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

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

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

      MultipleLines InternetService OnlineSecurity  ...
DeviceProtection  \
0  No phone service             DSL             No  ...
No
1                No             DSL            Yes  ...
Yes
2                No             DSL            Yes  ...
No
3  No phone service             DSL            Yes  ...
Yes
4                No     Fiber optic             No  ...
No

  TechSupport StreamingTV StreamingMovies        Contract
PaperlessBilling  \
0          No          No              No  Month-to-month
Yes
1          No          No              No        One year
No
2          No          No              No  Month-to-month
Yes
3         Yes          No              No        One year
No
4          No          No              No  Month-to-month
Yes

               PaymentMethod MonthlyCharges  TotalCharges Churn
0           Electronic check          29.85         29.85    No
1               Mailed check          56.95        1889.5    No
```

```
2               Mailed check          53.85        108.15   Yes
3  Bank transfer (automatic)          42.30       1840.75    No
4           Electronic check          70.70        151.65   Yes

[5 rows x 21 columns]
```

```
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

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

Lets check again the datatype of the total charges.

```
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
```

Check for null values in the datframe.

```
df.isnull()
```

```
      customerID  gender  SeniorCitizen  Partner  Dependents  tenure  \
0          False   False          False    False       False   False   

1          False   False          False    False       False   False   

2          False   False          False    False       False   False   

3          False   False          False    False       False   False   

4          False   False          False    False       False   False   

...          ...     ...            ...      ...         ...     ...   

7038       False   False          False    False       False   False   

7039       False   False          False    False       False   False   

7040       False   False          False    False       False   False   
```

```
7041       False   False          False    False       False   False

7042       False   False          False    False       False   False


      PhoneService  MultipleLines  InternetService
OnlineSecurity  ...  \
0            False          False            False
False  ...
1            False          False            False
False  ...
2            False          False            False
False  ...
3            False          False            False
False  ...
4            False          False            False
False  ...
...            ...            ...              ...              ...  ..
.
7038         False          False            False
False  ...
7039         False          False            False
False  ...
7040         False          False            False
False  ...
7041         False          False            False
False  ...
7042         False          False            False
False  ...

      DeviceProtection  TechSupport  StreamingTV  StreamingMovies
Contract  \
0                False        False        False            False
False
1                False        False        False            False
False
2                False        False        False            False
False
3                False        False        False            False
False
4                False        False        False            False
False
...                ...          ...          ...              ...
...
7038             False        False        False            False
False
7039             False        False        False            False
False
7040             False        False        False            False
False
```

```
7041              False        False        False             False
False
7042              False        False        False             False
False

      PaperlessBilling  PaymentMethod  MonthlyCharges  TotalCharges
Churn
0                 False          False           False         False
False
1                 False          False           False         False
False
2                 False          False           False         False
False
3                 False          False           False         False
False
4                 False          False           False         False
False
...                 ...            ...             ...           ...
...
7038              False          False           False         False
False
7039              False          False           False         False
False
7040              False          False           False         False
False
7041              False          False           False         False
False
7042              False          False           False         False
False

[7043 rows x 21 columns]
```

Sum the null values of each columns

```
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
```

Further, by adding .sum() in the end, it will provide overall sum of the null values in the dataframe.

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

```
np.int64(0)
```

Decribtion of the Dataset.

```
df.describe()
```

	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

Check for Duplicate values in the Dataset. Note: Without using .sum() aggregate function, the return values come in true/false.

```
df.duplicated().sum()
```

```
np.int64(0)
```

Check for duplciate vlaue in the Customer ID column.

```
df["customerID"].duplicated().sum()
```

```
np.int64(0)
```

#Convert 0 and 1 values of senior citizen to yes/no to make it easier to understand

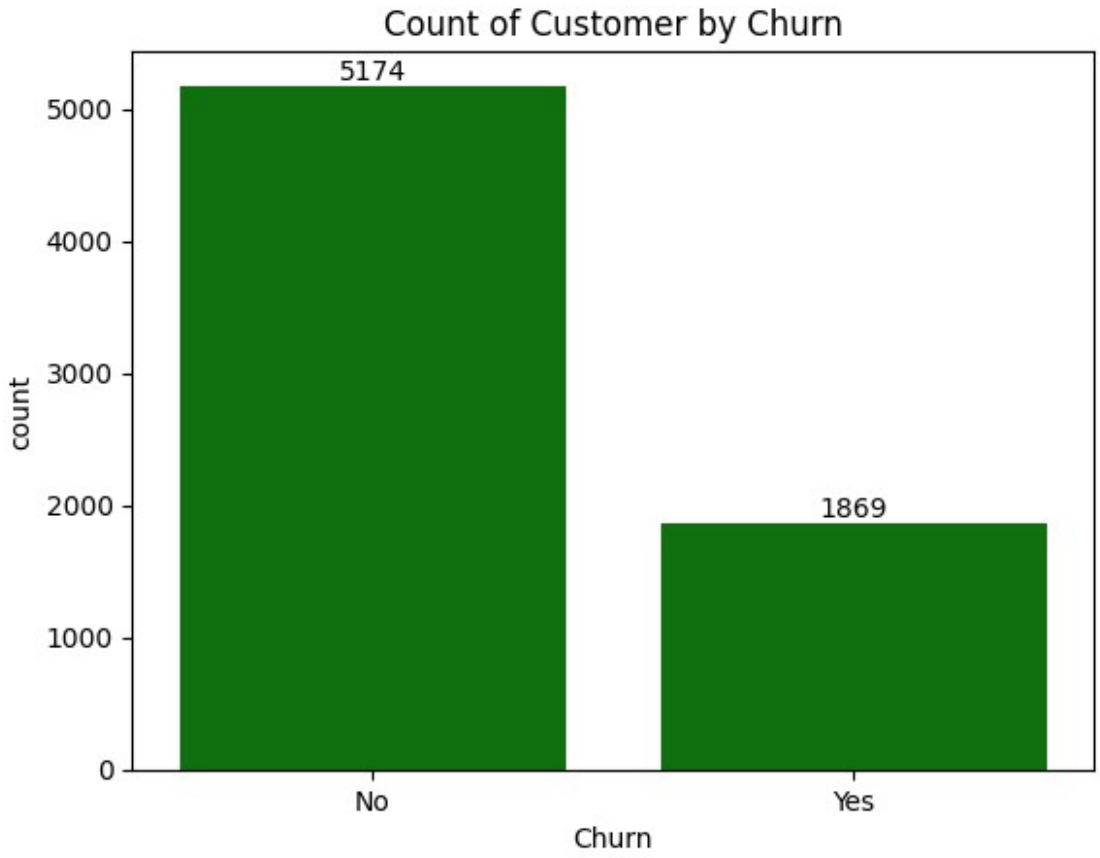
```
def conv(value):
    if value == 1:
```

```
        return "yes"
    else:
        return "no"

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

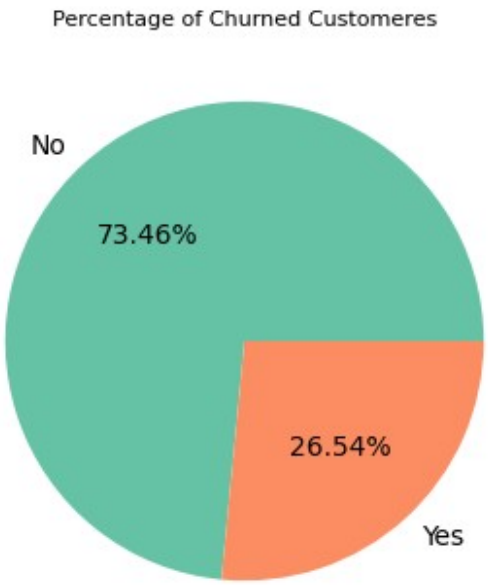
#Now, it value is converted to 0 and 1 values of senior citizen to yes/no.

Now, to determine how many customers are churn or not, we use countplot.

```
a=sns.countplot(x="Churn", data=df,color="green")
a.bar_label(a.containers[0])
plt.title("Count of Customer by Churn")
plt.show()
```



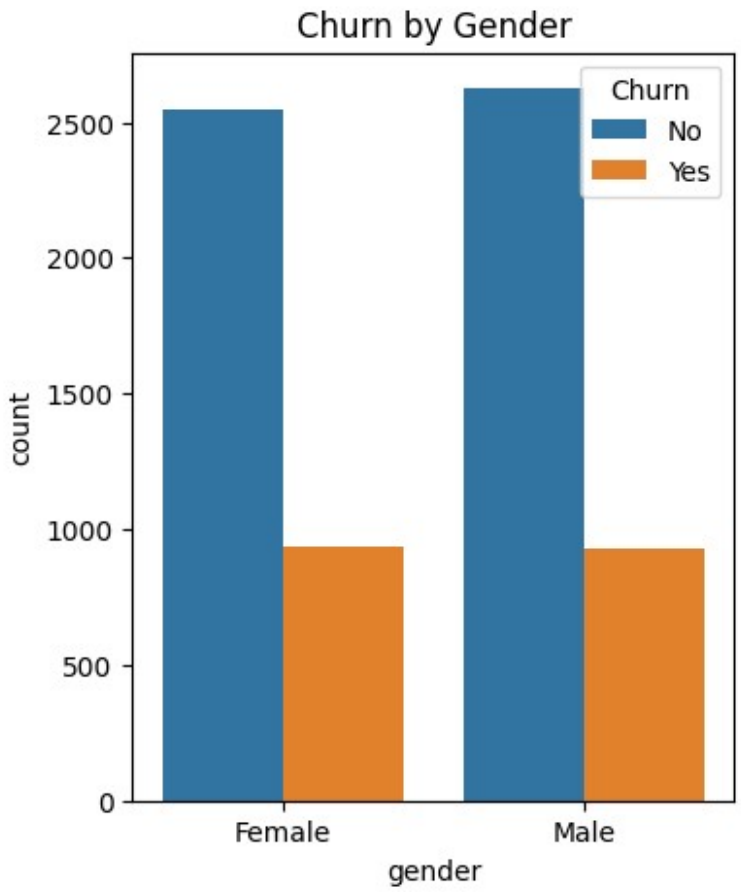

```
gb = df.groupby(by="Churn").agg({"Churn":"count"})
# gb
plt.figure(figsize=(4,4))
colors = sns.color_palette("Set2", n_colors=len(gb))
plt.pie(gb["Churn"],labels=gb.index,autopct="%1.2f%%", colors=colors)
plt.title("Percentage of Churned Customeres", fontsize = 8)
plt.show()
```



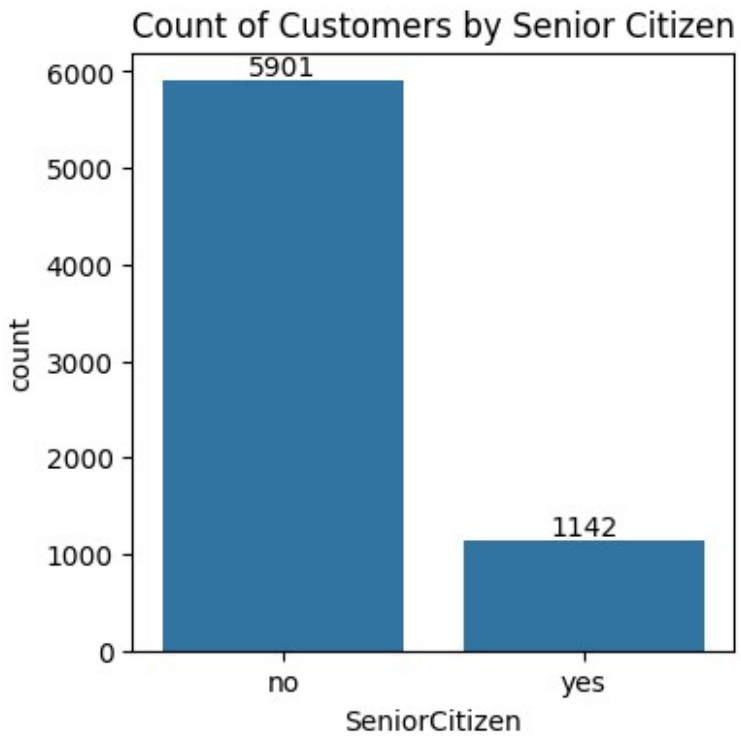
#from the given pie chart we can conclude that 26.54% of our customers have churned out.

#not let's explore the reason behind it

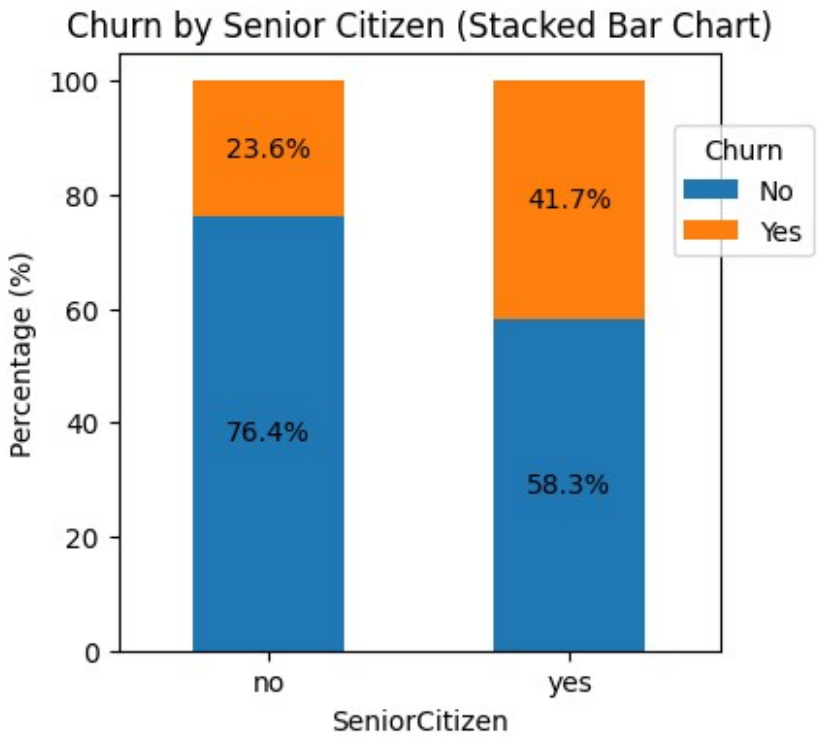
```
plt.figure(figsize = (4,5))
sns.countplot(x = "gender", data = df, hue = "Churn")
plt.title("Churn by Gender")
plt.show()
```




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

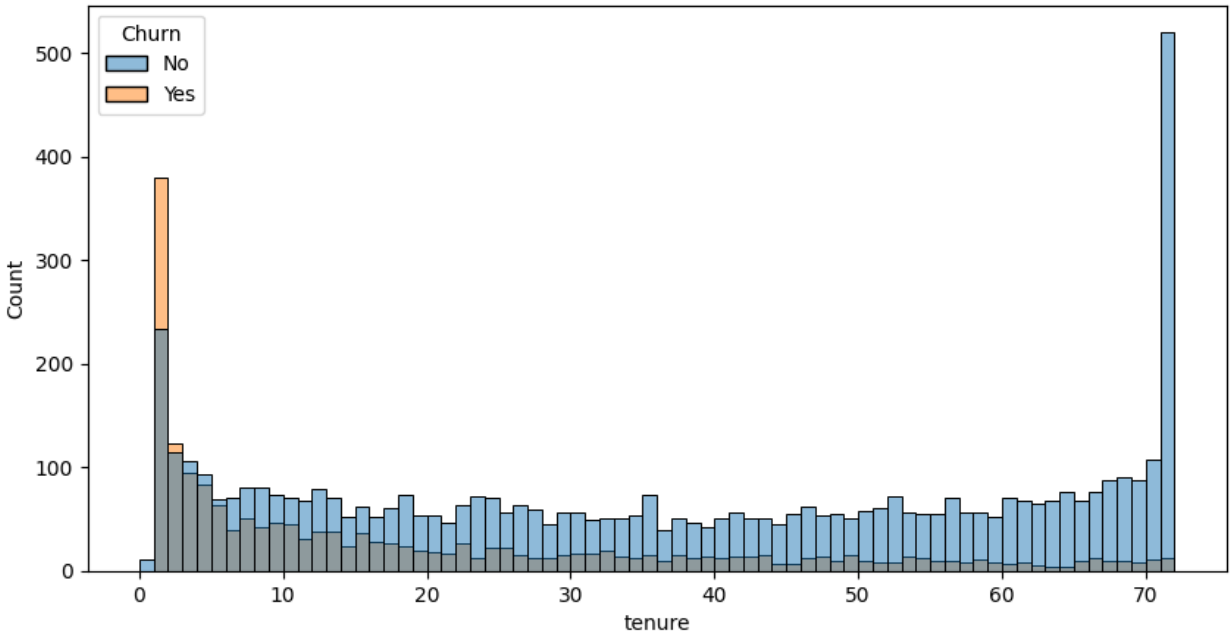



```
total_counts = df.groupby('SeniorCitizen')
['Churn'].value_counts(normalize=True).unstack() * 100

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

# Plot the bars
total_counts.plot(kind='bar', stacked=True, ax=ax, color=['#1f77b4',
'#ff7f0e'])  # Customize colors if desired

# 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='center')

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

plt.show()
```



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

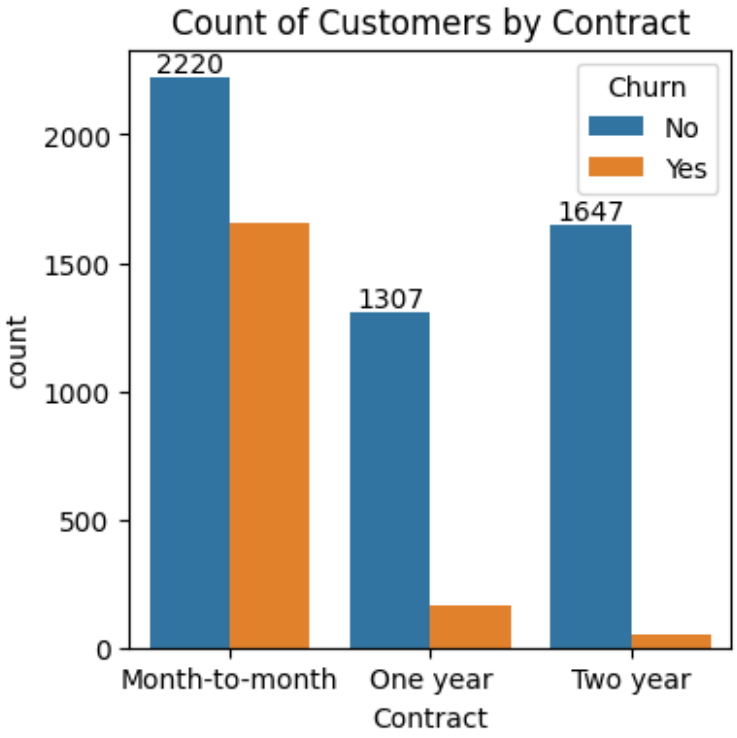
```
plt.figure(figsize = (10,5))
sns.histplot(x = "tenure", data = df, bins=72, hue="Churn")
plt.show()
```



#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

```
plt.figure(figsize = (4,4))
ax=sns.countplot(x="Contract", data=df, hue="Churn")
ax.bar_label(ax.containers[0])
plt.title("Count of Customers by Contract")
plt.show()
```



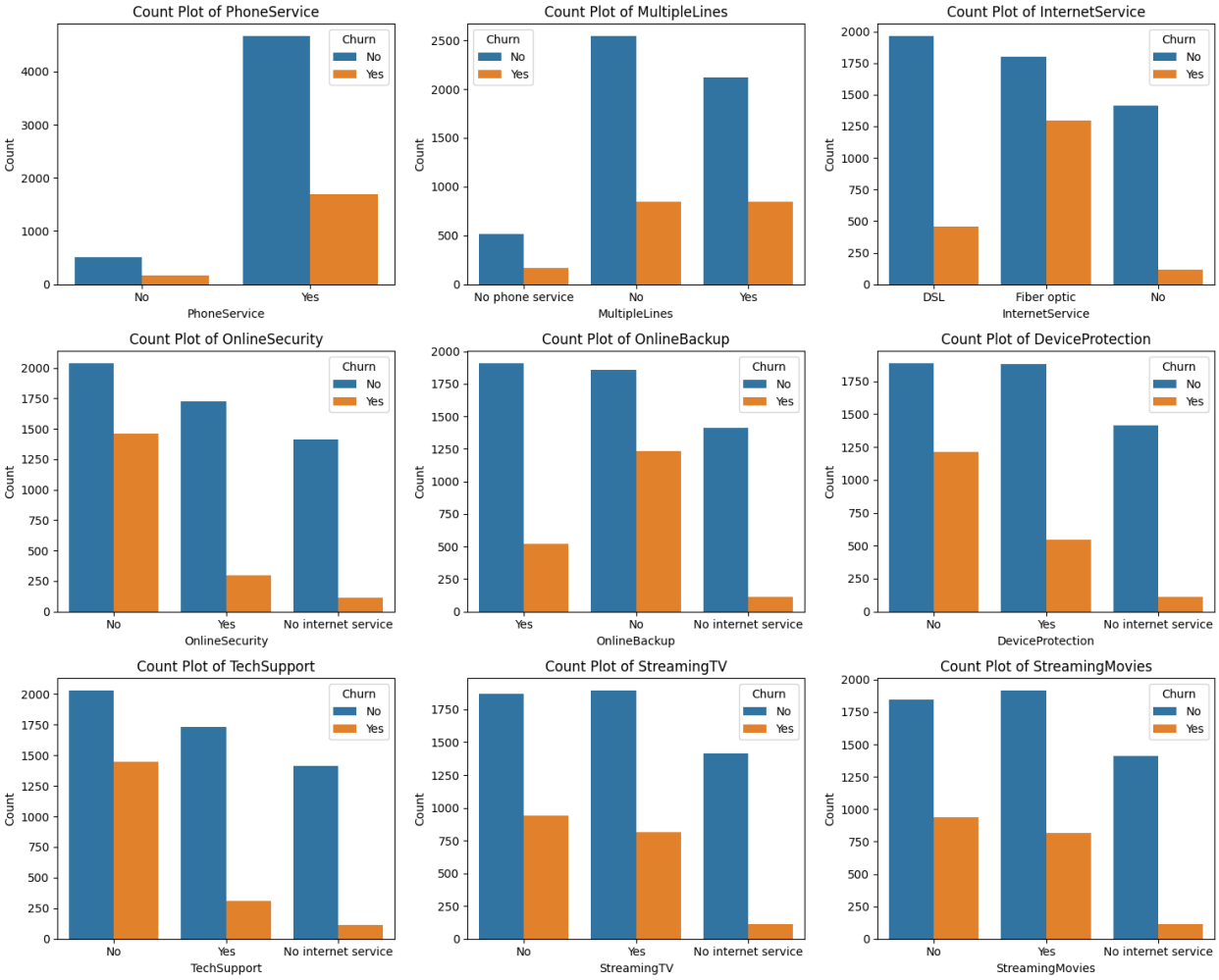
#people who have month to month contract are likely to churn then from those who have 1 or 2 years or contract.

```
df.columns.values
```

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

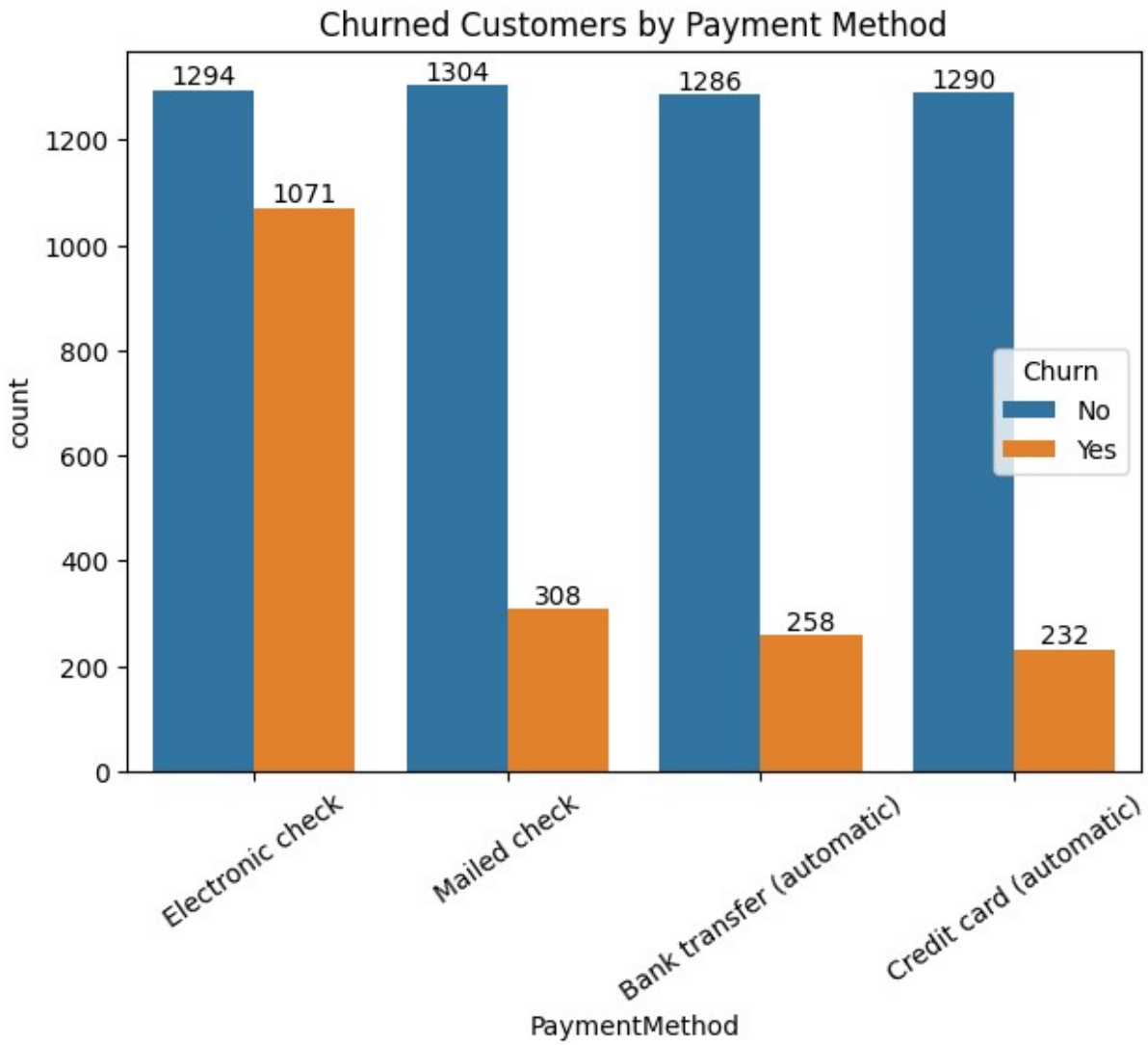
```
columns = ['PhoneService', 'MultipleLines', 'InternetService',
'OnlineSecurity',
           'OnlineBackup', 'DeviceProtection', 'TechSupport',
```

```
'StreamingTV', 'StreamingMovies']

# 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 needed

# Create subplots
fig, axes = plt.subplots(n_rows, n_cols, figsize=(15, n_rows * 4))  #
Adjust figsize as needed

# 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.

```
plt.figure(figsize = (7,5))
ax = sns.countplot(x = "PaymentMethod", data = df, hue = "Churn")
ax.bar_label(ax.containers[0])
ax.bar_label(ax.containers[1])
plt.title("Churned Customers by Payment Method")
plt.xticks(rotation = 35)
plt.show()
```



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