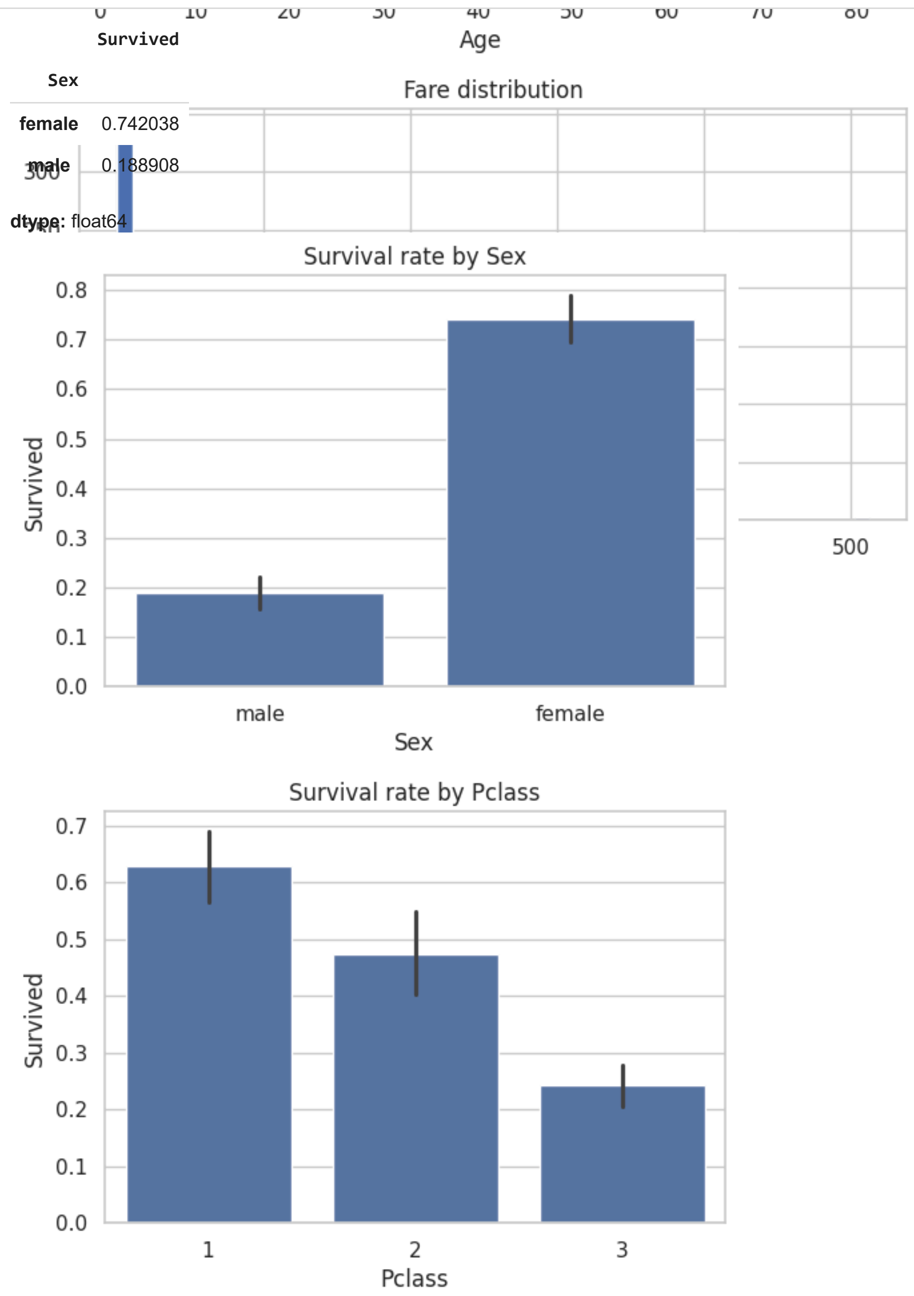


```
# Survival rate by Sex
display(df.groupby('Sex')['Survived'].mean().sort_values(ascending=False))
plt.figure(figsize=(6,4))
sns.barplot(x='Sex', y='Survived', data=df)
plt.title('Survival rate by Sex')
plt.savefig('/content/figures/survival_by_sex.png', bbox_inches='tight')
plt.show()

# Survival rate by Pclass
plt.figure(figsize=(6,4))
sns.barplot(x='Pclass', y='Survived', data=df, order=[1,2,3])
plt.title('Survival rate by Pclass')
plt.savefig('/content/figures/survival_by_pclass.png', bbox_inches='tight')
plt.show()
```

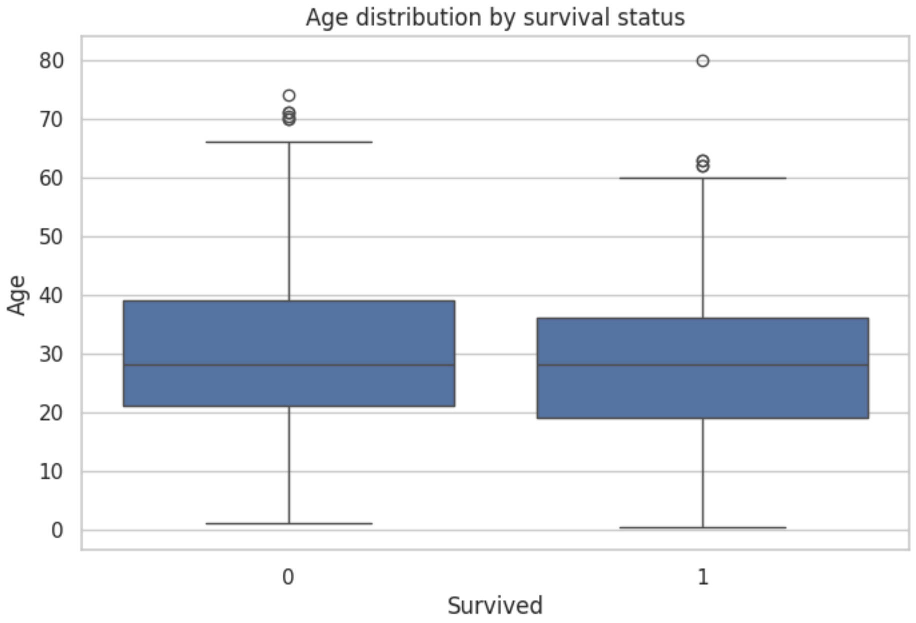


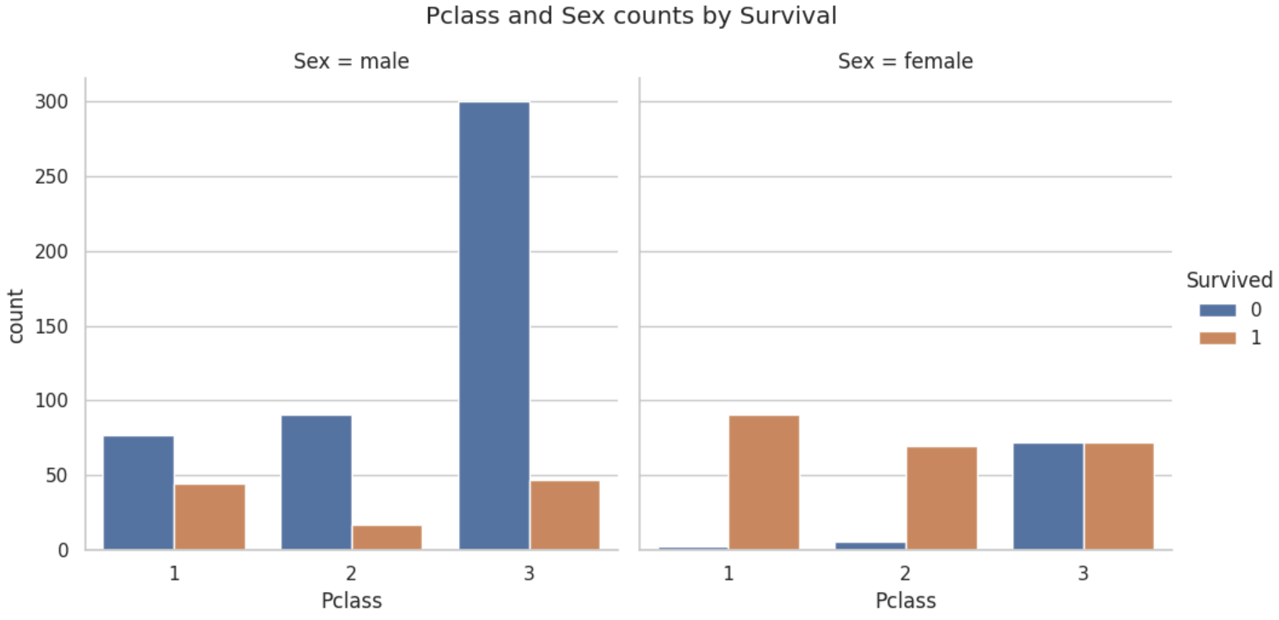


```
          Survived
Sex
female    0.742038
male      0.188908

dtype: float64
```



```
plt.figure(figsize=(8,5))
sns.boxplot(x='Survived', y='Age', data=df)
plt.title('Age distribution by survival status')
plt.savefig('/content/figures/age_by_survived.png', bbox_inches='tight')
plt.show()

# Pclass × Sex × Survival counts
g = sns.catplot(x='Pclass', col='Sex', hue='Survived', data=df, kind='count')
g.fig.suptitle('Pclass and Sex counts by Survival', y=1.04)
plt.savefig('/content/figures/pclass_sex_survival.png', bbox_inches='tight')
plt.show()
```





```
df['Title'] = df['Name'].str.extract(r',\s*([^\.]+)\.', expand=False).str.strip()
df['FamilySize'] = df['SibSp'] + df['Parch'] + 1
df['IsAlone'] = (df['FamilySize'] == 1).astype(int)
df['Deck'] = df['Cabin'].astype(str).str[0].replace('n', np.nan)
display(df[['Name','Title','FamilySize','IsAlone','Cabin','Deck']].head())
```

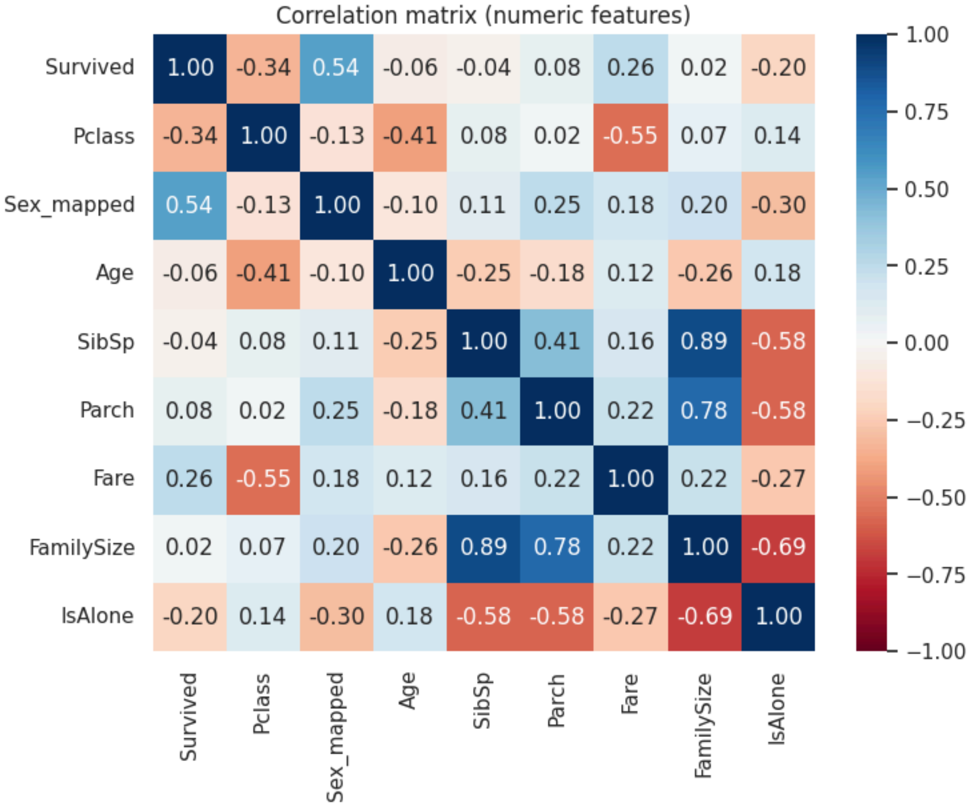
	Name	Title	FamilySize	IsAlone	Cabin	Deck
0	Braund, Mr. Owen Harris	Mr	2	0	NaN	NaN
1	Cumings, Mrs. John Bradley (Florence Briggs Th...	Mrs	2	0	C85	C
2	Heikkinen, Miss. Laina	Miss	1	1	NaN	NaN
3	Futrelle, Mrs. Jacques Heath (Lily May Peel)	Mrs	2	0	C123	C
4	Allen, Mr. William Henry	Mr	1	1	NaN	NaN

```
# fill Embarked with mode
df['Embarked'] = df['Embarked'].fillna(df['Embarked'].mode()[0])
# Fare median
df['Fare'] = df['Fare'].fillna(df['Fare'].median())

# Impute Age by median grouped by Sex & Pclass
df['Age'] = df.groupby(['Sex','Pclass'])['Age'].transform(lambda x: x.fillna(x.median()))
df['Age'] = df['Age'].fillna(df['Age'].median())
```

```
# Check remaining nulls
```

```
                 0
Deck           687
Cabin          687
PassengerId      0
Survived         0
Sex              0
Age              0
Pclass           0
Name             0
Parch            0
SibSp            0

dtype: int64
```

```
# Map sex to numeric and take subset
df2 = df.copy()
df2['Sex_mapped'] = df2['Sex'].map({'male':0, 'female':1})
num_cols = ['Survived','Pclass','Sex_mapped','Age','SibSp','Parch','Fare','FamilySize','IsAlone']
corr = df2[num_cols].corr()

plt.figure(figsize=(8,6))
sns.heatmap(corr, annot=True, fmt=".2f", cmap='RdBu', vmin=-1, vmax=1)
plt.title('Correlation matrix (numeric features)')
plt.savefig('/content/figures/corr_matrix.png', bbox_inches='tight')
plt.show()
```



	Survived	Pclass	Sex_mapped	Age	SibSp	Parch	Fare	FamilySize	IsAlone
Survived	1.00	-0.34	0.54	-0.06	-0.04	0.08	0.26	0.02	-0.20
Pclass	-0.34	1.00	-0.13	-0.41	0.08	0.02	-0.55	0.07	0.14
Sex_mapped	0.54	-0.13	1.00	-0.10	0.11	0.25	0.18	0.20	-0.30
Age	-0.06	-0.41	-0.10	1.00	-0.25	-0.18	0.12	-0.26	0.18
SibSp	-0.04	0.08	0.11	-0.25	1.00	0.41	0.16	0.89	-0.58
Parch	0.08	0.02	0.25	-0.18	0.41	1.00	0.22	0.78	-0.58
Fare	0.26	-0.55	0.18	0.12	0.16	0.22	1.00	0.22	-0.27
FamilySize	0.02	0.07	0.20	-0.26	0.89	0.78	0.22	1.00	-0.69
IsAlone	-0.20	0.14	-0.30	0.18	-0.58	-0.58	-0.27	-0.69	1.00

```
from statsmodels.tools.tools import add_constant
X = df2[['Pclass','Sex_mapped','Age','SibSp','Parch','Fare','FamilySize','IsAlone']]
X = add_constant(X)
vif = pd.DataFrame()
vif['feature'] = X.columns
vif['VIF'] = [variance_inflation_factor(X.values, i) for i in range(X.shape[1])]
display(vif.sort_values('VIF', ascending=False))
```