```
#importing all required Python libraries and calling datasets in
Jupyter notebook

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

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

```
      customerID  gender  SeniorCitizen Partner Dependents  tenure  \
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
...          ...     ...            ...     ...        ...     ...
7038  6840-RESVB    Male              0     Yes        Yes      24
7039  2234-XADUH  Female              0     Yes        Yes      72
7040  4801-JZAZL  Female              0     Yes        Yes      11
7041  8361-LTMKD    Male              1     Yes         No       4
7042  3186-AJIEK    Male              0      No         No      66

     PhoneService     MultipleLines InternetService
OnlineSecurity  ...  \
0              No  No phone service             DSL
No  ...
1             Yes                No             DSL
Yes  ...
2             Yes                No             DSL
Yes  ...
3              No  No phone service             DSL
Yes  ...
4             Yes                No     Fiber optic
No  ...
...           ...               ...             ...             ...  ..
.
7038          Yes               Yes             DSL
Yes  ...
7039          Yes               Yes     Fiber optic
No  ...
7040           No  No phone service             DSL
Yes  ...
7041          Yes               Yes     Fiber optic
No  ...
7042          Yes                No     Fiber optic
Yes  ...

     DeviceProtection TechSupport StreamingTV StreamingMovies
```

```
Contract  \
0                  No          No          No               No  Month-
to-month
1                 Yes          No          No               No
One year
2                  No          No          No               No  Month-
to-month
3                 Yes         Yes          No               No
One year
4                  No          No          No               No  Month-
to-month
...               ...         ...         ...              ...
...
7038              Yes         Yes         Yes              Yes
One year
7039              Yes          No         Yes              Yes
One year
7040               No          No          No               No  Month-
to-month
7041               No          No          No               No  Month-
to-month
7042              Yes         Yes         Yes              Yes
Two year

     PaperlessBilling              PaymentMethod MonthlyCharges
TotalCharges  \
0                 Yes           Electronic check          29.85
29.85
1                  No               Mailed check          56.95
1889.5
2                 Yes               Mailed check          53.85
108.15
3                  No  Bank transfer (automatic)          42.30
1840.75
4                 Yes           Electronic check          70.70
151.65
...               ...                        ...            ...
...
7038              Yes               Mailed check          84.80
1990.5
7039              Yes    Credit card (automatic)         103.20
7362.9
7040              Yes           Electronic check          29.60
346.45
7041              Yes               Mailed check          74.40
306.6
7042              Yes  Bank transfer (automatic)         105.65
6844.5
```

```
     Churn
0       No
1       No
2      Yes
3       No
4      Yes
...    ...
7038    No
7039    No
7040    No
7041   Yes
7042    No

[7043 rows x 21 columns]
```

```
#this share the information about the dataset here total chargers are not in float datatype so change the datatype and then check info of data again
```

```
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 as change the datatype of "TotalCharges" from object to float

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

# Again checking the information of the dataset and also checking the
changes are made or not.

df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 7043 entries, 0 to 7042
Data columns (total 21 columns):
 #   Column            Non-Null Count  Dtype
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 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
```

```
#".isnull" to check either the data has null values or not so it give
result as "True" and "False" by this it is not understandable the
dataset has null value or not so for this we use ".sum()" func. it
showing "0" for each column. If we check overall value we can use
".sum" func, again  for overall value of data

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

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

```
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
```

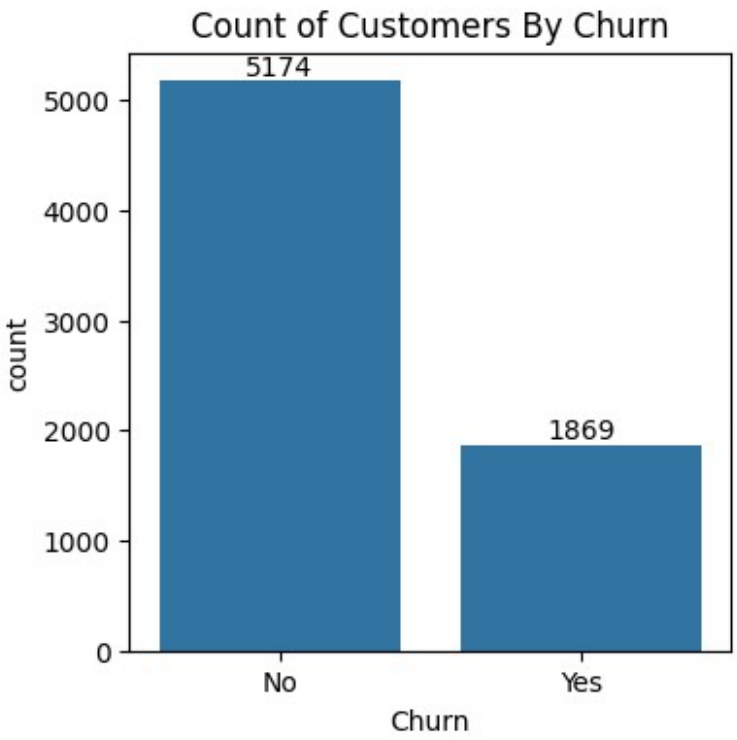
```
df["customerID"].duplicated().sum()
```

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

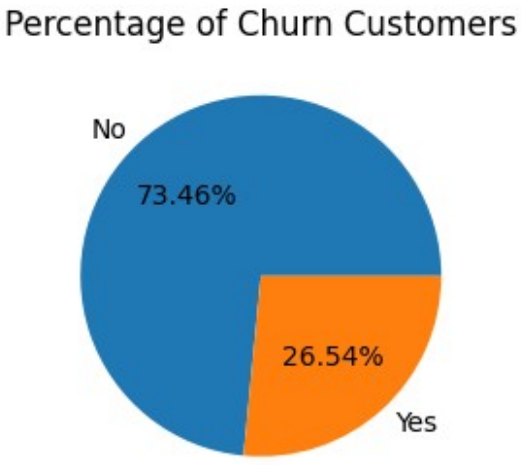
```
def conv(value):
    if value == 1:
        return "yes"
    else:
        return "no"

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

#converted 0 and 1 values of "SeniorCitizen" to yes/no to make it easier to understand

```
plt.figure(figsize = (4,4))
ax = sns.countplot(x = 'Churn', data = df)
plt.title("Count of Customers By Churn")

ax.bar_label(ax.containers[0])
plt.show()
```



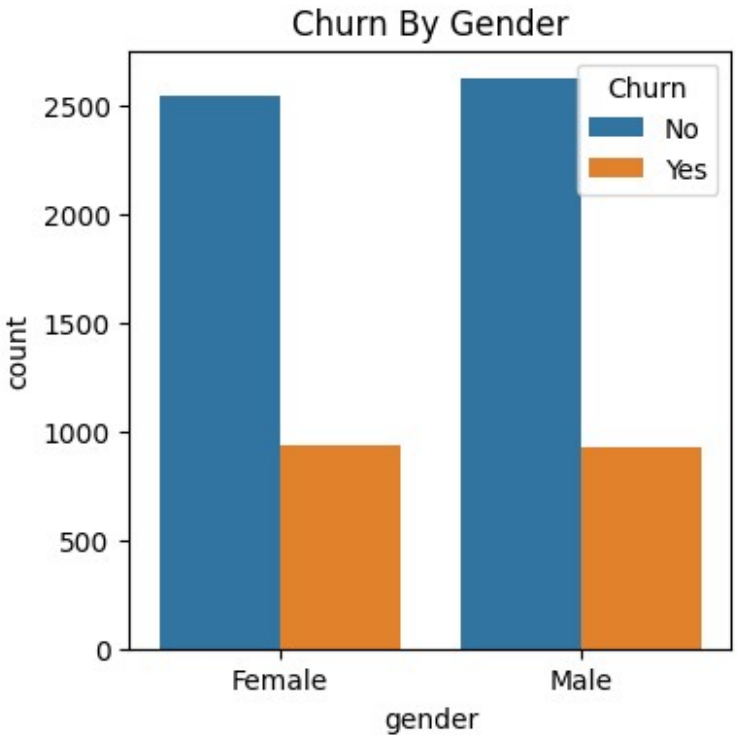

```
plt.figure(figsize = (3,4))
gb = df.groupby('Churn').agg({'Churn' : "count"})
plt.pie(gb['Churn'],labels = gb.index, autopct = "%1.2f%%")
plt.title("Percentage of Churn Customers")
plt.show()
```



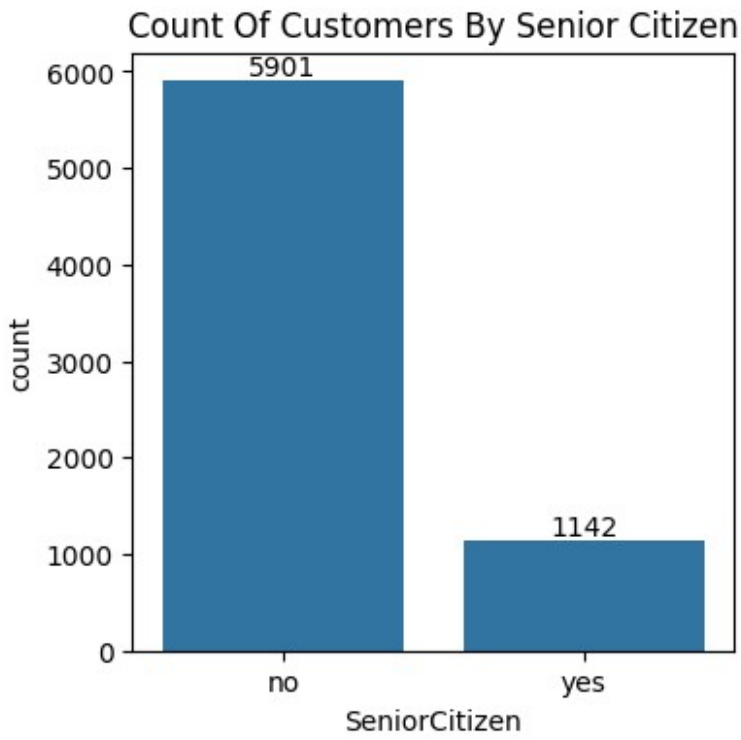
#from the given pie chart we can conclude that 26.54% of our customers have churned out.

#Now let's explore the reason behind it.

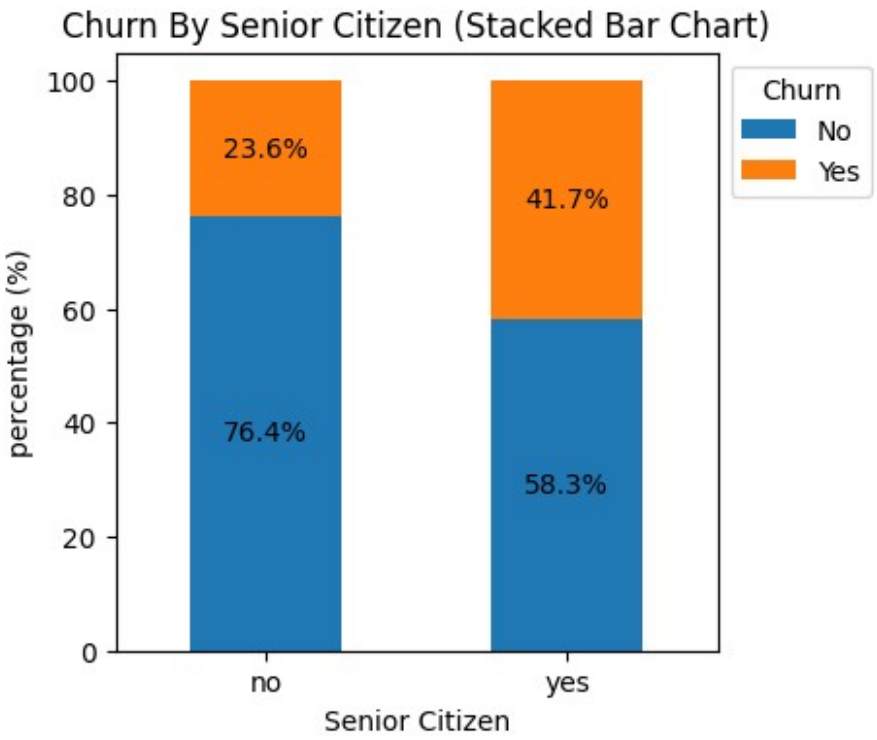
```
plt.figure(figsize = (4,4))
sns.countplot(x = "gender", data = df, hue = "Churn")
plt.title("Churn By Gender")
plt.show()
```




```
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()
```

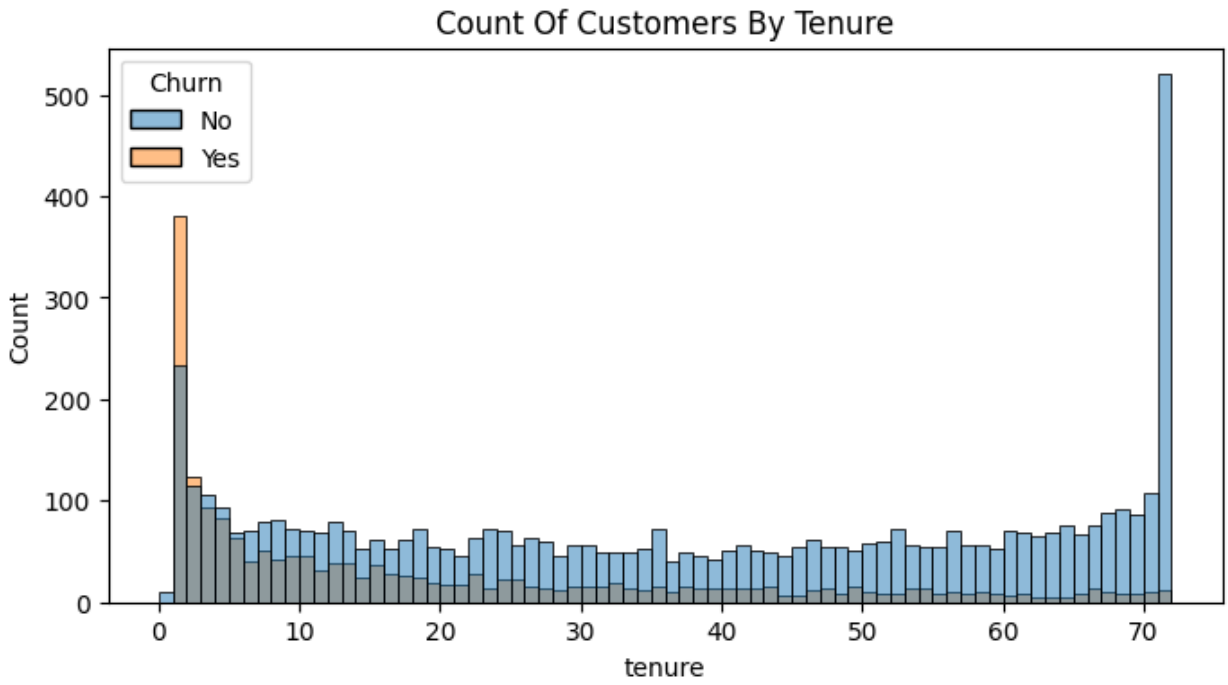



```
total_counts = df.groupby('SeniorCitizen')
['Churn'].value_counts(normalize=True).unstack()*100

#plot
fig, ax = plt.subplots(figsize=(4,4))  #adjust the 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 lables 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('Senior Citizen')
plt.ylabel('percentage (%)')
plt.xticks(rotation=0)
plt.legend(title = 'Churn', bbox_to_anchor = (1,1))  #customize legend
Location

plt.show()
```



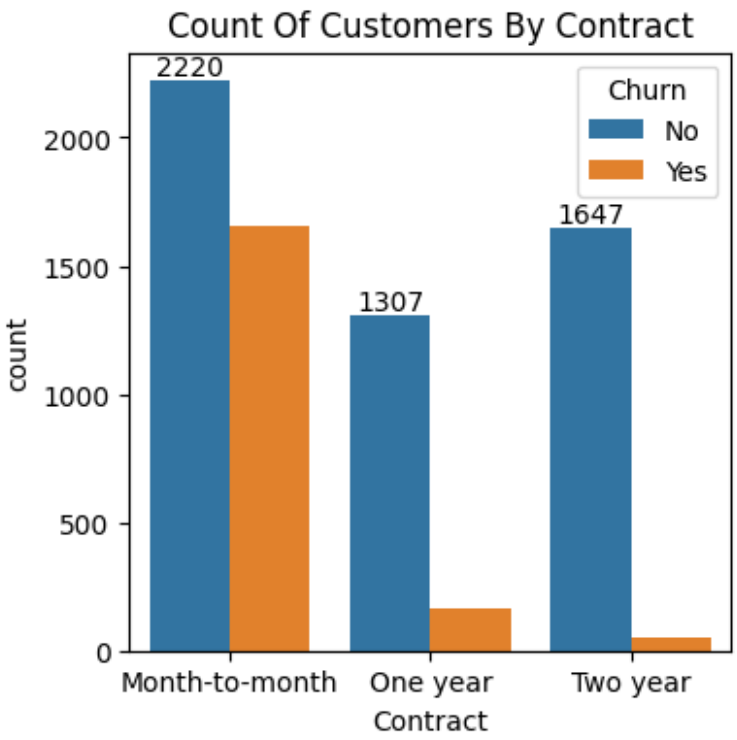
#comparative a greater percentage of people in senior citizen category have churned.

```
plt.figure(figsize = (8,4))
sns.histplot(x = "tenure", data = df, bins = 72, hue = "Churn")
plt.title("Count Of Customers By Tenure")
plt.show()
```



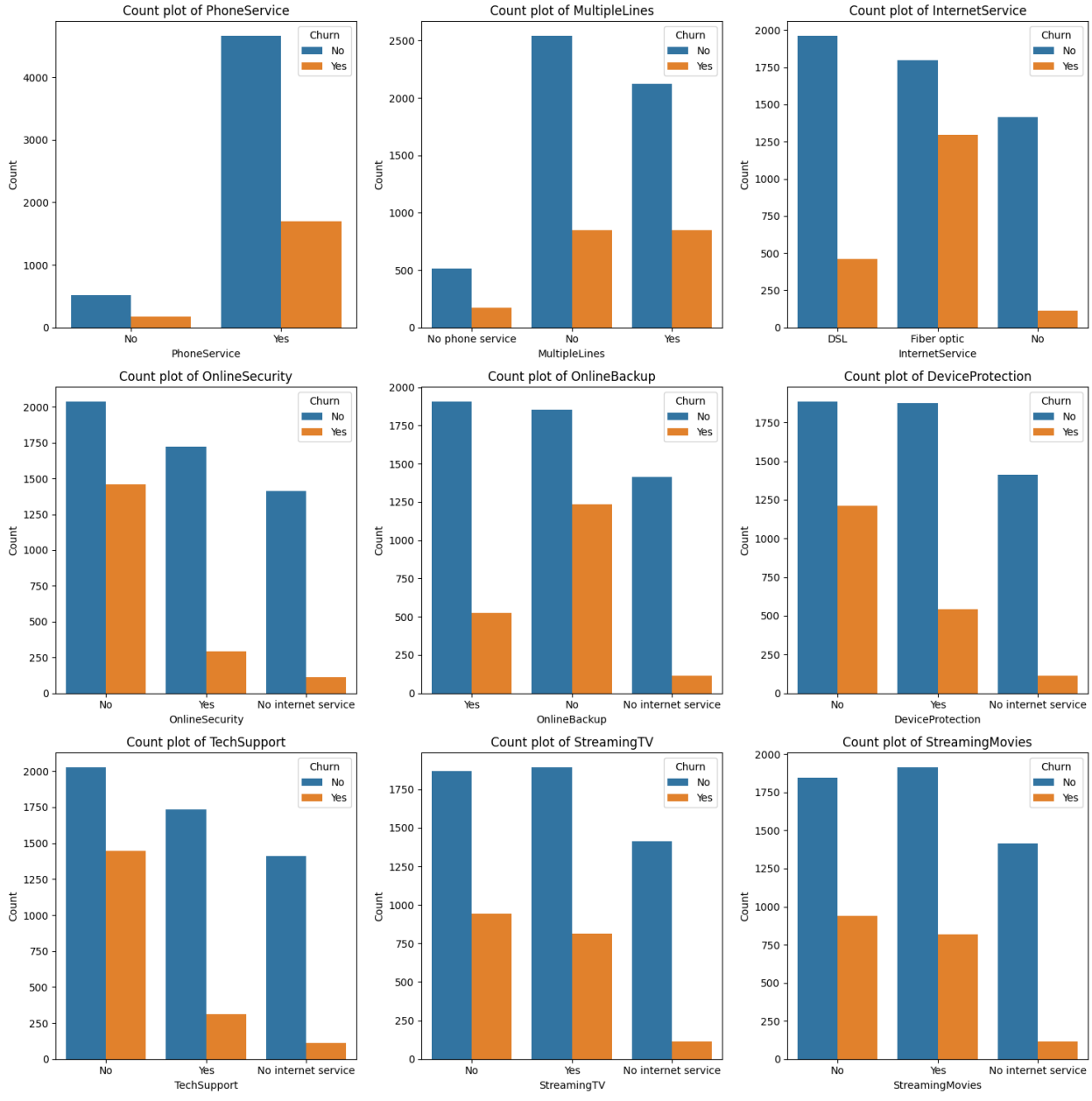
#people who have used our services for a long time have stayed and people who have used our services for 1 ro 2 months have churned.

```
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 are likely to churn 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)

# Assuming 'df' is your DataFrame containing the relevant columns
columns = ['PhoneService', 'MultipleLines', 'InternetService',
'OnlineSecurity',
           'OnlineBackup', 'DeviceProtection', 'TechSupport',
'StreamingTV', 'StreamingMovies']

# Set up the matplotlib figure with subplots
fig, axes = plt.subplots(3, 3, figsize=(15, 15))  # Adjust the figsize
as needed
axes = axes.flatten()  # Flatten the 2D axes array into 1D for easy
iteration

# Loop through each of the columns and create a count plot
for i, column in enumerate(columns):
```

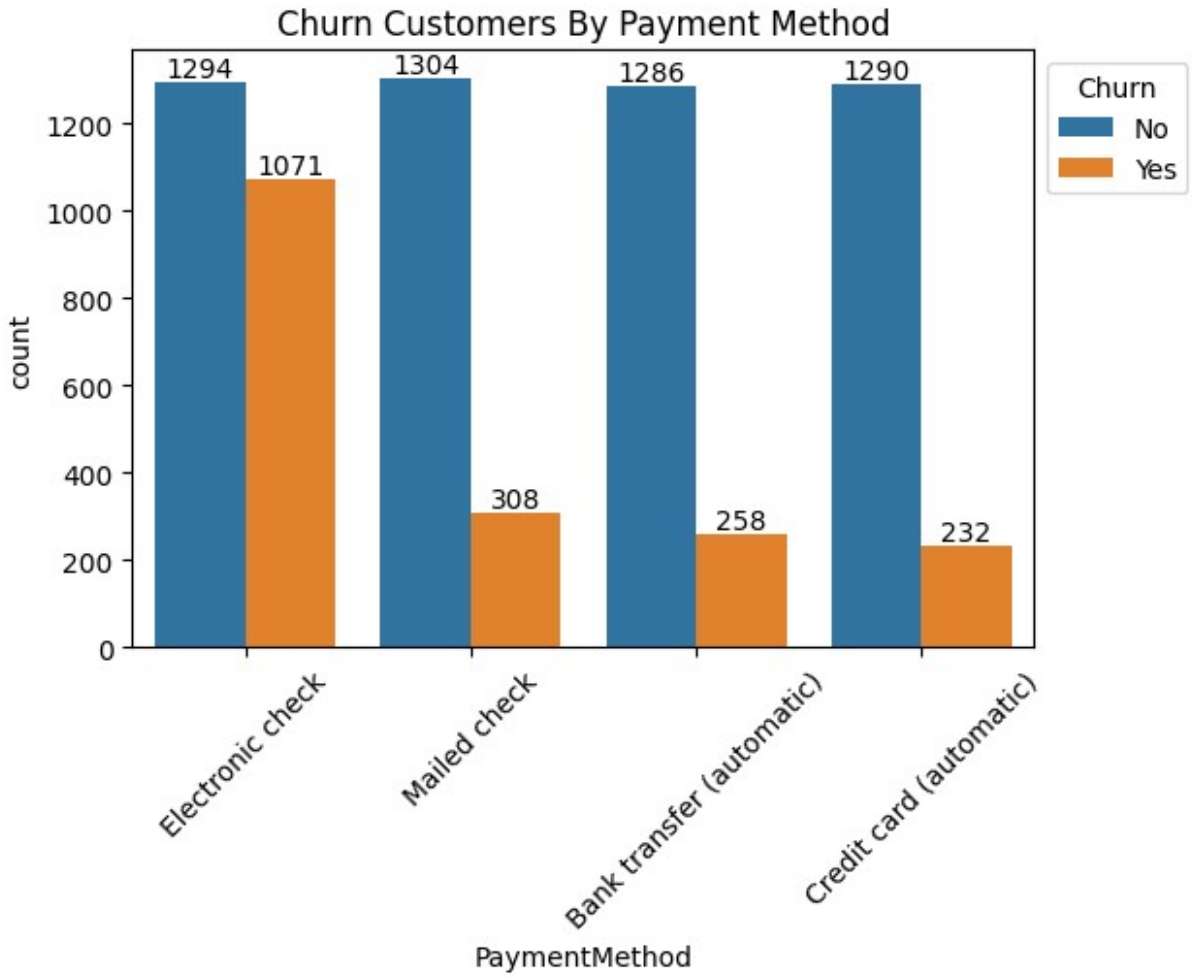
```
    sns.countplot(x=column, data=df, ax=axes[i], hue = df["Churn"])
    axes[i].set_title(f'Count plot of {column}')
    axes[i].set_xlabel(column)
    axes[i].set_ylabel('Count')

# Adjust layout to avoid overlap
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, OnlineBackup, TechSuppoet and

Streaming TV, churn rates are noticeably higher when these serives 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.legend(title = 'Churn', bbox_to_anchor = (1,1))
plt.title("Churn Customers By Payment Method")
plt.xticks(rotation = 45)
plt.show()
```



#Customer is likely to churn when he/she is using electronic check asa a payment method