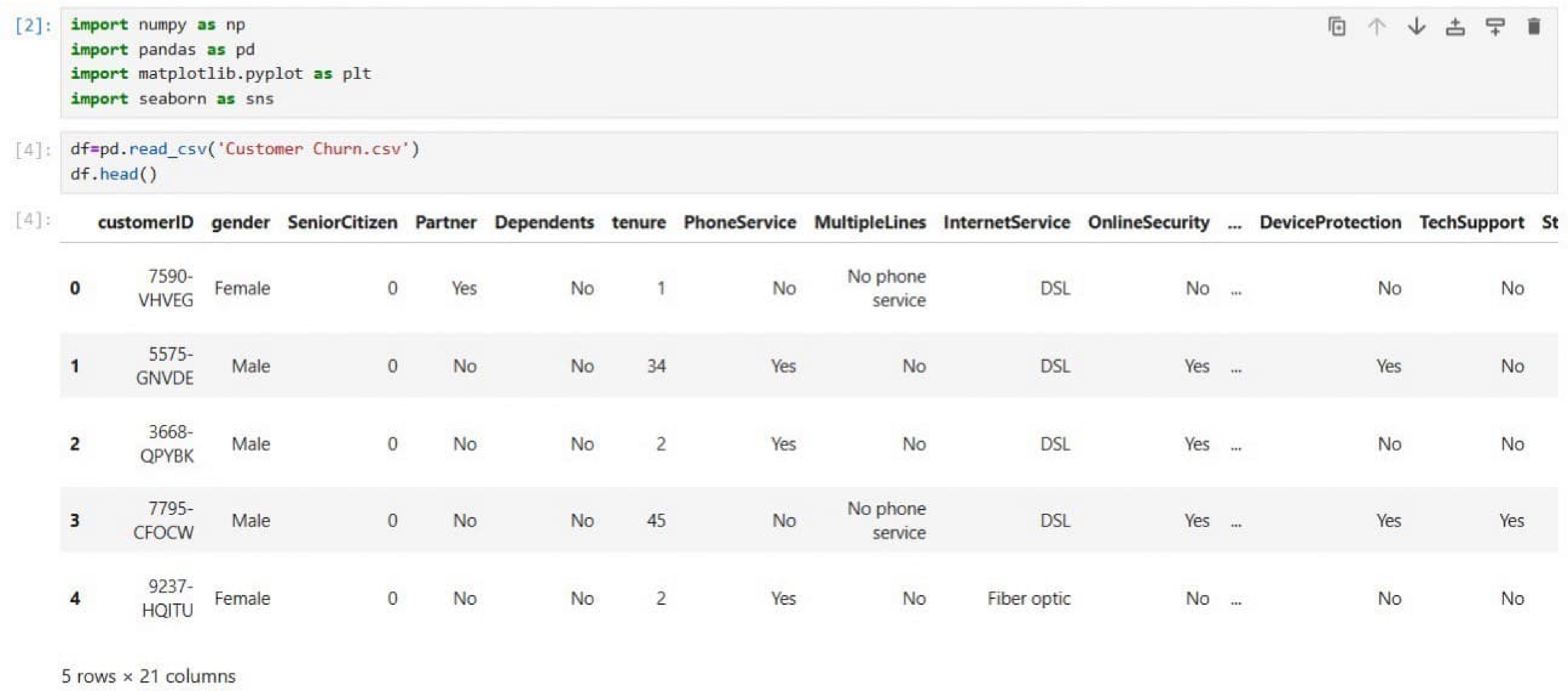


[2]:

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

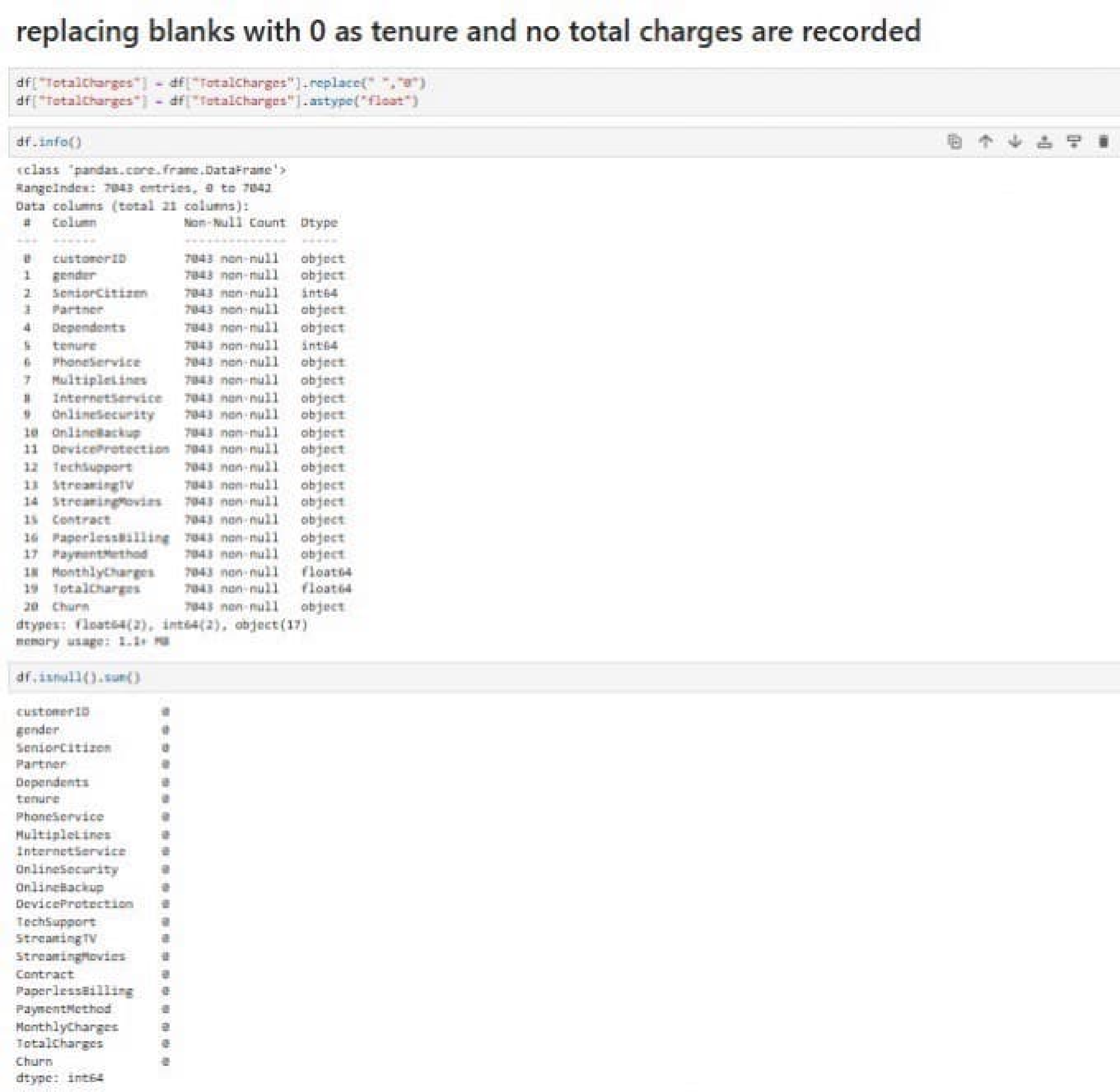
[4]:

```python
df=pd.read_csv('Customer Churn.csv')
df.head()
```

[4]:

	customerID	gender	SeniorCitizen	Partner	Dependents	tenure	PhoneService	MultipleLines	InternetService	OnlineSecurity	...	DeviceProtection	TechSupport	St
0	7590-VHVEG	Female	0	Yes	No	1	No	No phone service	DSL	No	...	No	No	
1	5575-GNVDE	Male	0	No	No	34	Yes	No	DSL	Yes	...	Yes	No	
2	3668-QPYBK	Male	0	No	No	2	Yes	No	DSL	Yes	...	No	No	
3	7795-CFOCW	Male	0	No	No	45	No	No phone service	DSL	Yes	...	Yes	Yes	
4	9237-HQITU	Female	0	No	No	2	Yes	No	Fiber optic	No	...	No	No	

5 rows × 21 columns



replacing blanks with 0 as tenure and no total charges are recorded

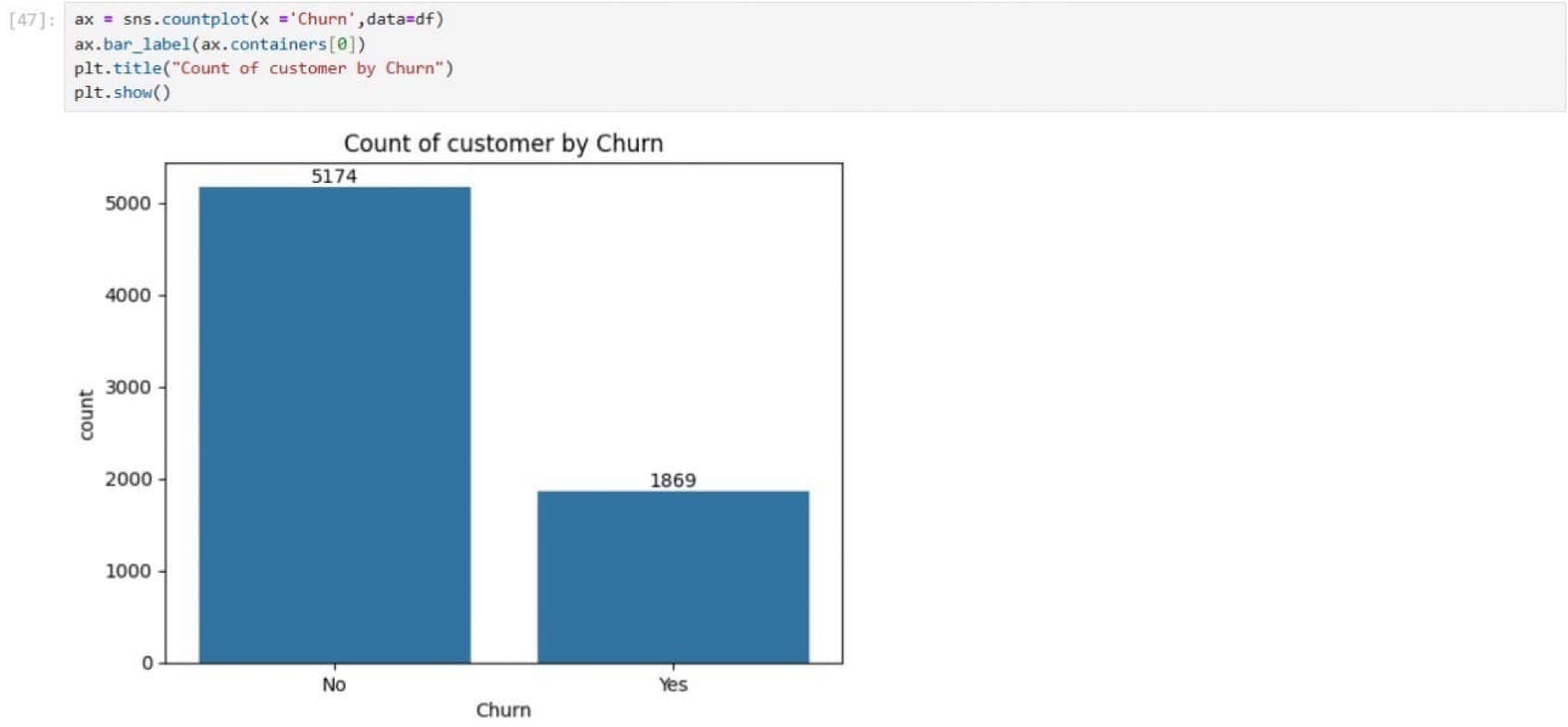
```
df["TotalCharges"] = df["TotalCharges"].replace(" ","0")
df["TotalCharges"] = df["TotalCharges"].astype("float")
```

```
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 7043 entries, 0 to 7042
Data columns (total 21 columns):
 #   Column            Non-Null Count  Dtype  
---  ------            --------------  -----  
 0   customerID        7043 non-null   object 
 1   gender            7043 non-null   object 
 2   SeniorCitizen     7043 non-null   int64  
 3   Partner           7043 non-null   object 
 4   Dependents        7043 non-null   object 
 5   tenure            7043 non-null   int64  
 6   PhoneService      7043 non-null   object 
 7   MultipleLines     7043 non-null   object 
 8   InternetService   7043 non-null   object 
 9   OnlineSecurity    7043 non-null   object 
 10  OnlineBackup      7043 non-null   object 
 11  DeviceProtection  7043 non-null   object 
 12  TechSupport       7043 non-null   object 
 13  StreamingTV       7043 non-null   object 
 14  StreamingMovies   7043 non-null   object 
 15  Contract          7043 non-null   object 
 16  PaperlessBilling  7043 non-null   object 
 17  PaymentMethod     7043 non-null   object 
 18  MonthlyCharges    7043 non-null   float64
 19  TotalCharges      7043 non-null   float64
 20  Churn             7043 non-null   object 
dtypes: float64(2), int64(2), object(17)
memory usage: 1.1+ MB
```

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

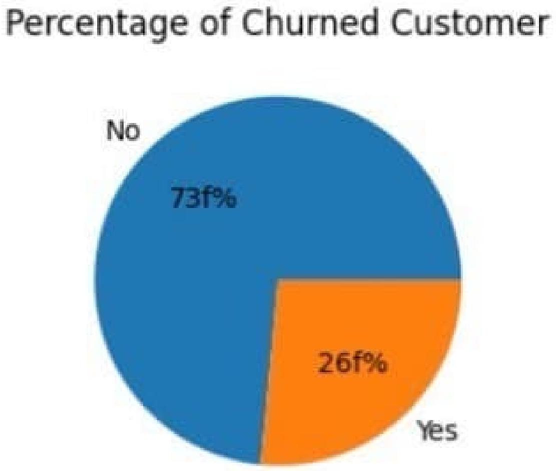
```
customerID          0
gender              0
SeniorCitizen       0
Partner             0
Dependents          0
tenure              0
PhoneService        0
MultipleLines       0
InternetService     0
OnlineSecurity      0
OnlineBackup        0
DeviceProtection    0
TechSupport         0
StreamingTV         0
StreamingMovies     0
Contract            0
PaperlessBilling    0
PaymentMethod       0
MonthlyCharges      0
TotalCharges        0
Churn               0
dtype: int64
```



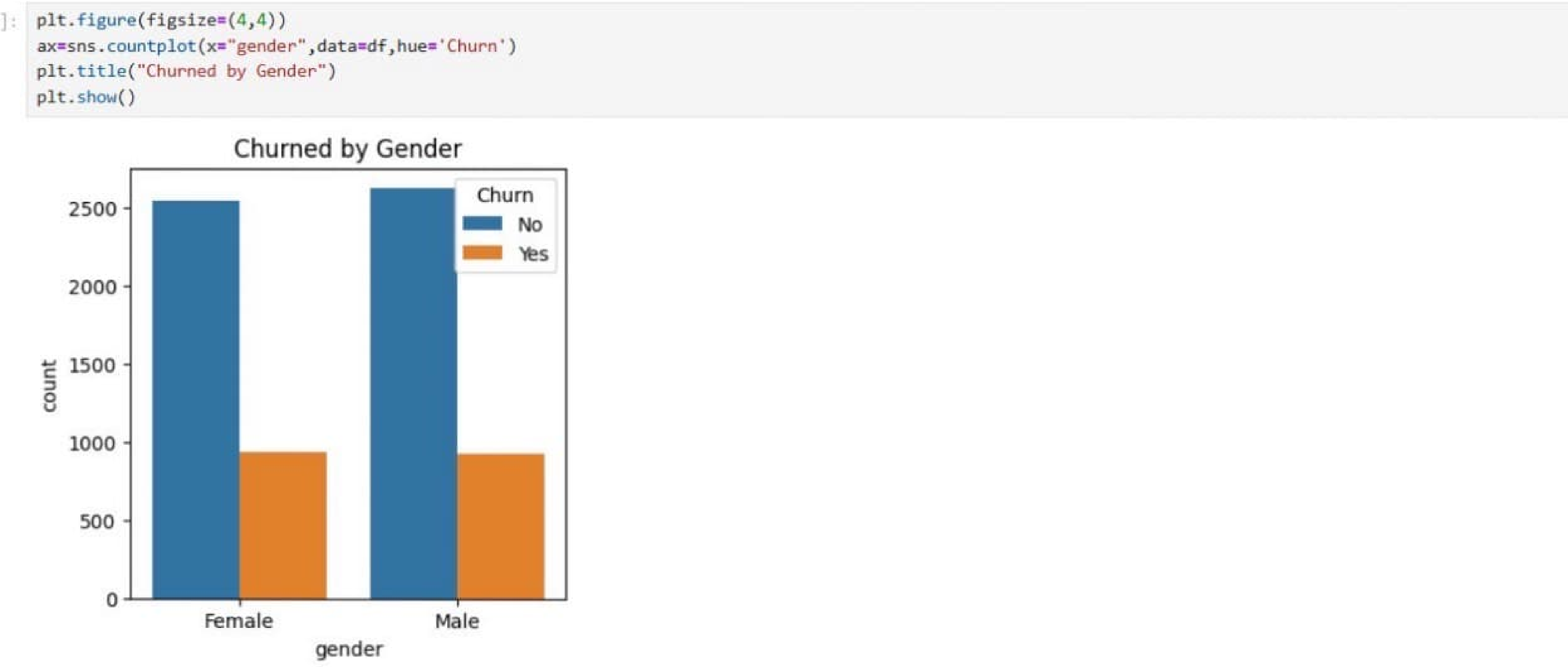
[47]:

```
ax = sns.countplot(x ='Churn',data=df)
ax.bar_label(ax.containers[0])
plt.title("Count of customer by Churn")
plt.show()
```

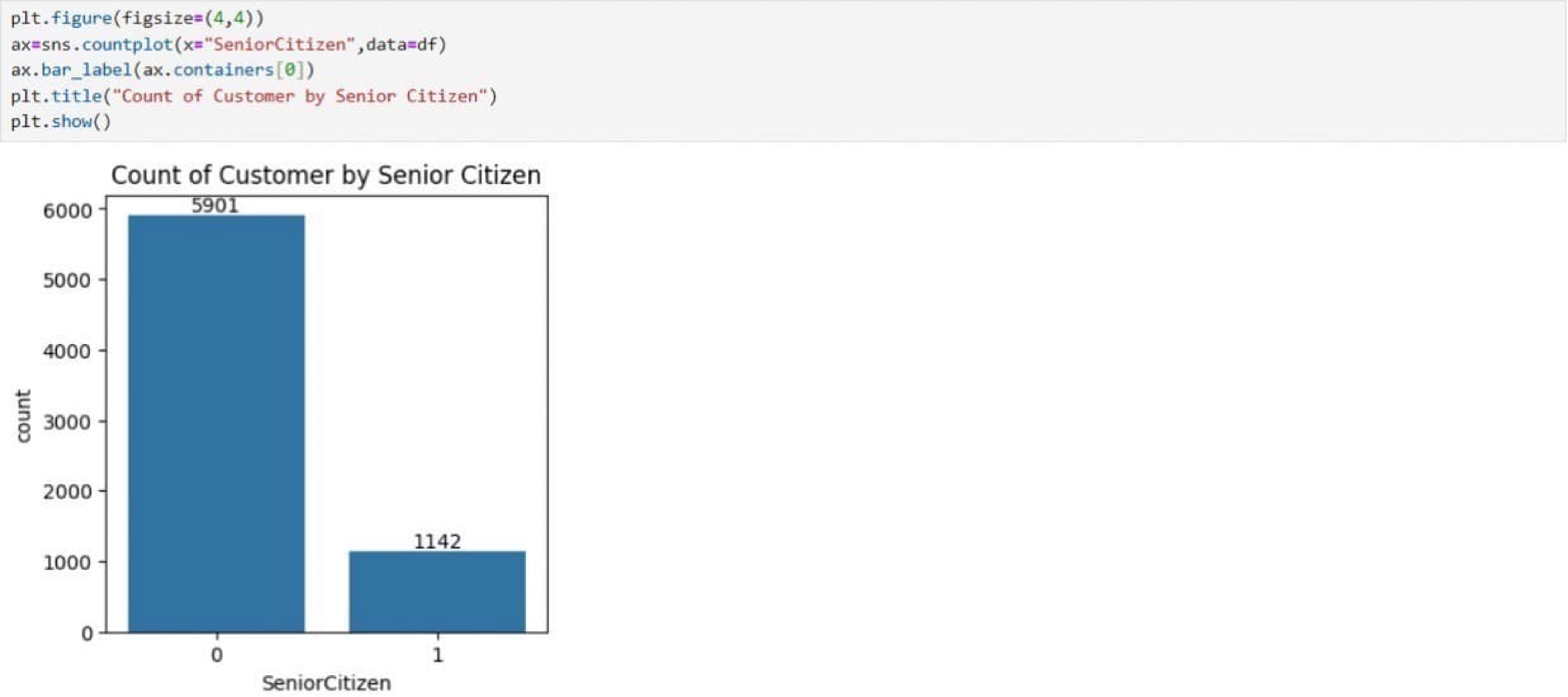
```
50]: plt.figure(figsize=(3,4))
     gb = df.groupby("Churn").agg({'Churn':"count"})
     plt.pie(gb['Churn'],labels=gb.index,autopct= "%1.2sf%%")
     plt.title("Percentage of Churned Customer")
     plt.show()
```



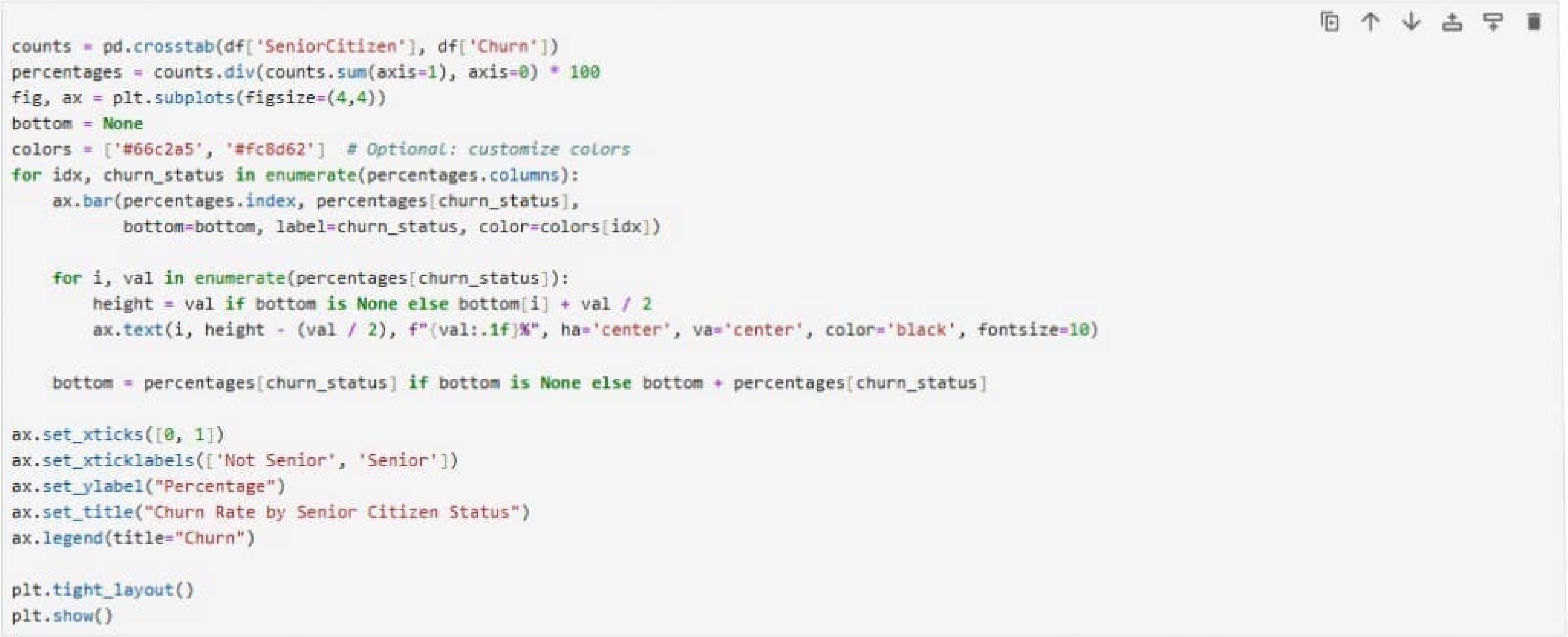
```
[ ]: # From the given pie chart we can caonclude that 26.54% of our customers have churned out.  # now let's explore the reason behind it
```



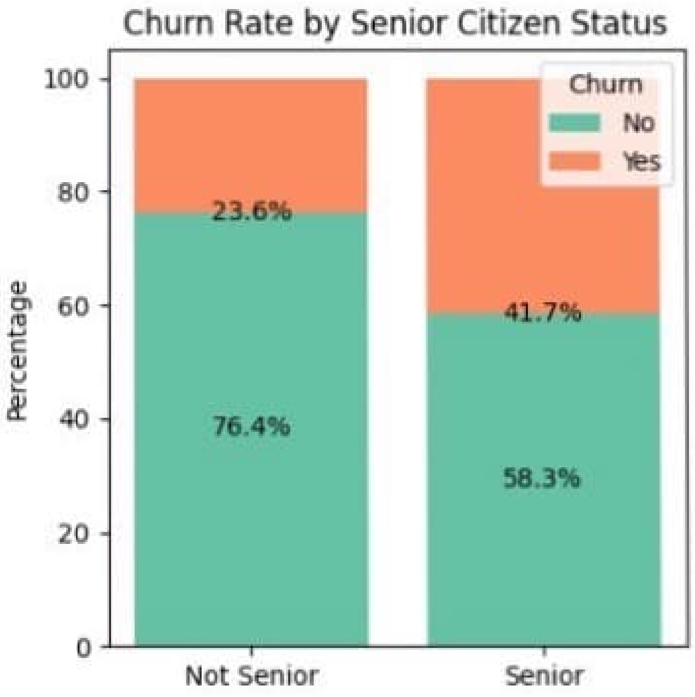
```
plt.figure(figsize=(4,4))
ax=sns.countplot(x="gender",data=df,hue='Churn')
plt.title("Churned by Gender")
plt.show()
```



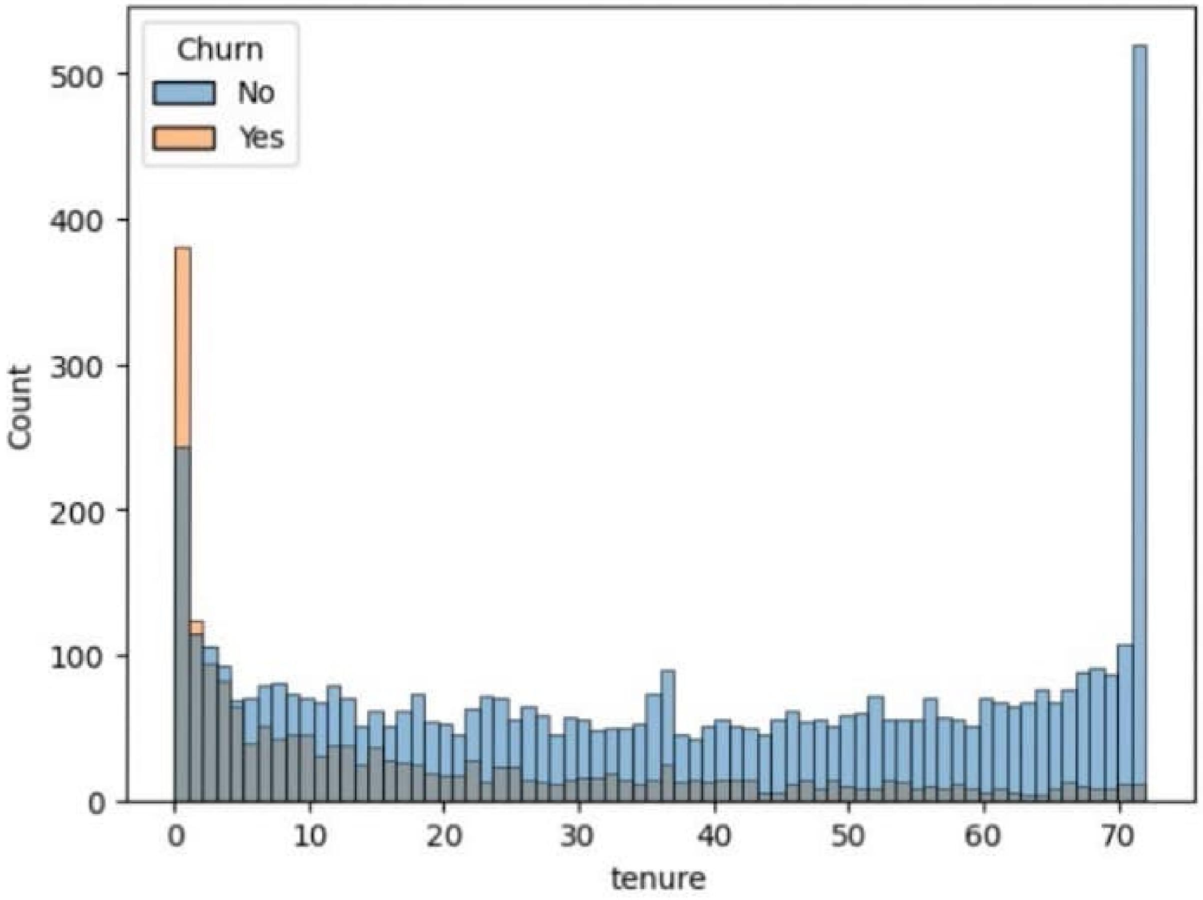
```
plt.figure(figsize=(4,4))
ax=sns.countplot(x="SeniorCitizen",data=df)
ax.bar_label(ax.containers[0])
plt.title("Count of Customer by Senior Citizen")
plt.show()
```

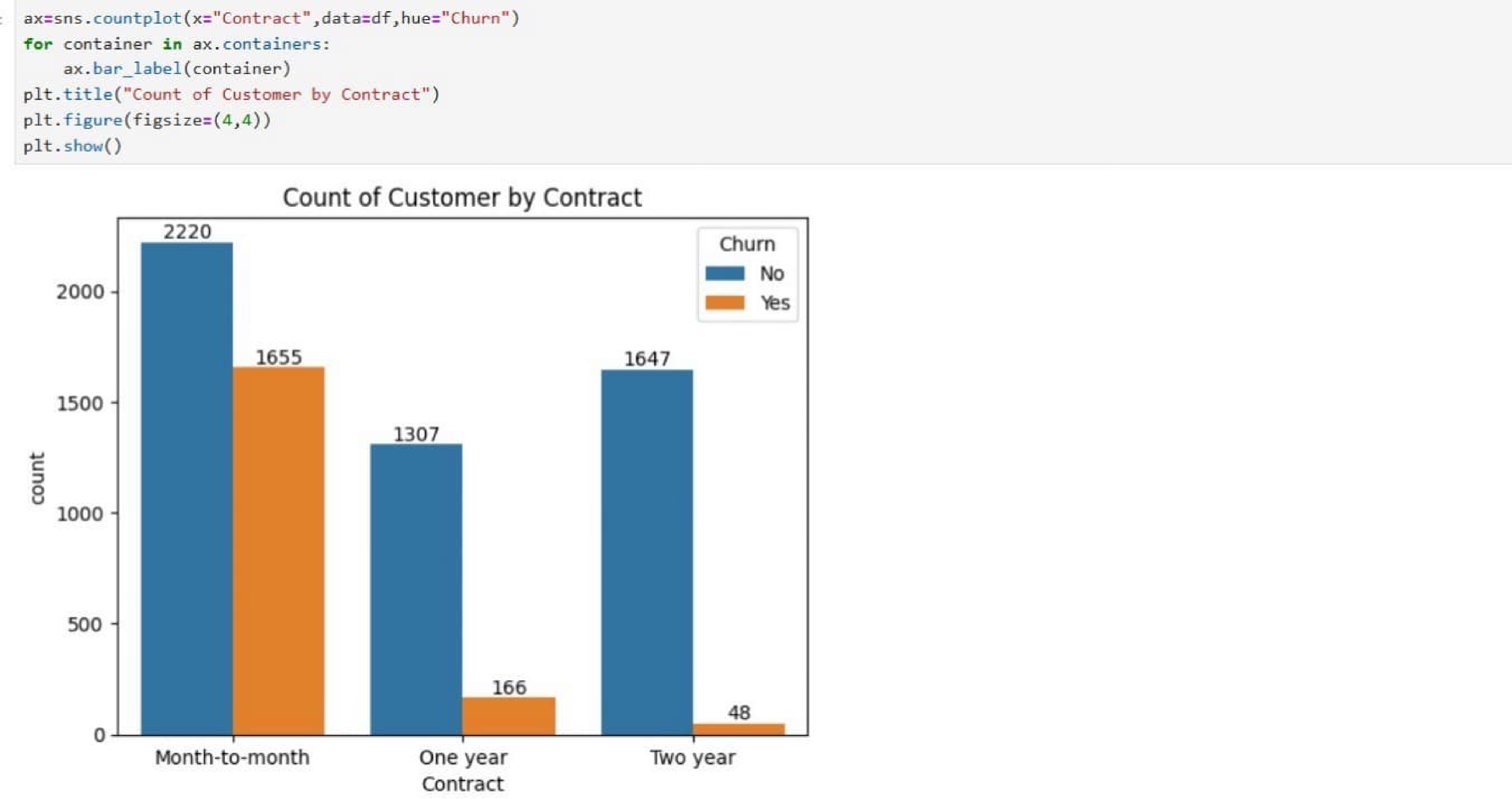


```python
counts = pd.crosstab(df['SeniorCitizen'], df['Churn'])
percentages = counts.div(counts.sum(axis=1), axis=0) * 100
fig, ax = plt.subplots(figsize=(4,4))
bottom = None
colors = ['#66c2a5', '#fc8d62']  # Optional: customize colors
for idx, churn_status in enumerate(percentages.columns):
    ax.bar(percentages.index, percentages[churn_status],
           bottom=bottom, label=churn_status, color=colors[idx])

    for i, val in enumerate(percentages[churn_status]):
        height = val if bottom is None else bottom[i] + val / 2
        ax.text(i, height - (val / 2), f"{val:.1f}%", ha='center', va='center', color='black', fontsize=10)

    bottom = percentages[churn_status] if bottom is None else bottom + percentages[churn_status]

ax.set_xticks([0, 1])
ax.set_xticklabels(['Not Senior', 'Senior'])
ax.set_ylabel("Percentage")
ax.set_title("Churn Rate by Senior Citizen Status")
ax.legend(title="Churn")

plt.tight_layout()
plt.show()
```

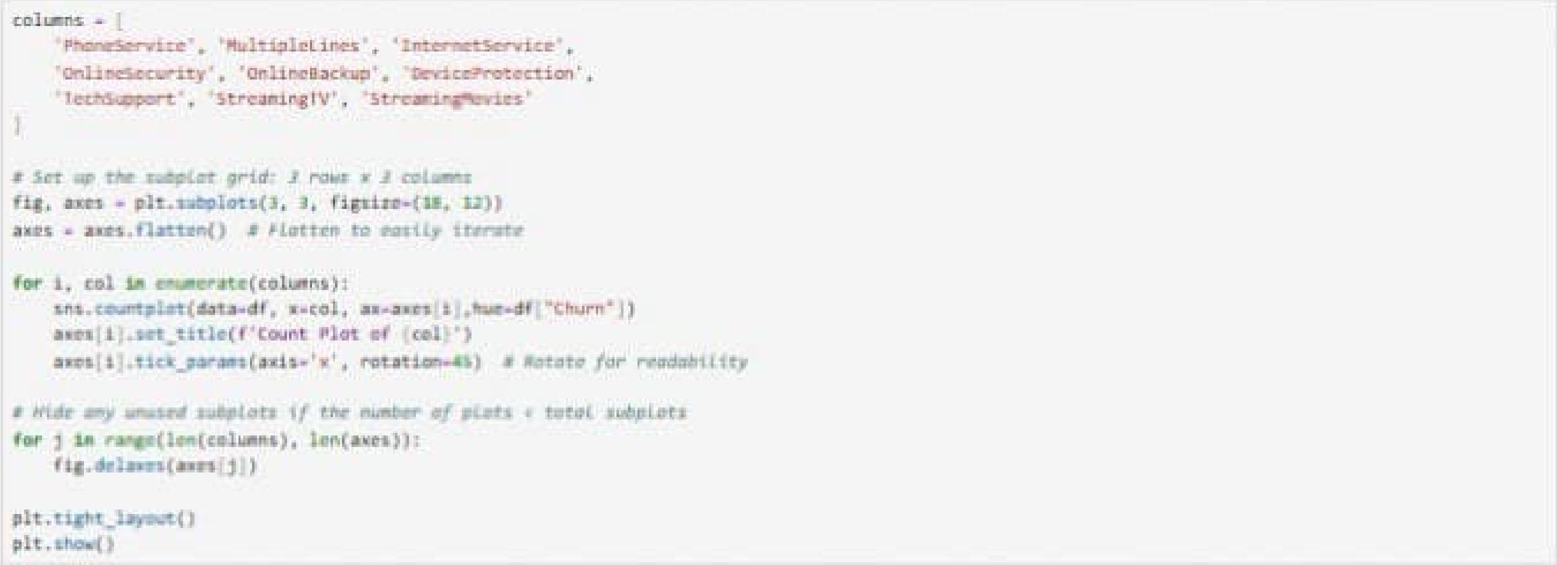


```
sns.histplot(x="tenure",data =df,bins=70,hue="Churn")
plt.figure(figsize=(9,4))
plt.show()
```

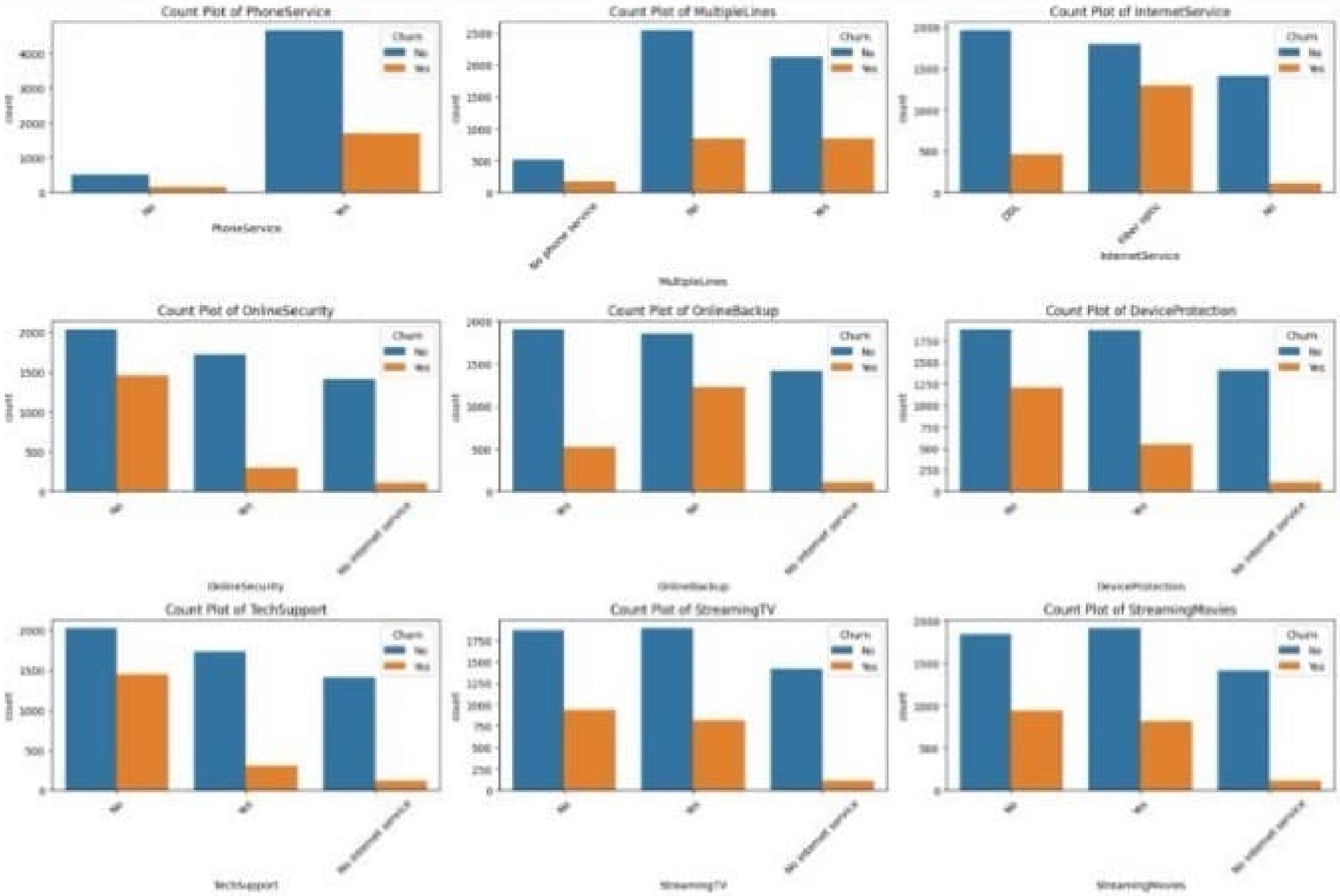


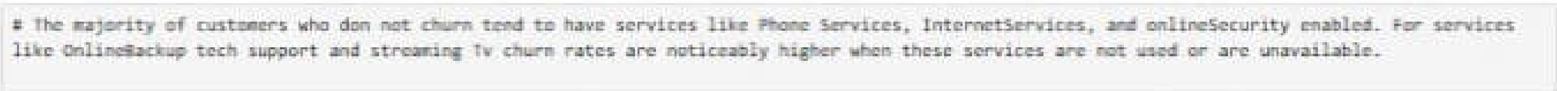


```
ax=sns.countplot(x="Contract",data=df,hue="Churn")
for container in ax.containers:
    ax.bar_label(container)
plt.title("Count of Customer by Contract")
plt.figure(figsize=(4,4))
plt.show()
```



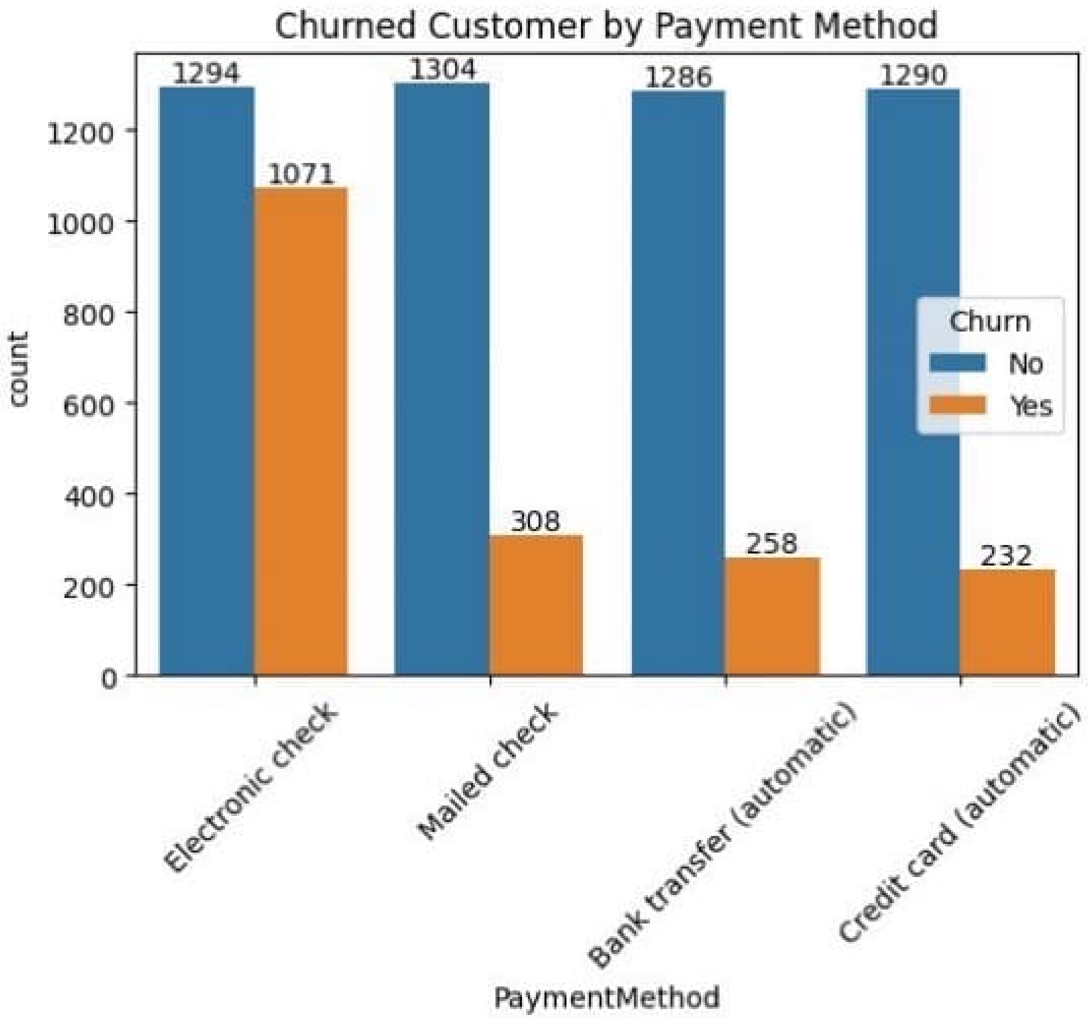
```
columns = [
    'PhoneService', 'MultipleLines', 'InternetService',
    'OnlineSecurity', 'OnlineBackup', 'DeviceProtection',
    'TechSupport', 'StreamingTV', 'StreamingMovies'
]

# Set up the subplot grid: 3 rows x 3 columns
fig, axes = plt.subplots(3, 3, figsize=(18, 12))
axes = axes.flatten()  # Flatten to easily iterate

for i, col in enumerate(columns):
    sns.countplot(data=df, x=col, ax=axes[i],hue=df["Churn"])
    axes[i].set_title(f'Count Plot of {col}')
    axes[i].tick_params(axis='x', rotation=45)  # Rotate for readability

# Hide any unused subplots if the number of plots < total subplots
for j in range(len(columns), len(axes)):
    fig.delaxes(axes[j])

plt.tight_layout()
plt.show()
```





```
# The majority of customers who don not churn tend to have services like Phone Services, InternetServices, and onlineSecurity enabled. For services
like OnlineBackup tech support and streaming Tv churn rates are noticeably higher when these services are not used or are unavailable.
```

```
plt.figure(figsize=(6,4))
ax=sns.countplot(x="PaymentMethod", data=df,hue="Churn")
ax.bar_label(ax.containers[0])
ax.bar_label(ax.containers[1])
plt.title("Churned Customer by Payment Method")
plt.xticks(rotation= 45)
plt.show()
```



```
# customer is likely tp churn when he is using electrnoic check as a payment method.
```