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In [96]:
```
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
import matplotlib.style
import seaborn as sns
```

In [97]:
```
with open('titanic.csv') as f:
    df = pd.read_csv(f, dtype={'age': np.float64, 'sibsp': np.int64, 'parch': np.int64})
```

In [98]:
```
df.head(12)
```

Out[98]:

	pclass	survived	name	sex	age	sibsp	parch	ticket	fare	cabin	embarked	boat	body	home.dest
0	1	1	Allen, Miss. Elisabeth Walton	female	29.0000	0	0	24160	211.3375	B5	S	2	NaN	St Louis, MO
1	1	1	Allison, Master. Hudson Trevor	male	0.9167	1	2	113781	151.5500	C22 C26	S	11	NaN	Montreal, PQ / Chesterville, ON
2	1	0	Allison, Miss. Helen Loraine	female	2.0000	1	2	113781	151.5500	C22 C26	S	NaN	NaN	Montreal, PQ / Chesterville, ON
3	1	0	Allison, Mr. Hudson Joshua Creighton	male	30.0000	1	2	113781	151.5500	C22 C26	S	NaN	135.0	Montreal, PQ / Chesterville, ON
4	1	0	Allison, Mrs. Hudson J C (Bessie Waldo Daniels)	female	25.0000	1	2	113781	151.5500	C22 C26	S	NaN	NaN	Montreal, PQ / Chesterville, ON
5	1	1	Anderson, Mr. Harry	male	48.0000	0	0	19952	26.5500	E12	S	3	NaN	New York, NY
6	1	1	Andrews, Miss. Kornelia Theodosia	female	63.0000	1	0	13502	77.9583	D7	S	10	NaN	Hudson, NY
7	1	0	Andrews, Mr. Thomas Jr	male	39.0000	0	0	112050	0.0000	A36	S	NaN	NaN	Belfast, NI
8	1	1	Appleton, Mrs. Edward Dale (Charlotte Lamson)	female	53.0000	2	0	11769	51.4792	C101	S	D	NaN	Bayside, Queens, NY
9	1	0	Artagaveytia, Mr. Ramon	male	71.0000	0	0	PC 17609	49.5042	NaN	C	NaN	22.0	Montevideo, Uruguay
10	1	0	Astor, Col. John Jacob	male	47.0000	1	0	PC 17757	227.5250	C62 C64	C	NaN	124.0	New York, NY
11	1	1	Astor, Mrs. John Jacob (Madeleine Talmadge Force)	female	18.0000	1	0	PC 17757	227.5250	C62 C64	C	4	NaN	New York, NY

In [99]:
```
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 1309 entries, 0 to 1308
Data columns (total 14 columns):
 #   Column     Non-Null Count  Dtype
---  ------     --------------  -----
 0   pclass     1309 non-null   int64
 1   survived   1309 non-null   int64
 2   name       1309 non-null   object
 3   sex        1309 non-null   object
 4   age        1046 non-null   float64
 5   sibsp      1309 non-null   int64
 6   parch      1309 non-null   int64
 7   ticket     1309 non-null   object
 8   fare       1308 non-null   float64
 9   cabin      295 non-null    object
 10  embarked   1307 non-null   object
 11  boat       486 non-null    object
 12  body       121 non-null    float64
 13  home.dest  745 non-null    object
dtypes: float64(3), int64(4), object(7)
memory usage: 143.3+ KB
```

In [100…

```
df.describe()
```

Out[100…

	pclass	survived	age	sibsp	parch	fare	body
count	1309.000000	1309.000000	1046.000000	1309.000000	1309.000000	1308.000000	121.000000
mean	2.294882	0.381971	29.881135	0.498854	0.385027	33.295479	160.809917
std	0.837836	0.486055	14.413500	1.041658	0.865560	51.758668	97.696922
min	1.000000	0.000000	0.166700	0.000000	0.000000	0.000000	1.000000
25%	2.000000	0.000000	21.000000	0.000000	0.000000	7.895800	72.000000
50%	3.000000	0.000000	28.000000	0.000000	0.000000	14.454200	155.000000
75%	3.000000	1.000000	39.000000	1.000000	0.000000	31.275000	256.000000
max	3.000000	1.000000	80.000000	8.000000	9.000000	512.329200	328.000000

In [101…

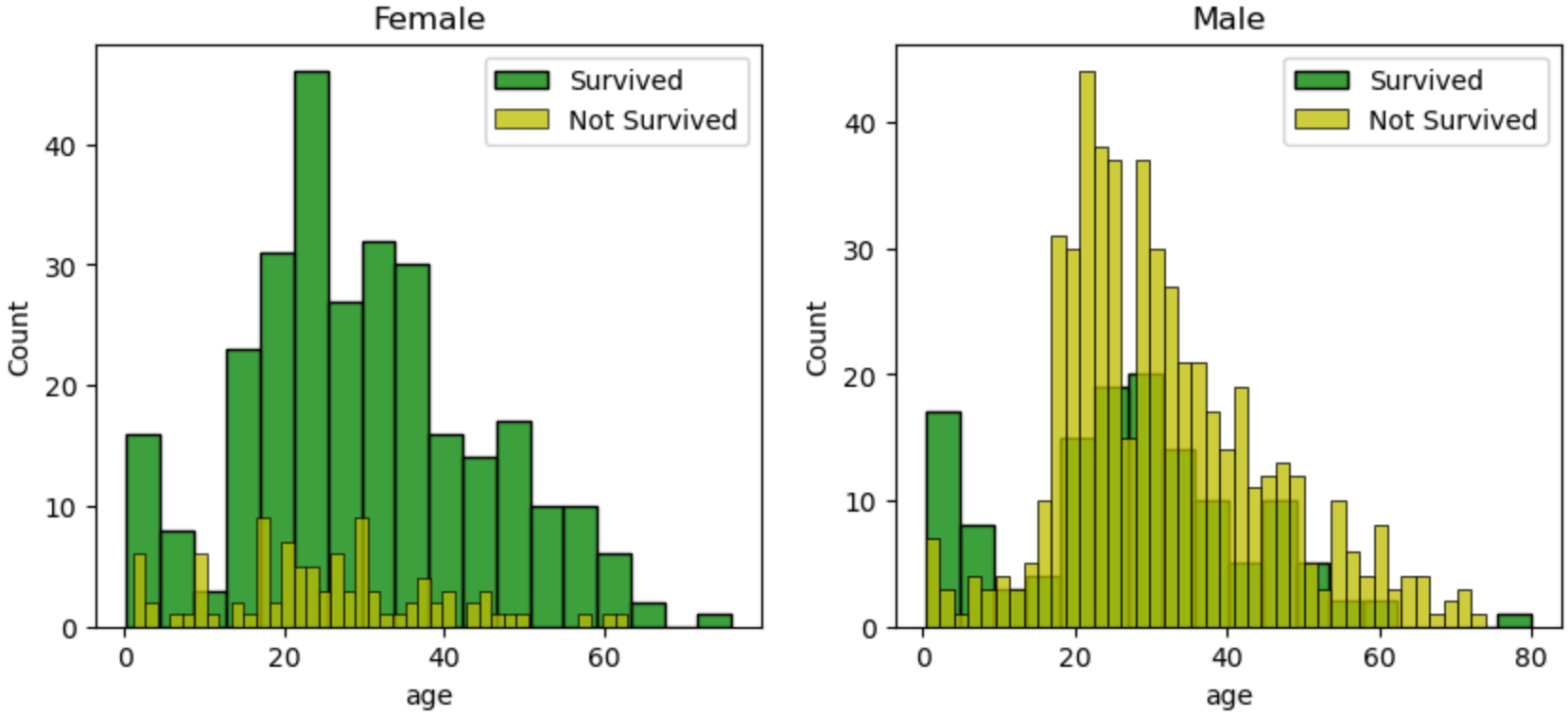
```
total = df.isnull().sum().sort_values(ascending=False)
percent_1 = df.isnull().sum() / df.isnull().count() * 100
percent_2 = (round(percent_1, 1)).sort_values(ascending=False)
missing_data = pd.concat([total, percent_2], axis=1, keys=['Total', '%'])
missing_data.head(5)
```

Out[101…

	Total	%
body	1188	90.8
cabin	1014	77.5
boat	823	62.9
home.dest	564	43.1
age	263	20.1

In [102…

```
sur = 'Survived'
not_sur = 'Not Survived'
fig, axes = plt.subplots(nrows=1, ncols=2, figsize=(10, 4))
women = df[df['sex'] == 'female']
men = df[df['sex'] == 'male']
ax = sns.histplot(women[women['survived'] == 1].age.dropna(), bins=18, label=sur, ax=axes[0], kde=False, color='g')
ax = sns.histplot(women[women['survived'] == 0].age.dropna(), bins=40, label=not_sur, ax=axes[0], kde=False, color='y')
ax.legend()
ax.set_title('Female')
ax = sns.histplot(men[men['survived'] == 1].age.dropna(), bins=18, label=sur, ax=axes[1], kde=False, color='g')
ax = sns.histplot(men[men['survived'] == 0].age.dropna(), bins=40, label=not_sur, ax=axes[1], kde=False, color='y')
ax.legend()
_ = ax.set_title('Male')
```

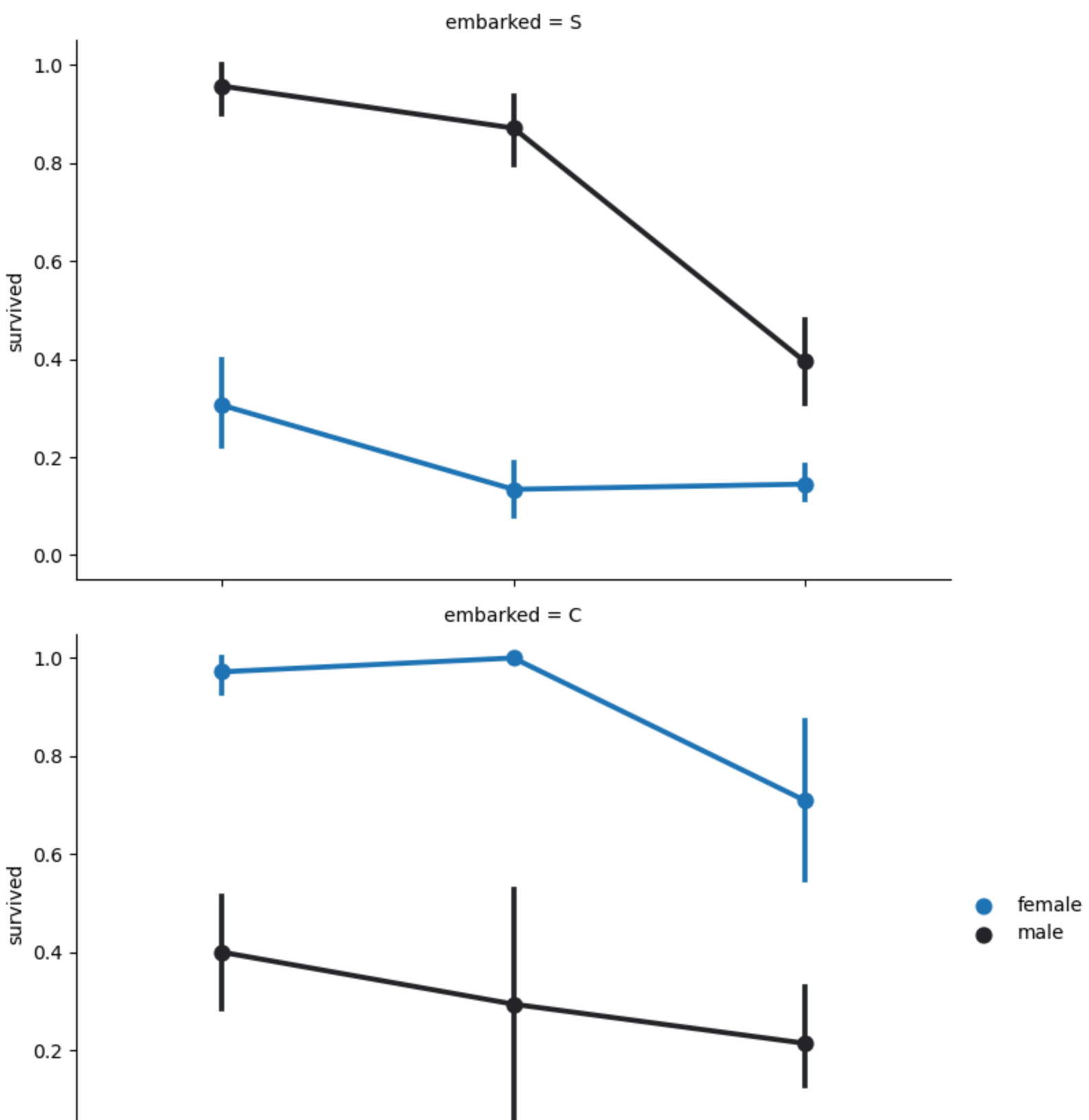


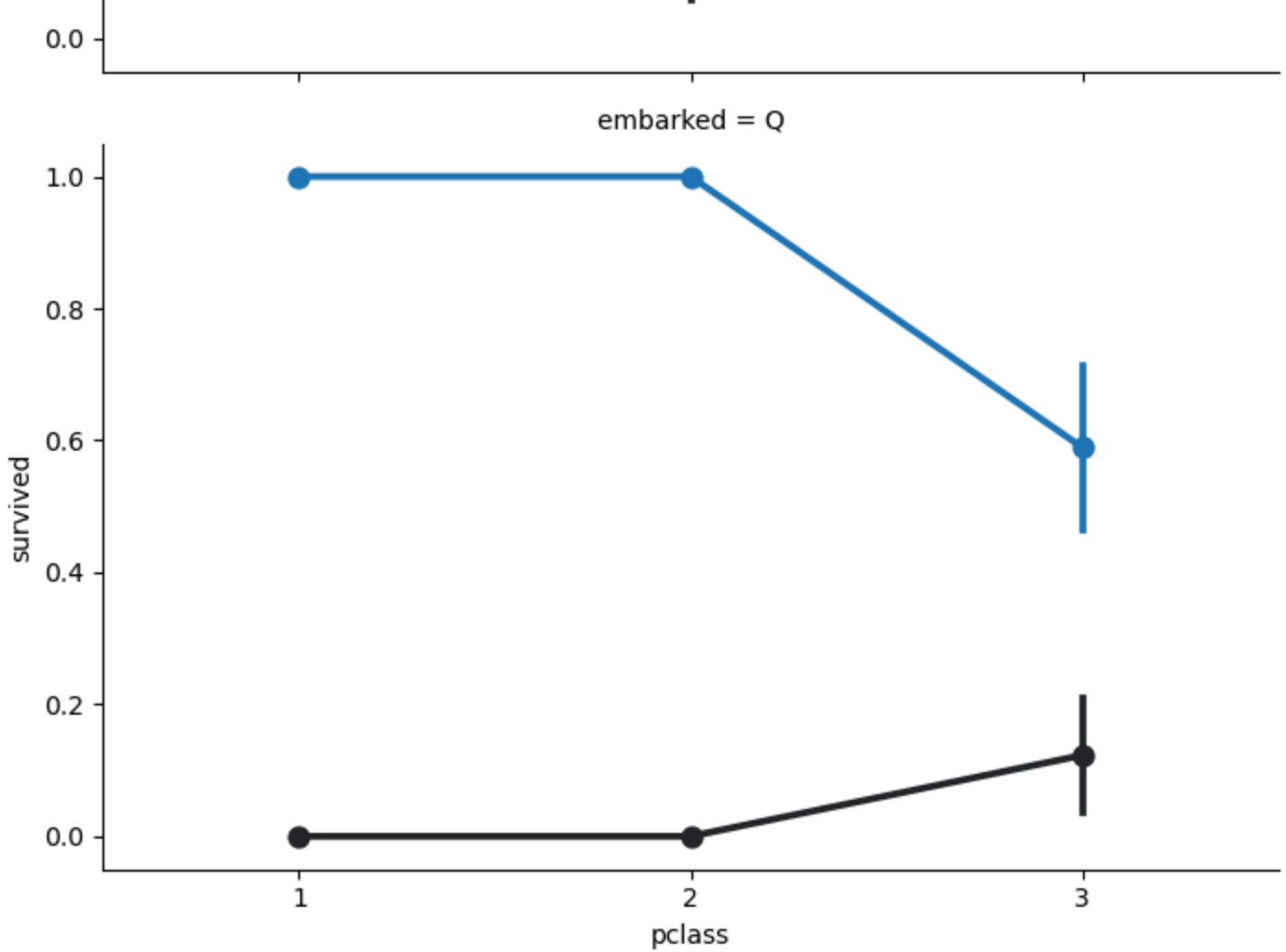
In [103…

```
FacetGrid = sns.FacetGrid(df, row='embarked', height=4.5, aspect=1.6)
FacetGrid.map(sns.pointplot, 'pclass', 'survived', 'sex', palette=None, order=None, hue_order=None)
FacetGrid.add_legend()
```

Out[103…

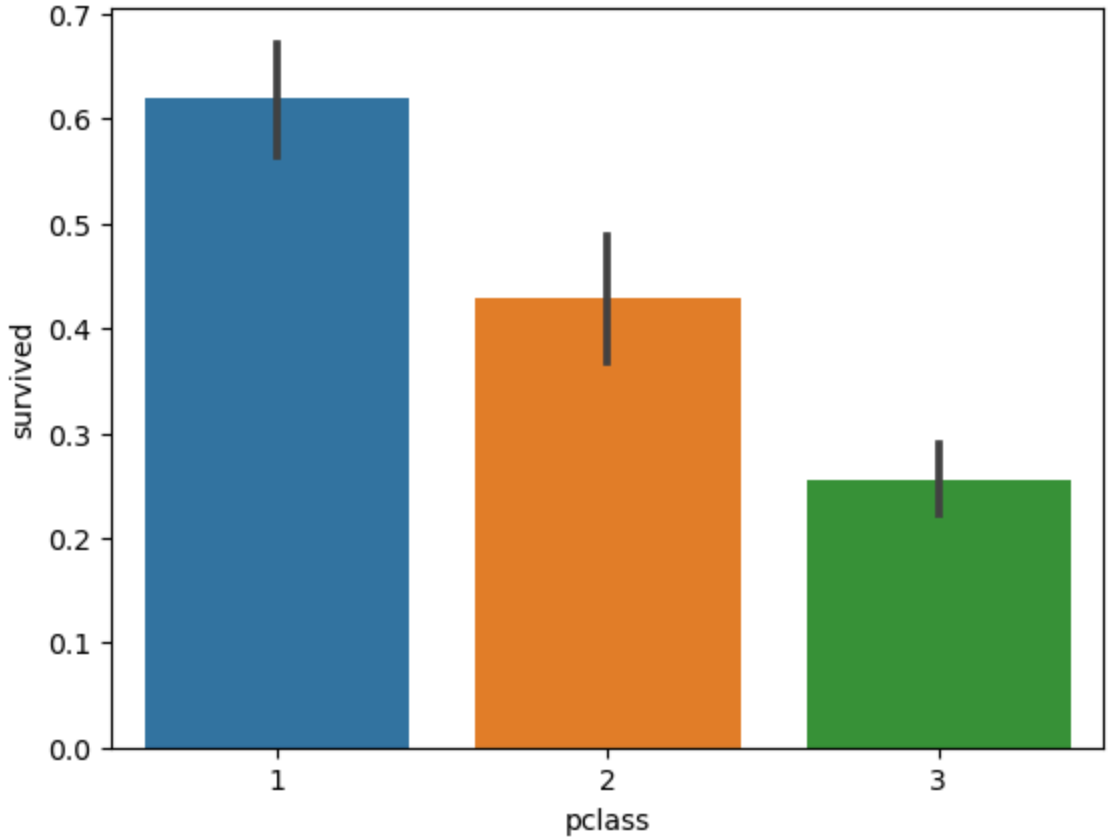
```
<seaborn.axisgrid.FacetGrid at 0x1d89c5c5e80>
```


embarked = S
survived
1.0
0.8
0.6
0.4
0.2
0.0
embarked = C
survived
1.0
0.8
0.6
0.4
0.2
female
male



In [104…
```
sns.barplot(x='pclass', y='survived', data=df)
```

Out[104…
```
<Axes: xlabel='pclass', ylabel='survived'>
```

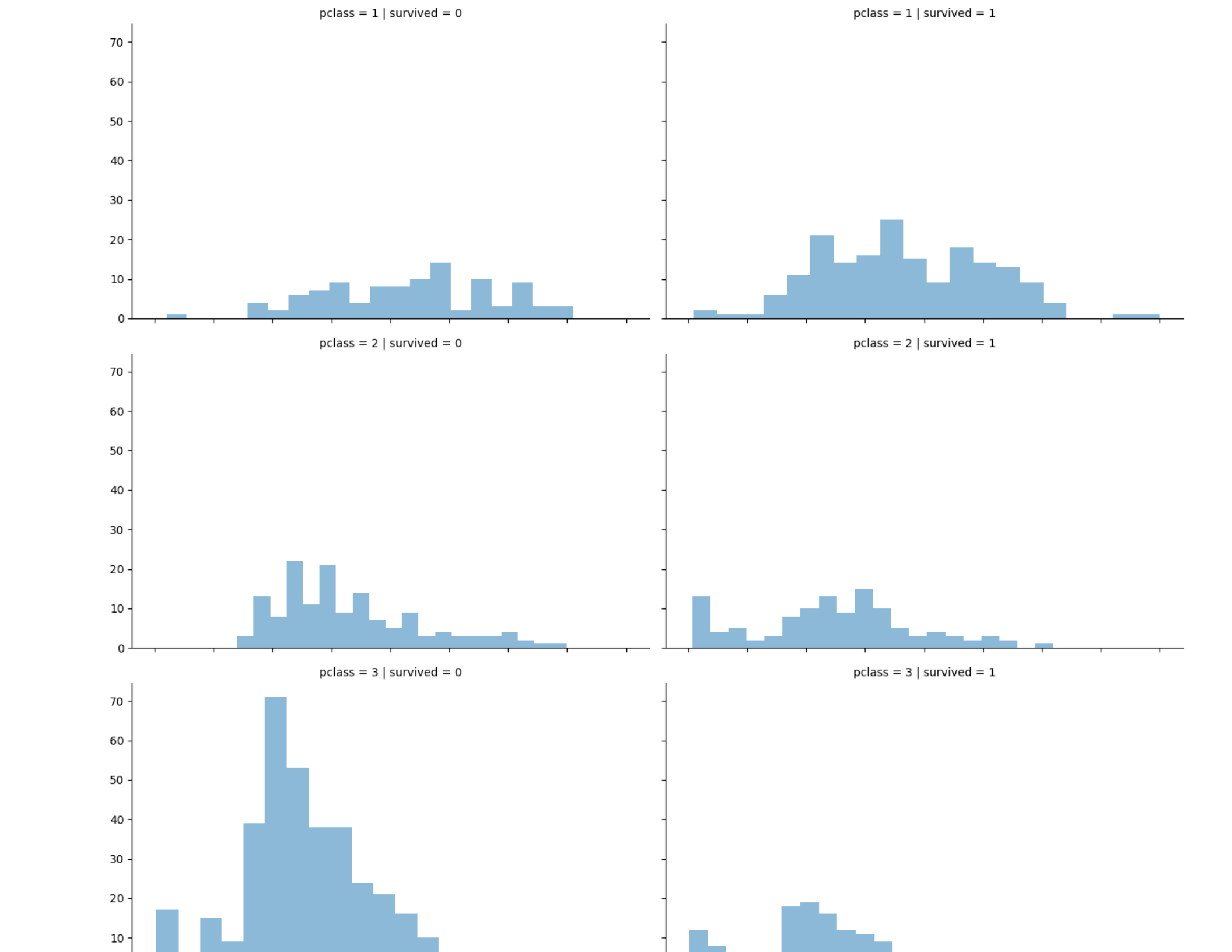


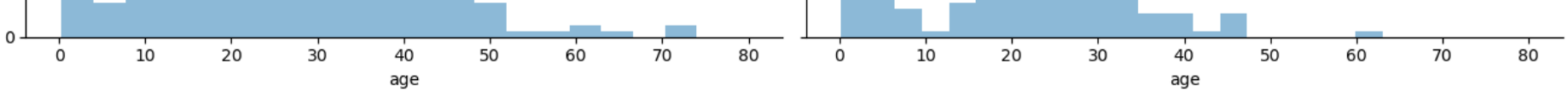
In [105…

```
grid = sns.FacetGrid(df, col='survived', row='pclass', height=4.2, aspect=1.6)
grid.map(plt.hist, 'age', alpha=.5, bins=20)
grid.add_legend()
```

Out[105…

```
<seaborn.axisgrid.FacetGrid at 0x1d89faf0e30>
```

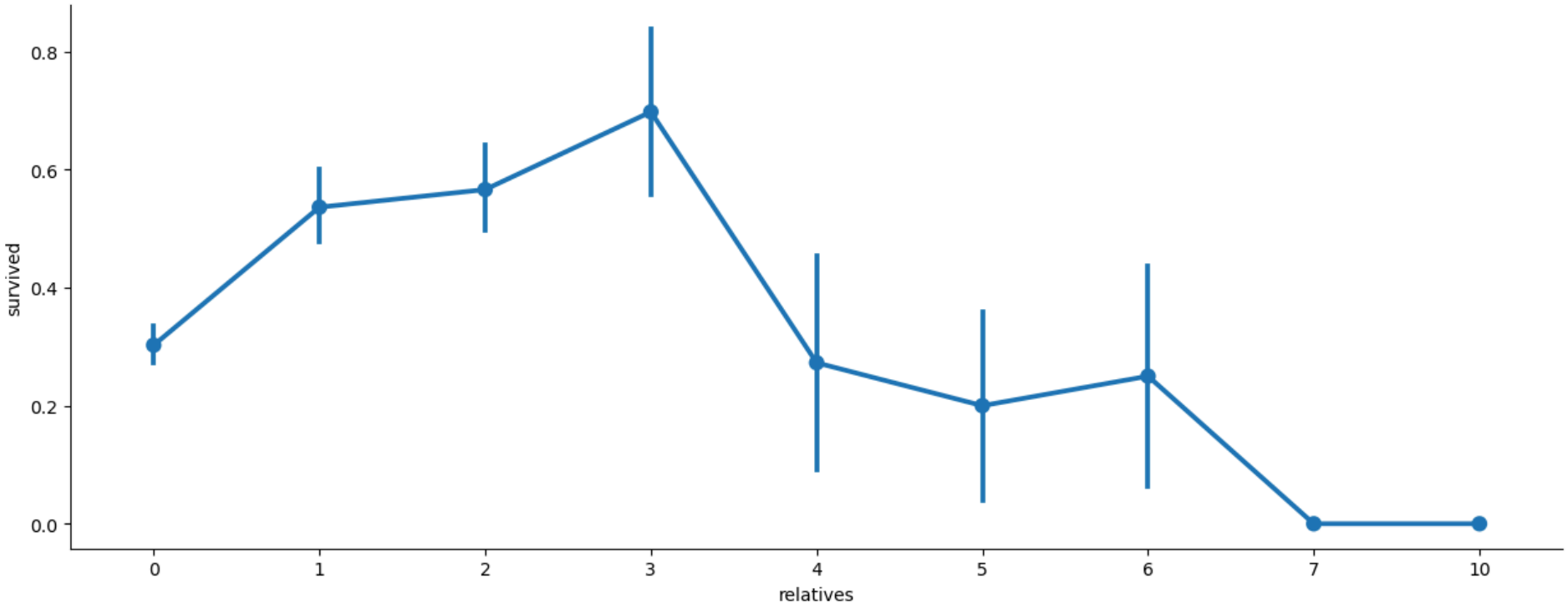

pclass = 1 | survived = 0
pclass = 1 | survived = 1
pclass = 2 | survived = 0
pclass = 2 | survived = 1
pclass = 3 | survived = 0
pclass = 3 | survived = 1
0
10
20
30
40
50
60
70



In [106…]
```
for dataset in [df]:
    dataset['relatives'] = dataset['sibsp'] + dataset['parch']
    dataset.loc[dataset['relatives'] > 0, 'not_alone'] = 0
    dataset.loc[dataset['relatives'] == 0, 'not_alone'] = 1
    dataset['not_alone'] = dataset['not_alone'].astype(int)
df['not_alone'].value_counts()
```

Out[106…]
```
not_alone
1    790
0    519
Name: count, dtype: int64
```

In [107…]
```
axes = sns.catplot(x='relatives', y='survived', data=df, aspect=2.5, kind='point')
```



In [108…]
```
import re
deck = {"A": 1, "B": 2, "C": 3, "D": 4, "E": 5, "F": 6, "G": 7, "U": 8}

for data in [df]:
    data['cabin'] = data['cabin'].fillna("U0")
    data['deck'] = data['cabin'].map(lambda x: re.compile("([a-zA-Z]+)").search(x).group())
```

```
    data['deck'] = data['deck'].map(deck)
    data['deck'] = data['deck'].fillna(0)
    data['deck'] = data['deck'].astype(int)
df = df.drop(['cabin'], axis=1)
```

In [109…
```
df['ticket'].describe()
```

Out[109…
```
count         1309
unique         929
top       CA. 2343
freq             11
Name: ticket, dtype: object
```

In [110…
```
df = df.drop(['ticket'], axis=1)
df = df.drop(['boat'], axis=1)
df = df.drop(['body'], axis=1)
df = df.drop(['home.dest'], axis=1)
```

In [111…
```
for data in [df]:
    mean = df['age'].mean()
    std = df['age'].std()
    is_null = data['age'].isnull().sum()
    #compute random numbers
    rand_age = np.random.randint(mean - std, mean + std, size=is_null)
    #fill NA
    age_slice = data['age'].copy()
    age_slice[np.isnan(age_slice)] = rand_age
    data['age'] = age_slice
    data['age'] = df['age'].astype(int)
df['age'].isnull().sum()
```

Out[111…
```
0
```

In [112…
```
df['embarked'].describe()
```

Out[112…
```
count     1307
unique       3
top          S
freq       914
Name: embarked, dtype: object
```

In [113…
```
com_val = 'S'
for data in [df]:
    data['embarked'] = data['embarked'].fillna(com_val)
```

In [114…
```
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 1309 entries, 0 to 1308
Data columns (total 12 columns):
 #   Column      Non-Null Count  Dtype
---  ------      --------------  -----
 0   pclass      1309 non-null   int64
 1   survived    1309 non-null   int64
 2   name        1309 non-null   object
 3   sex         1309 non-null   object
 4   age         1309 non-null   int32
 5   sibsp       1309 non-null   int64
 6   parch       1309 non-null   int64
 7   fare        1308 non-null   float64
 8   embarked    1309 non-null   object
 9   relatives   1309 non-null   int64
 10  not_alone   1309 non-null   int32
 11  deck        1309 non-null   int32
dtypes: float64(1), int32(3), int64(5), object(3)
memory usage: 107.5+ KB
```

In [115…

```python
for data in [df]:
    data['fare'] = data['fare'].fillna(0)
    data['fare'] = data['fare'].astype(int)
```

In [116…

```python
titles = {"Mr": 1, "Miss": 2, "Mrs": 3, "Master": 4, "Rare": 5}

for data in [df]:
    # Extract titles
    data['title'] = data.name.str.extract('  ([A-Za-z]+)\.', expand=False)
    # Replace titles
    data['title'] = data['title'].replace(['Lady', 'Countess', 'Capt', 'Col', 'Don', 'Dr', 'Major', 'Rev', 'Sir', 'Jonkheer', 'Don
    data['title'] = data['title'].replace('Mlle', 'Miss')
    data['title'] = data['title'].replace('Ms', 'Miss')
    data['title'] = data['title'].replace('Mme', 'Mrs')
    # Convert titles into numbers
    data['title'] = data['title'].map(titles)
    # Fill NA
    data['title'] = data['title'].fillna(0)
df = df.drop(['name'], axis=1)
```

In [118…

```python
genders = {"male": 0, "female": 1}
for data in [df]:
    data['sex'] = data['sex'].map(genders)
```

In [120…

```python
ports = {"S": 0, "C": 1, "Q": 2}
for data in [df]:
```

```
    data['embarked'] = data['embarked'].map(ports)
```

In [123…

```
for data in [df]:
    data['age'] = data['age'].astype(int)
    data.loc[data['age'] <= 11, 'age'] = 0
    data.loc[(data['age'] > 11) & (data['age'] <= 18), 'age'] = 1
    data.loc[(data['age'] > 18) & (data['age'] <= 22), 'age'] = 2
    data.loc[(data['age'] > 22) & (data['age'] <= 27), 'age'] = 3
    data.loc[(data['age'] > 27) & (data['age'] <= 33), 'age'] = 4
    data.loc[(data['age'] > 33) & (data['age'] <= 40), 'age'] = 5
    data.loc[(data['age'] > 40) & (data['age'] <= 66), 'age'] = 6
    data.loc[(data['age'] > 66)] = 7
```

In [125…

```
for data in [df]:
    data.loc[data['fare'] <= 7.91, 'fare'] = 0
    data.loc[(data['fare'] > 7.91) & (data['fare'] <= 14.454), 'fare'] = 1
    data.loc[(data['fare'] > 14.454) & (data['fare'] <= 31), 'fare'] = 2
    data.loc[(data['fare'] > 31) & (data['fare'] <= 99), 'fare'] = 3
    data.loc[(data['fare'] > 99) & (data['fare'] <= 250), 'fare'] = 4
    data.loc[data['fare'] > 250] = 5
    data['fare'] = data['fare'].astype(int)
```

In [127…

```
for data in [df]:
    data['age_class'] = data['age'] * data['pclass']
```

In [128…

```
for data in [df]:
    data['fare_per_person'] = data['fare'] / (data['relatives'] + 1)
    data['fare_per_person'] = data['fare_per_person'].astype(int)
df.head(10)
```

Out[128...

	pclass	survived	sex	age	sibsp	parch	fare	embarked	relatives	not_alone	deck	title	age_class	fare_per_person
0	1	1	1	4	0	0	4	0	0	1	2	0.0	4	4
1	1	1	0	0	1	2	4	0	3	0	3	0.0	0	1
2	1	0	1	0	1	2	4	0	3	0	3	0.0	0	1
3	1	0	0	4	1	2	4	0	3	0	3	0.0	4	1
4	1	0	1	3	1	2	4	0	3	0	3	0.0	3	1
5	1	1	0	6	0	0	2	0	0	1	5	0.0	6	2
6	1	1	1	6	1	0	3	0	1	0	4	0.0	6	1
7	1	0	0	5	0	0	0	0	0	1	1	0.0	5	0
8	1	1	1	6	2	0	3	0	2	0	3	0.0	6	1
9	7	7	7	7	7	7	0	7	7	7	7	7.0	49	0

In [ ]: