```
   age           job  marital  education default  balance housing loan  \
0   58    management  married   tertiary      no     2143     yes   no
1   44    technician   single  secondary      no       29     yes   no
2   33  entrepreneur  married  secondary      no        2     yes  yes
3   47   blue-collar  married    unknown      no     1506     yes   no
4   33       unknown   single    unknown      no        1      no   no

    contact  day month  duration  campaign  pdays  previous poutcome   y
0  unknown    5   may       261         1     -1         0  unknown  no
1  unknown    5   may       151         1     -1         0  unknown  no
2  unknown    5   may        76         1     -1         0  unknown  no
3  unknown    5   may        92         1     -1         0  unknown  no
4  unknown    5   may       198         1     -1         0  unknown  no
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 45211 entries, 0 to 45210
Data columns (total 17 columns):
 #   Column     Non-Null Count  Dtype
---  ------     --------------  -----
 0   age        45211 non-null  int64
 1   job        45211 non-null  object
 2   marital    45211 non-null  object
 3   education  45211 non-null  object
 4   default    45211 non-null  object
 5   balance    45211 non-null  int64
 6   housing    45211 non-null  object
 7   loan       45211 non-null  object
 8   contact    45211 non-null  object
 9   day        45211 non-null  int64
 10  month      45211 non-null  object
 11  duration   45211 non-null  int64
 12  campaign   45211 non-null  int64
 13  pdays      45211 non-null  int64
 14  previous   45211 non-null  int64
 15  poutcome   45211 non-null  object
 16  y          45211 non-null  object
dtypes: int64(7), object(10)
memory usage: 5.9+ MB
None
```

```
Index(['job', 'marital', 'education', 'default', 'housing', 'loan', 'contact',
       'month', 'poutcome', 'y'],
      dtype='object')
['management' 'technician' 'entrepreneur' 'blue-collar' 'unknown'
 'retired' 'admin.' 'services' 'self-employed' 'unemployed' 'housemaid'
 'student']
['married' 'single' 'divorced']
['tertiary' 'secondary' 'unknown' 'primary']
['no' 'yes']
['yes' 'no']
['no' 'yes']
['unknown' 'cellular' 'telephone']
['may' 'jun' 'jul' 'aug' 'oct' 'nov' 'dec' 'jan' 'feb' 'mar' 'apr' 'sep']
['unknown' 'failure' 'other' 'success']
['no' 'yes']
age          0
job          0
marital      0
education    0
default      0
balance      0
housing      0
loan         0
contact      0
day          0
month        0
duration     0
campaign     0
pdays        0
previous     0
poutcome     0
y            0
dtype: int64
   age  balance  day  duration  campaign  pdays  previous
0   58     2143    5       261         1     -1         0
1   44       29    5       151         1     -1         0
2   33        2    5        76         1     -1         0
3   47     1506    5        92         1     -1         0
4   33        1    5       198         1     -1         0
                age        balance           day      duration      campaign  \
count  45211.000000   45211.000000  45211.000000  45211.000000  45211.000000
mean      40.936210    1362.272058     15.806419    258.163080      2.763841
std       10.618762    3044.765829      8.322476    257.527812      3.098021
min       18.000000   -8019.000000      1.000000      0.000000      1.000000
25%       33.000000      72.000000      8.000000    103.000000      1.000000
50%       39.000000     448.000000     16.000000    180.000000      2.000000
75%       48.000000    1428.000000     21.000000    319.000000      3.000000
max       95.000000  102127.000000     31.000000   4918.000000     63.000000
```

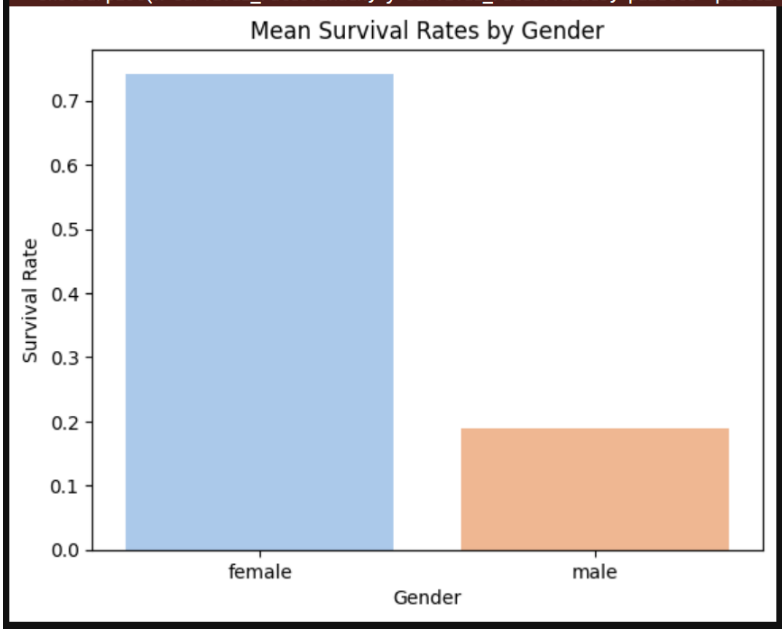
```
First 5 rows:
   Student ID   Age  Gender      Height     Weight Blood Type        BMI
0         1.0  18.0  Female  161.777924  72.354947          O  27.645835
1         2.0   NaN    Male  152.069157  47.630941          B        NaN
2         3.0  32.0  Female  182.537664  55.741083          A  16.729017
3         NaN  30.0    Male  182.112867  63.332207          B  19.096042
4         5.0  23.0  Female         NaN  46.234173          O        NaN

   Temperature  Heart Rate  Blood Pressure  Cholesterol Diabetes Smoking
0          NaN        95.0           109.0        203.0       No     NaN
1    98.714977        93.0           104.0        163.0       No      No
2    98.260293        76.0           130.0        216.0      Yes      No
3    98.839605        99.0           112.0        141.0       No     Yes
4    98.480008        95.0             NaN        231.0       No      No

DataFrame Info:
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 200000 entries, 0 to 199999
Data columns (total 13 columns):
 #   Column          Non-Null Count   Dtype
---  ------          --------------   -----
 0   Student ID      180000 non-null  float64
 1   Age             180000 non-null  float64
 2   Gender          180000 non-null  object
 3   Height          180000 non-null  float64
 4   Weight          180000 non-null  float64
 5   Blood Type      180000 non-null  object
 6   BMI             180000 non-null  float64
 7   Temperature     180000 non-null  float64
 8   Heart Rate      180000 non-null  float64
 9   Blood Pressure  180000 non-null  float64
 10  Cholesterol     180000 non-null  float64
 11  Diabetes        180000 non-null  object
 12  Smoking         180000 non-null  object
dtypes: float64(9), object(4)
memory usage: 19.8+ MB
None
```

```
Missing values per column:
Student ID        20000
Age               20000
Gender            20000
Height            20000
Weight            20000
Blood Type        20000
BMI               20000
Temperature       20000
Heart Rate        20000
Blood Pressure    20000
Cholesterol       20000
Diabetes          20000
Smoking           20000
dtype: int64
Filled missing values in numeric column 'Student ID' with mean.
Filled missing values in numeric column 'Age' with mean.
Filled missing values in categorical column 'Gender' with mode.
Filled missing values in numeric column 'Height' with mean.
Filled missing values in numeric column 'Weight' with mean.
Filled missing values in categorical column 'Blood Type' with mode.
Filled missing values in numeric column 'BMI' with mean.
Filled missing values in numeric column 'Temperature' with mean.
Filled missing values in numeric column 'Heart Rate' with mean.
Filled missing values in numeric column 'Blood Pressure' with mean.
Filled missing values in numeric column 'Cholesterol' with mean.
Filled missing values in categorical column 'Diabetes' with mode.
Filled missing values in categorical column 'Smoking' with mode.

Missing values after imputation:
Student ID        0
Age               0
Gender            0
Height            0
Weight            0
Blood Type        0
BMI               0
Temperature       0
Heart Rate        0
Blood Pressure    0
Cholesterol       0
Diabetes          0
Smoking           0
dtype: int64

Number of duplicate rows: 12572
```

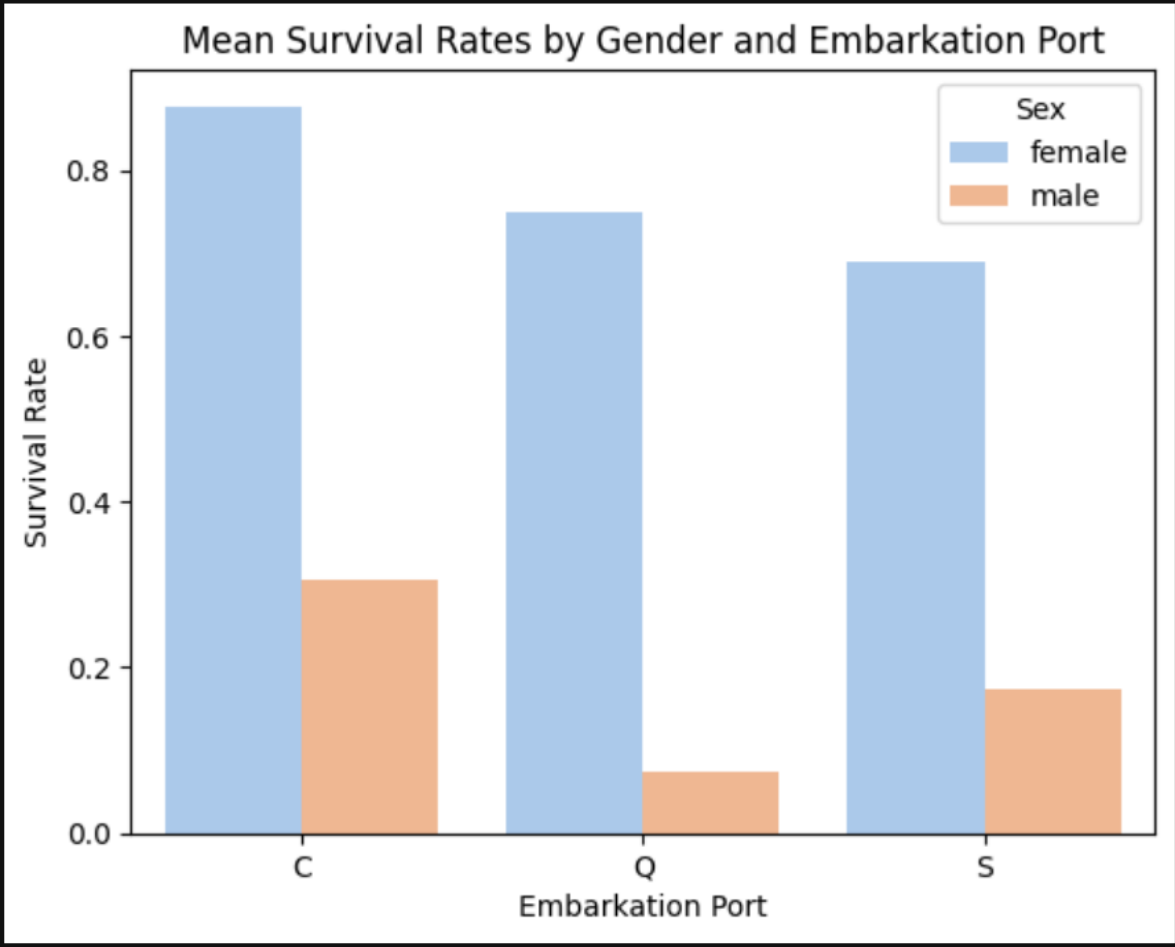
```
Number of null values in 'Age': 177

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

      Fare  Survived
0   7.2500         0
1  71.2833         1
2   7.9250         1
3  53.1000         1
4   8.0500         0
```

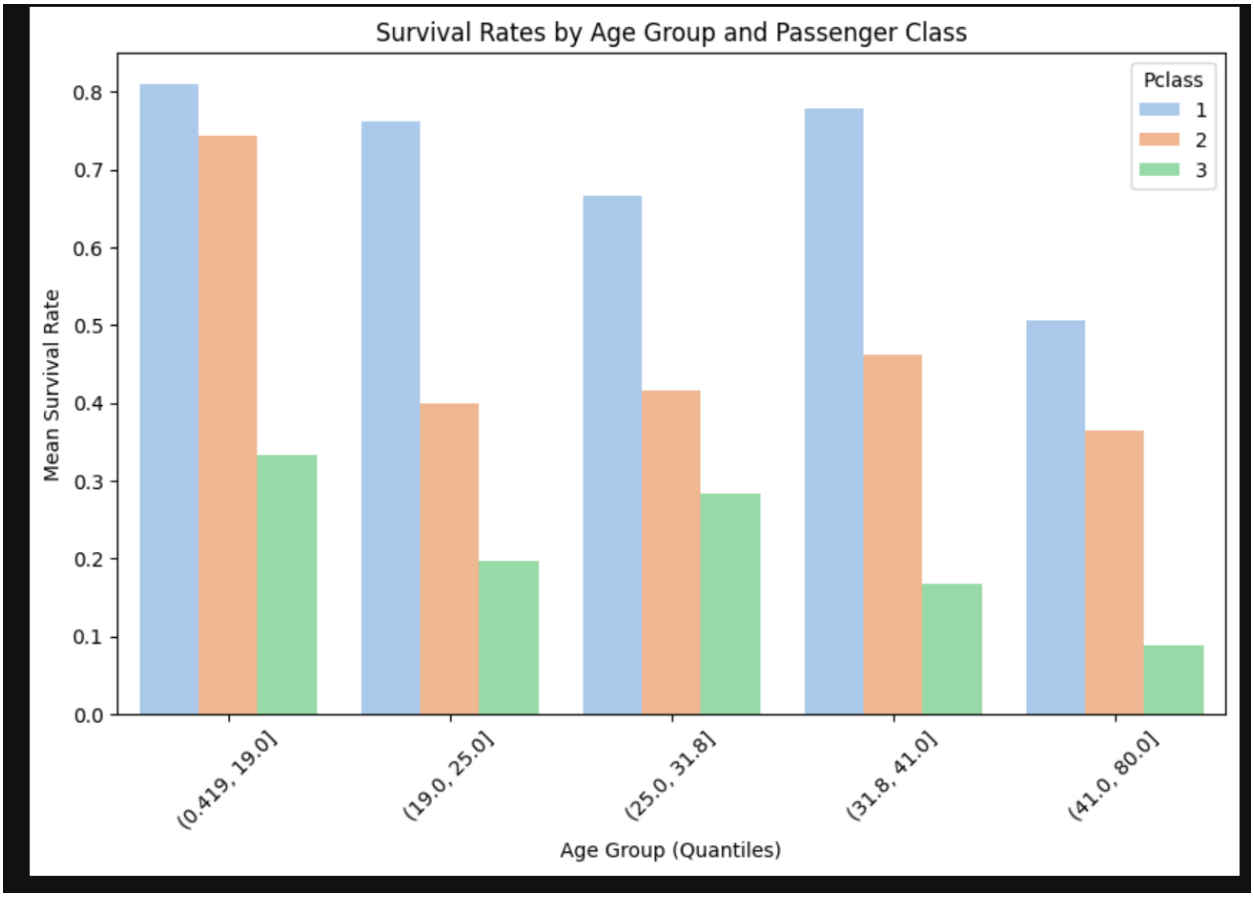
```
   PassengerId  Survived  Pclass  \
0            1         0       3
1            2         1       1
2            3         1       3
3            4         1       1
4            5         0       3

                                                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_C  Embarked_Q  Embarked_S
0      0         A/5 21171   7.2500   NaN       False       False        True
1      0          PC 17599  71.2833   C85        True       False       False
2      0  STON/O2. 3101282   7.9250   NaN       False       False        True
3      0            113803  53.1000  C123       False       False        True
4      0            373450   8.0500   NaN       False       False        True
```

```
Mean survival rates by gender:
Sex
female    0.742038
male      0.188908
Name: Survived, dtype: float64
/tmp/ipython-input-154143843.py:8: FutureWarning:

Passing `palette` without assigning `hue` is deprecated and will be removed in v0.14.0. Assign the `x` variable to `hue` and
set `legend=False` for the same effect.

  sns.barplot(x=survival_rates.index, y=survival_rates.values, palette="pastel")
```



```
Mean survival rates by gender and embarkation port:
      Sex Embarked  Survived
0  female        C  0.876712
1  female        Q  0.750000
2  female        S  0.689655
3    male        C  0.305263
4    male        Q  0.073171
5    male        S  0.174603
```




Survival Rates by Age Group and Passenger Class
Pclass
1
2
3
Mean Survival Rate
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
(0.419, 19.0]
(19.0, 25.0]
(25.0, 31.8]
(31.8, 41.0]
(41.0, 80.0]
Age Group (Quantiles)