In [1]:
```
import pandas as pd
import matplotlib.pyplot as plt
import numpy as np
import seaborn as sns
```

In [3]:
```
df = pd.read_csv("Customer Churn.csv")
```

In [5]:
```
df.head()
```

Out[5]:

	customerID	gender	SeniorCitizen	Partner	Dependents	tenure	PhoneServ
0	7590-VHVEG	Female	0	Yes	No	1	
1	5575-GNVDE	Male	0	No	No	34	
2	3668-QPYBK	Male	0	No	No	2	
3	7795-CFOCW	Male	0	No	No	45	
4	9237-HQITU	Female	0	No	No	2	

5 rows × 21 columns

In [7]:
```
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   object 
 20  Churn             7043 non-null   object 
dtypes: float64(1), int64(2), object(18)
memory usage: 1.1+ MB
```

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

In [10]:
```
df["TotalCharges"] = df["TotalCharges"].replace(" ","0")
df['TotalCharges']= df['TotalCharges'].astype("float")
```

In [12]:
```
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
```

In [18]:
```
df.isnull().sum().sum()
```

Out[18]:
```
0
```

In [20]:
```
df.describe()
```

Out[20]:

	SeniorCitizen	tenure	MonthlyCharges	TotalCharges
count	7043.000000	7043.000000	7043.000000	7043.000000
mean	0.162147	32.371149	64.761692	2279.734304
std	0.368612	24.559481	30.090047	2266.794470
min	0.000000	0.000000	18.250000	0.000000
25%	0.000000	9.000000	35.500000	398.550000
50%	0.000000	29.000000	70.350000	1394.550000
75%	0.000000	55.000000	89.850000	3786.600000
max	1.000000	72.000000	118.750000	8684.800000

Converting seniorcitizen value 0-1 to yes or no.

In [40]:
```
def conv(value):
    if value == 1:
        return"yes"
    else:
        return"no"

df['SeniorCitizen'] = df['SeniorCitizen'].apply(conv)
```

In [26]:
```
df.duplicated().sum()
```

Out[26]:
```
0
```

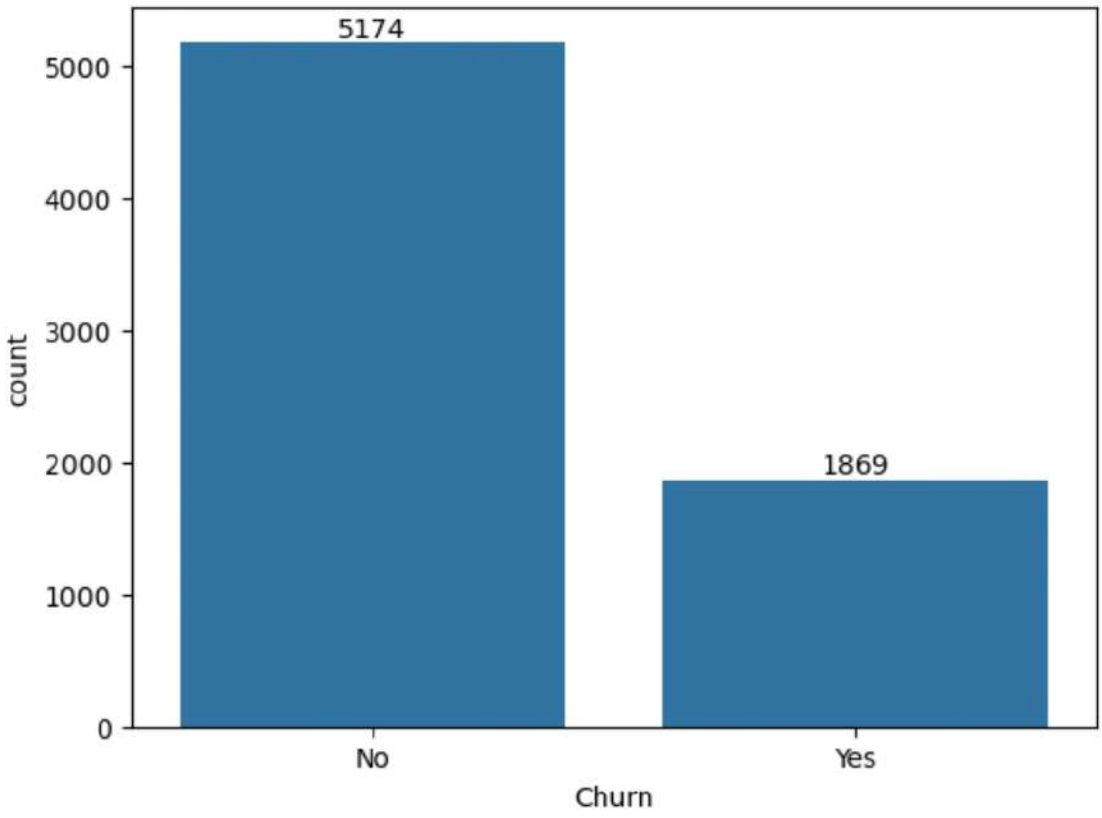
In [42]:
```
df.head()
```

Out[42]:

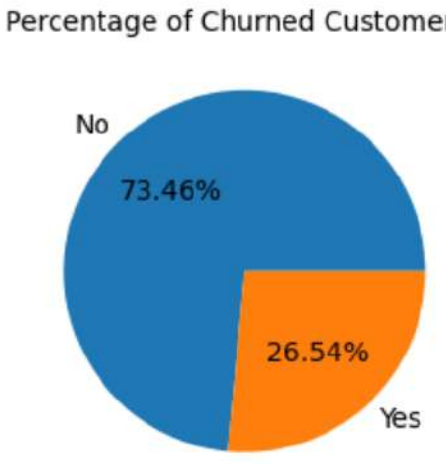
	customerID	gender	SeniorCitizen	Partner	Dependents	tenure	PhoneServ
0	7590-VHVEG	Female	no	Yes	No	1	
1	5575-GNVDE	Male	no	No	No	34	
2	3668-QPYBK	Male	no	No	No	2	
3	7795-CFOCW	Male	no	No	No	45	
4	9237-HQITU	Female	no	No	No	2	

5 rows × 21 columns

In [49]:
```
ax = sns.countplot(data = df, x = 'Churn')
ax.bar_label(ax.containers[0])
plt.show()
```



In [51]:
```
plt.figure(figsize = (3,4))
gb = df.groupby("Churn").agg({'Churn':"count"})
plt.pie(gb['Churn'], labels = gb.index, autopct = "%1.2f%%")
plt.title("Percentage of Churned Customeres", fontsize = 10)
plt.show()
```



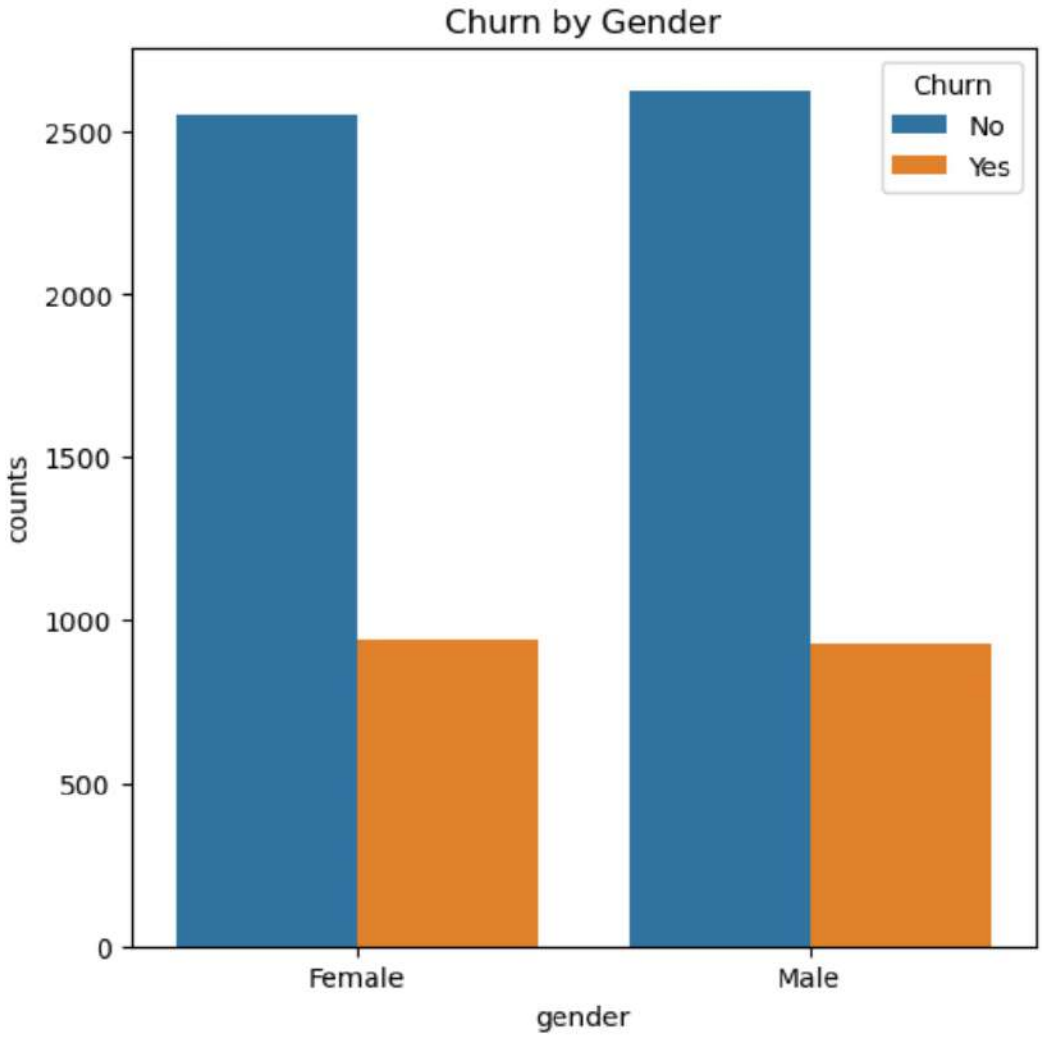
from the given pie chart we can conclude that 26.54% of our customers have churned out.

In [58]:
```
# Churn by Gender
Churn_by_gender= df.groupby('gender')['Churn'].count().reset_index()
Churn_by_gender
```

Out[58]:

	gender	Churn
0	Female	3488
1	Male	3555

In [66]:
```
plt.figure(figsize=(6,6))
sns.countplot(data = df, x = 'gender', hue ='Churn')
plt.xlabel('gender')
plt.ylabel('counts')
plt.title("Churn by Gender")
plt.show()
```



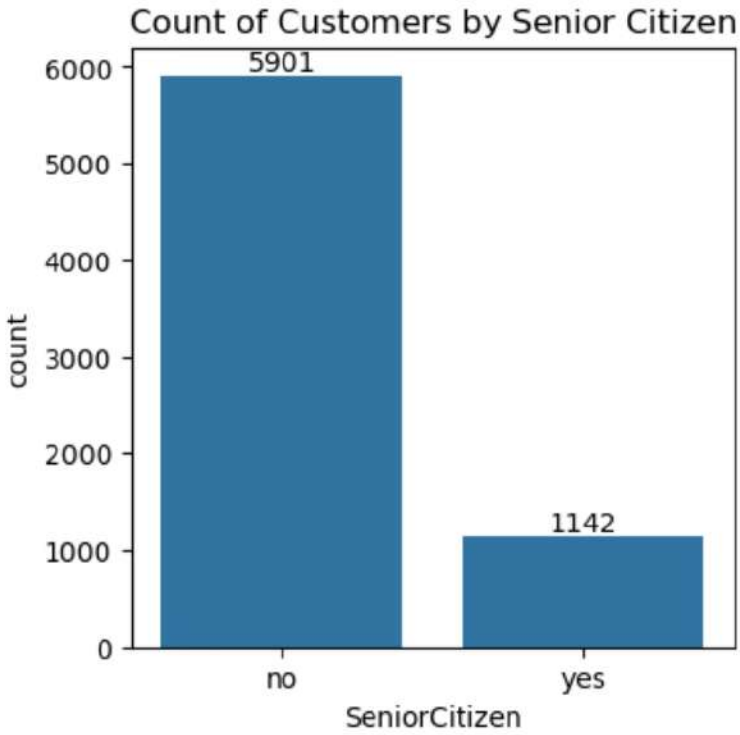
Churn by SeniorCitizen

In [71]:
```
Churn_by_SeniorCitizen= df.groupby('SeniorCitizen')['Churn'].count().reset_inc
Churn_by_SeniorCitizen
```

Out[71]:

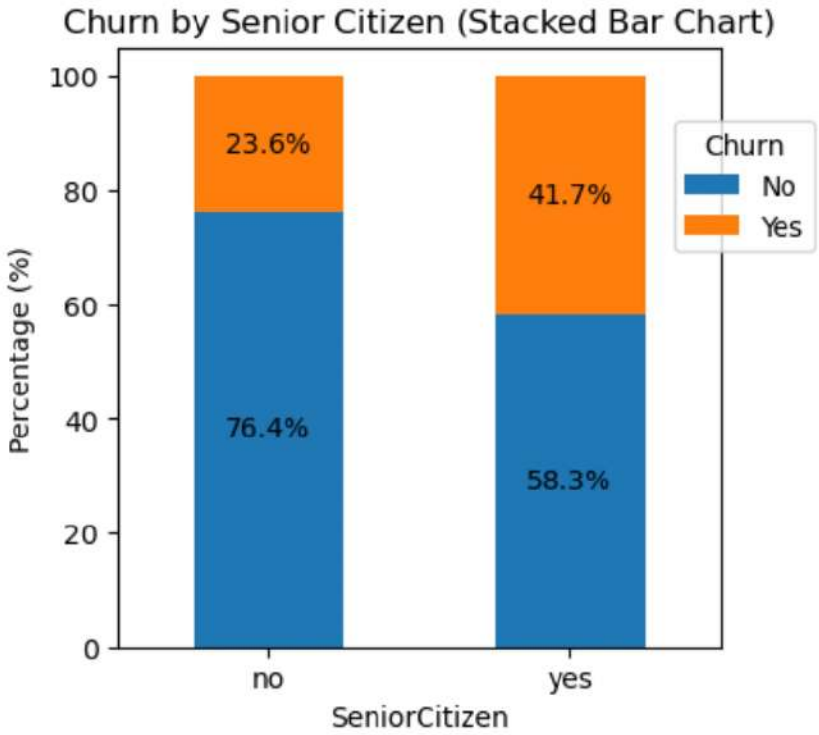
	SeniorCitizen	Churn
0	no	5901
1	yes	1142

In [75]:
```
plt.figure(figsize=(4,4))
ax= sns.countplot(data = df , x = 'SeniorCitizen')
ax.bar_label(ax.containers[0])
plt.title("Count of Customers by Senior Citizen")
plt.show()
```



In [77]:

```
total_counts = df.groupby('SeniorCitizen')['Churn'].value_counts(normalize=Tru

# Plot
fig, ax = plt.subplots(figsize=(4, 4))  # Adjust figsize for better visualizat

# Plot the bars
total_counts.plot(kind='bar', stacked=True, ax=ax, color=['#1f77b4', '#ff7f0e'

# Add percentage labels on the bars
for p in ax.patches:
    width, height = p.get_width(), p.get_height()
    x, y = p.get_xy()
    ax.text(x + width / 2, y + height / 2, f'{height:.1f}%', ha='center', va='

plt.title('Churn by Senior Citizen (Stacked Bar Chart)')
plt.xlabel('SeniorCitizen')
plt.ylabel('Percentage (%)')
plt.xticks(rotation=0)
plt.legend(title='Churn', bbox_to_anchor = (0.9,0.9))  # Customize legend loca

plt.show()
```



comparative a greater pecentage of people in senior citizen category have churned

Churn by Tenure

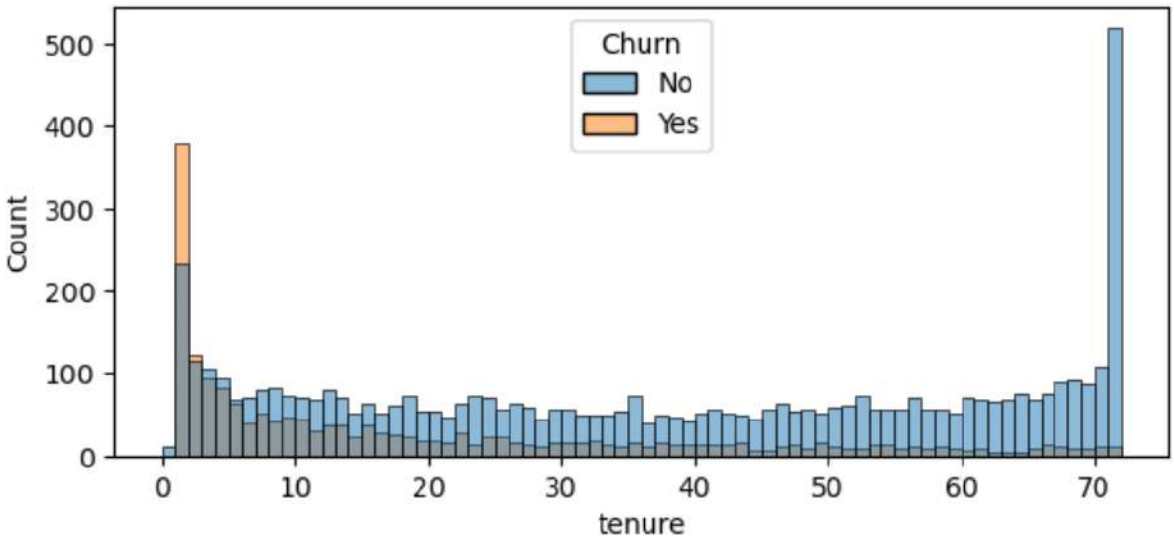
In [87]:
```
Churn_by_Tenure= df.groupby('tenure')['Churn'].count().reset_index()
Churn_by_Tenure
```

Out[87]:

	tenure	Churn
0	0	11
1	1	613
2	2	238
3	3	200
4	4	176
...	...	...
68	68	100
69	69	95
70	70	119
71	71	170
72	72	362

73 rows × 2 columns

In [91]:
```
plt.figure(figsize=(7,3))
sns.histplot(x = "tenure", data = df, bins = 72, hue = "Churn")
plt.show()
```



people who have used our services for a long time have stayed and people who have used our sevices 1 or 2 months have churned

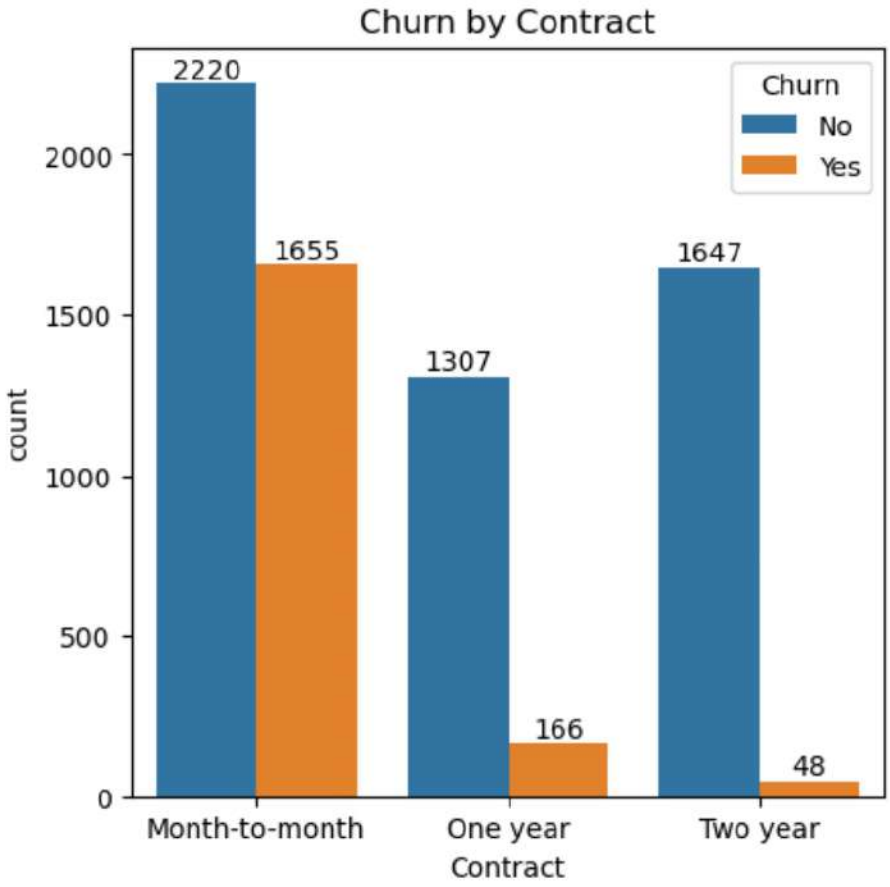
Churn by Contract

In [97]:
```
Churn_by_Contract= df.groupby('Contract')['Churn'].count().reset_index()
Churn_by_Contract
```

Out[97]:

	Contract	Churn
0	Month-to-month	3875
1	One year	1473
2	Two year	1695

In [144…
```
plt.figure(figsize=(5,5))
ax= sns.countplot(x = "Contract", data = df,hue = "Churn")
ax.bar_label(ax.containers[0])
ax.bar_label(ax.containers[1])
plt.title("Churn by Contract")
plt.show()
```



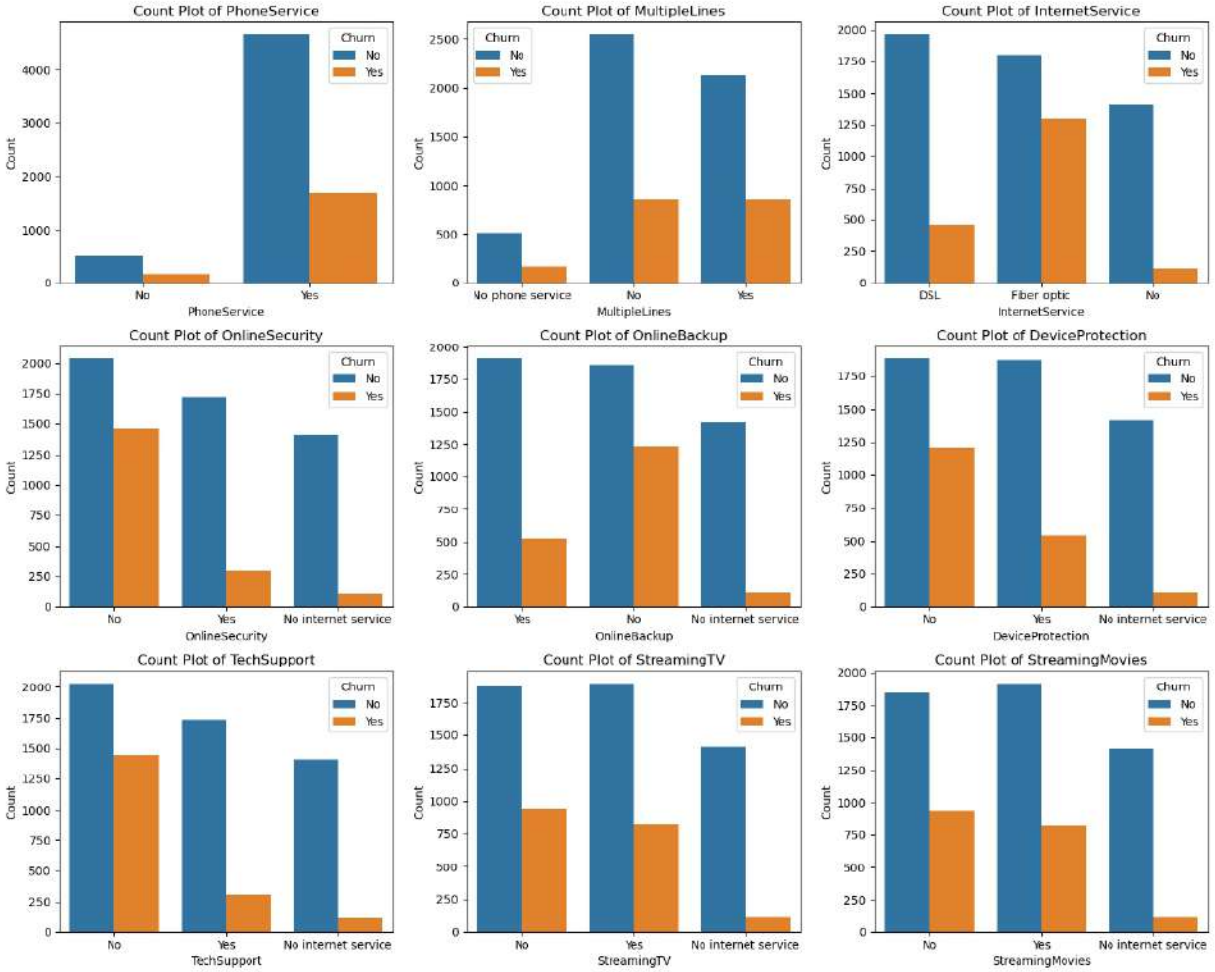
people who have month to month contract are likely to churn then from those who have 1 or 2 years or contract.

In [115…
```
df.columns.values
```

Out[115…
```
array(['customerID', 'gender', 'SeniorCitizen', 'Partner', 'Dependents',
       'tenure', 'PhoneService', 'MultipleLines', 'InternetService',
       'OnlineSecurity', 'OnlineBackup', 'DeviceProtection',
       'TechSupport', 'StreamingTV', 'StreamingMovies', 'Contract',
       'PaperlessBilling', 'PaymentMethod', 'MonthlyCharges',
       'TotalCharges', 'Churn'], dtype=object)
```

In [117…
```
columns = ['PhoneService', 'MultipleLines', 'InternetService', 'OnlineSecurity
           'OnlineBackup', 'DeviceProtection', 'TechSupport', 'StreamingTV', '

# Number of columns for the subplot grid (you can change this)
n_cols = 3
n_rows = (len(columns) + n_cols - 1) // n_cols  # Calculate number of rows nee
```

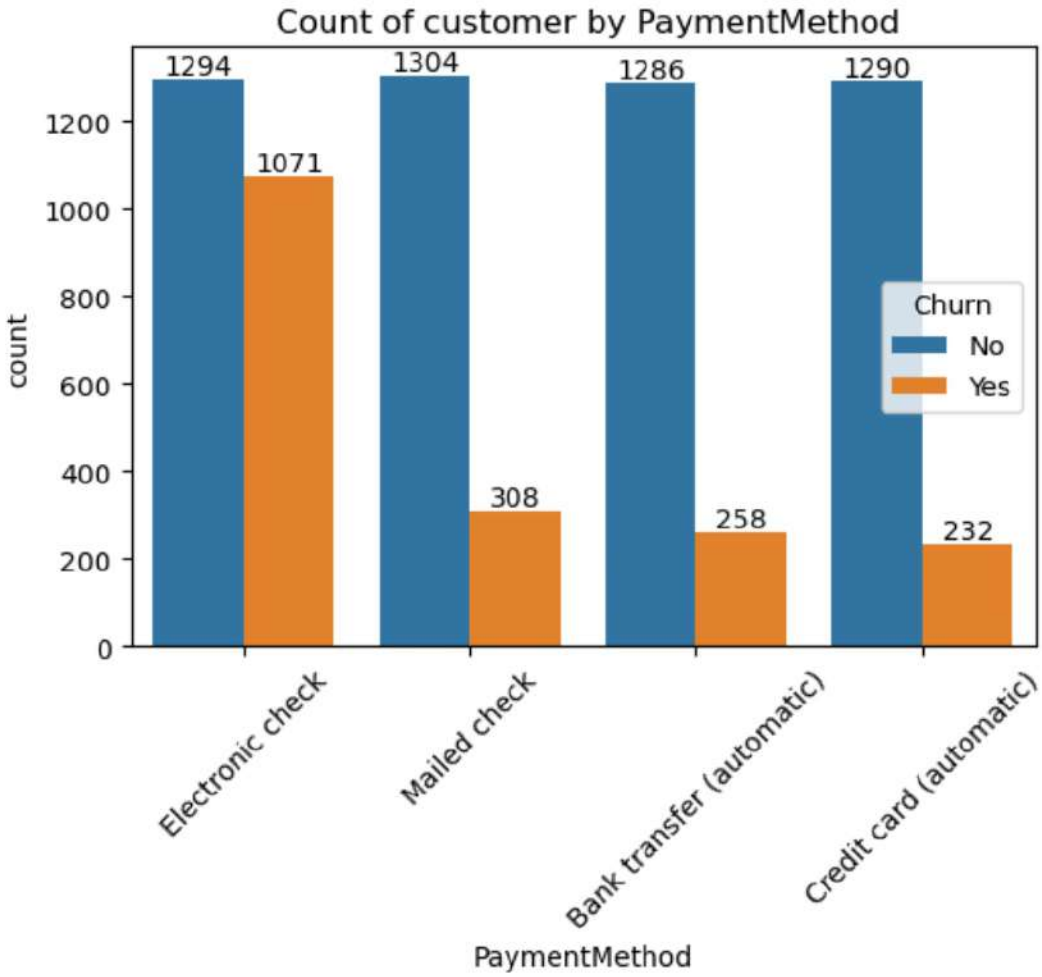
```python
# Create subplots
fig, axes = plt.subplots(n_rows, n_cols, figsize=(15, n_rows * 4))  # Adjust f

# Flatten the axes array for easy iteration (handles both 1D and 2D arrays)
axes = axes.flatten()

# Iterate over columns and plot count plots
for i, col in enumerate(columns):
    sns.countplot(x=col, data=df, ax=axes[i], hue = df["Churn"])
    axes[i].set_title(f'Count Plot of {col}')
    axes[i].set_xlabel(col)
    axes[i].set_ylabel('Count')

# Remove empty subplots (if any)
for j in range(i + 1, len(axes)):
    fig.delaxes(axes[j])

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



The majority of customers who do not churn tend to have services like PhoneService, InternetService (particularly DSL), and OnlineSecurity enabled. For services like OnlineBackup, TechSupport, and StreamingTV, churn rates are noticeably higher when these services are not used or are unavailable.

In [ ]:
```
# Payment Method
```

In [142…
```
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(" Count of customer by PaymentMethod")
plt.xticks(rotation = 45)
plt.show()
```



customer is likely to churn when he is using electronic check as a payment method.

In [ ]: