Import Library

```
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.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
```

```
# Replace the blanks in TotalCharges column with 0 as Values under
Tenure are 0. No total charges are recorded

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

df.info()
```

```
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Data columns (total 21 columns):
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```

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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
```

```
df.isnull().sum()  # To check if there is any null values
```

```
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
```

```
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.duplicated() # check duplicate
```

```
0       False
1       False
2       False
3       False
4       False
        ...
7038    False
7039    False
7040    False
7041    False
7042    False
Length: 7043, dtype: bool
```

```
df.duplicated().sum() # check duplicate
```

```
0
```

```
df["customerID"].duplicated().sum() # check duplicate values in one
column
```

```
0
```

Replacing 0 and 1 values of senior citizen to yes/no

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

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

df.head()
```

```
   customerID  gender SeniorCitizen Partner Dependents  tenure
PhoneService  \
0  7590-VHVEG  Female            no     Yes         No       1
```

```
No
1  5575-GNVDE    Male             no      No         No       34
Yes
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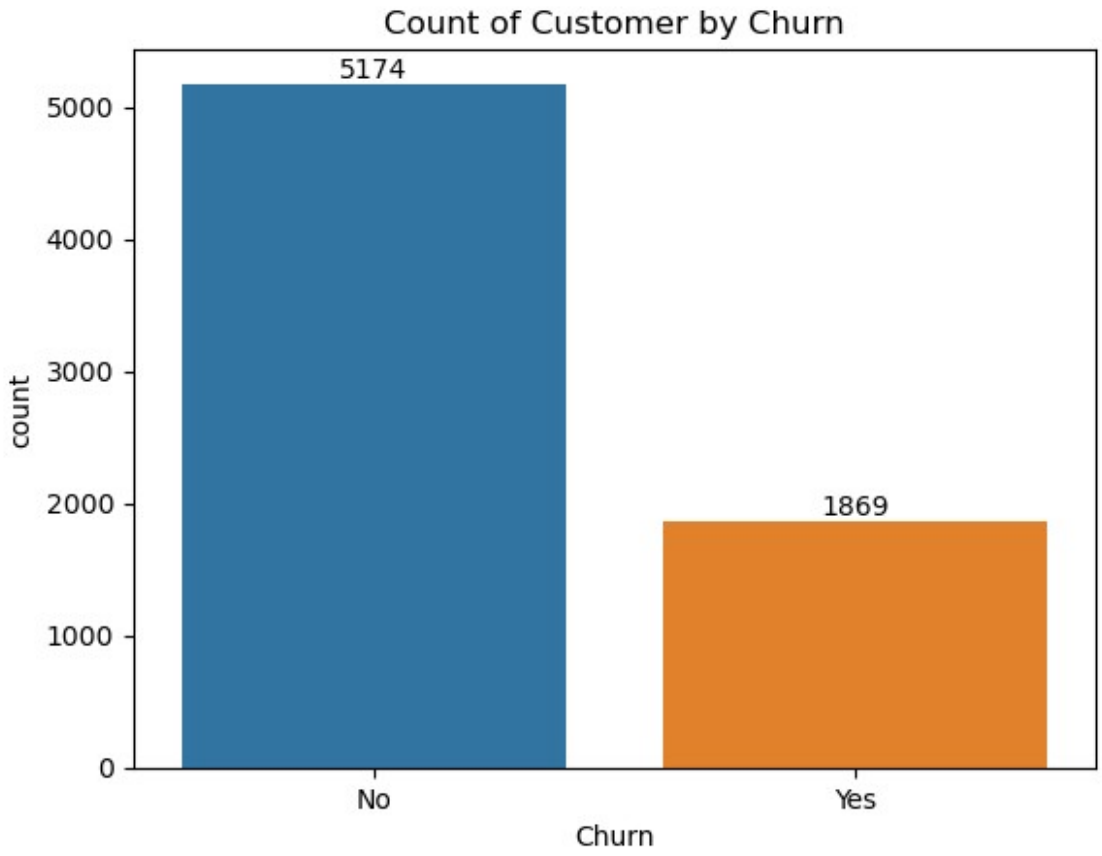
      MultipleLines InternetService OnlineSecurity  ...
DeviceProtection  \
0  No phone service             DSL             No  ...
No
1                No             DSL            Yes  ...
Yes
2                No             DSL            Yes  ...
No
3  No phone service             DSL            Yes  ...
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

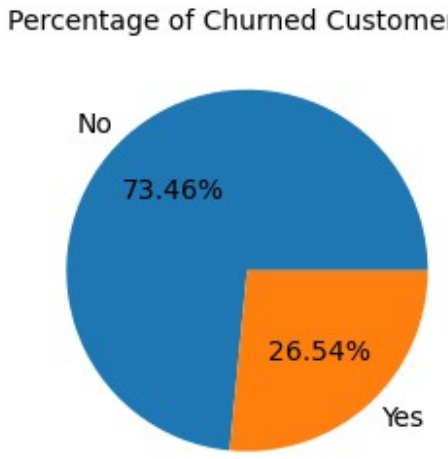
                PaymentMethod MonthlyCharges  TotalCharges  Churn
0           Electronic check          29.85         29.85     No
1               Mailed check          56.95       1889.50     No
2               Mailed check          53.85        108.15    Yes
3  Bank transfer (automatic)          42.30       1840.75     No
4           Electronic check          70.70        151.65    Yes

[5 rows x 21 columns]
```

```
ax = sns.countplot(x = 'Churn', data = df)
ax.bar_label(ax.containers[0]) #To show value as label
plt.title("Count of Customer by Churn")
plt. show()
```



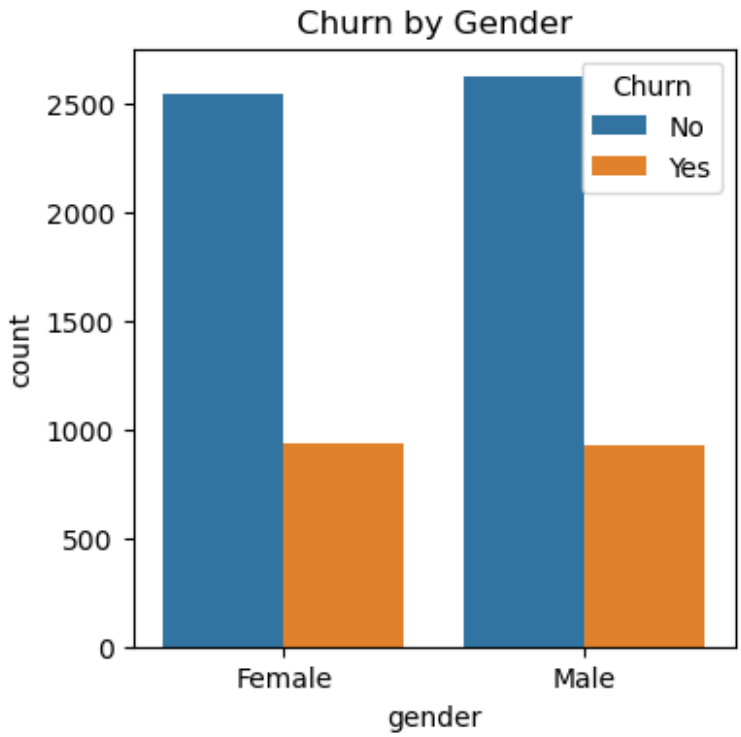

```
plt.figure(figsize = (3,4))
gb = df.groupby("Churn").agg({'Churn':"count"})
plt.pie(gb['Churn'], labels = gb.index, autopct = "%1.2f%%")
plt.title("Percentage of Churned Customeres", fontsize = 10)
plt.show()
```



```
# Finding : 26.54% of customers have churned out

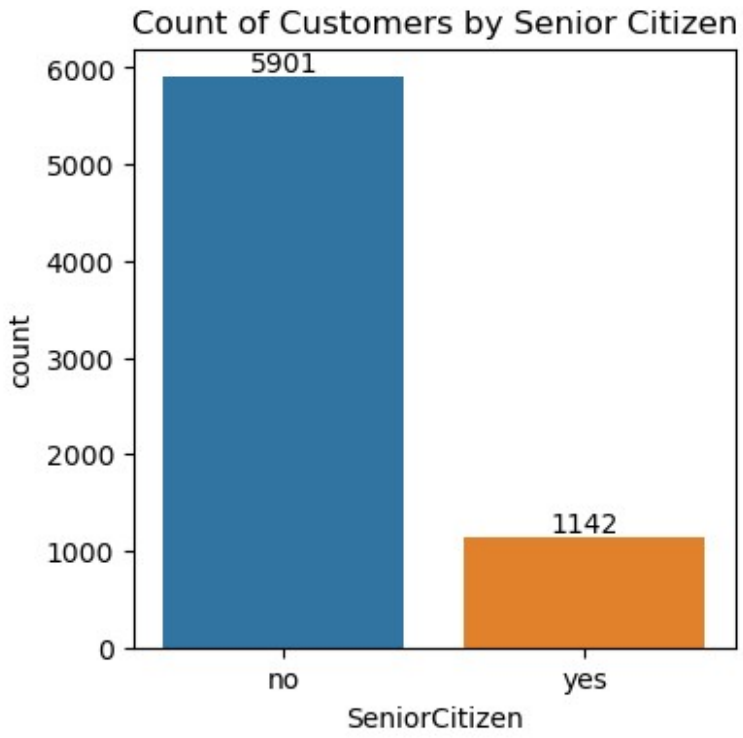
# The Reason behind it:

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




```
# Above says Churn out is not much affected by Gender

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




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

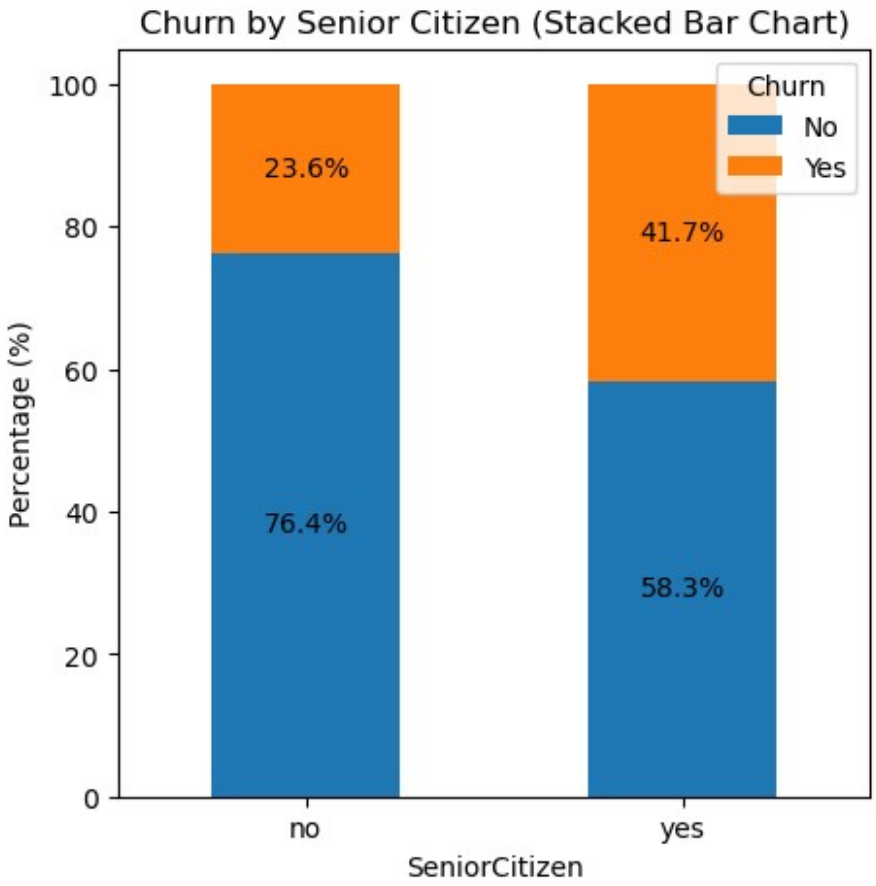
# Plot
fig, ax = plt.subplots(figsize=(5, 5)) # Adjust figsize for better
visualization

# 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')

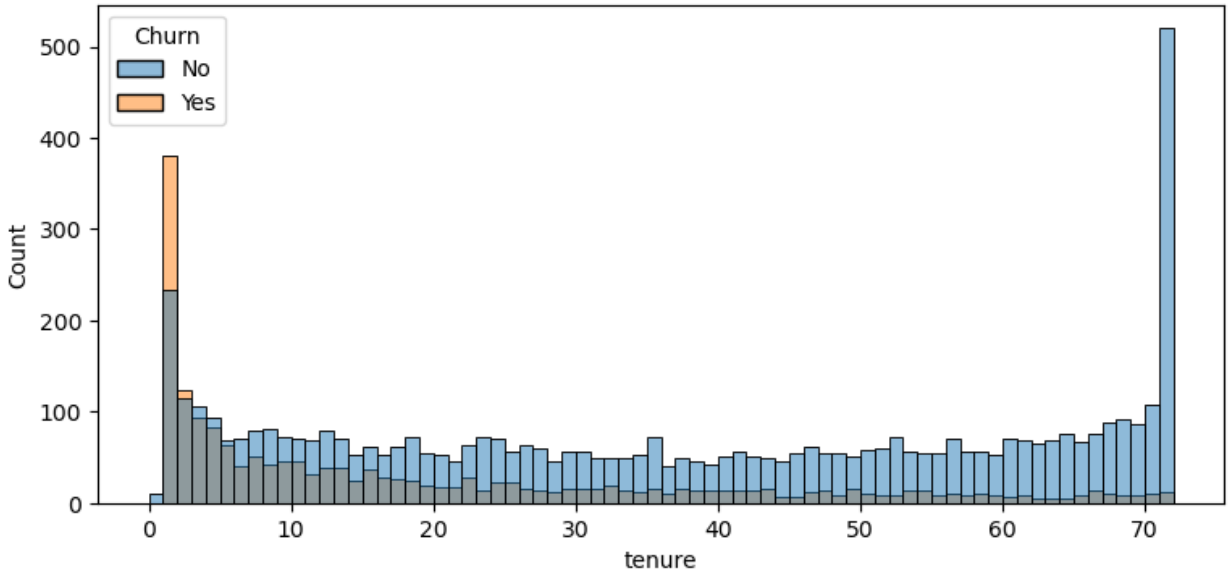
plt.title('Churn by Senior Citizen (Stacked Bar Chart)')
plt.xlabel('SeniorCitizen')
plt.ylabel('Percentage (%)')
plt.xticks(rotation=0)
plt.legend(title='Churn', loc='upper right') # Customize legend
location

plt.show()
```



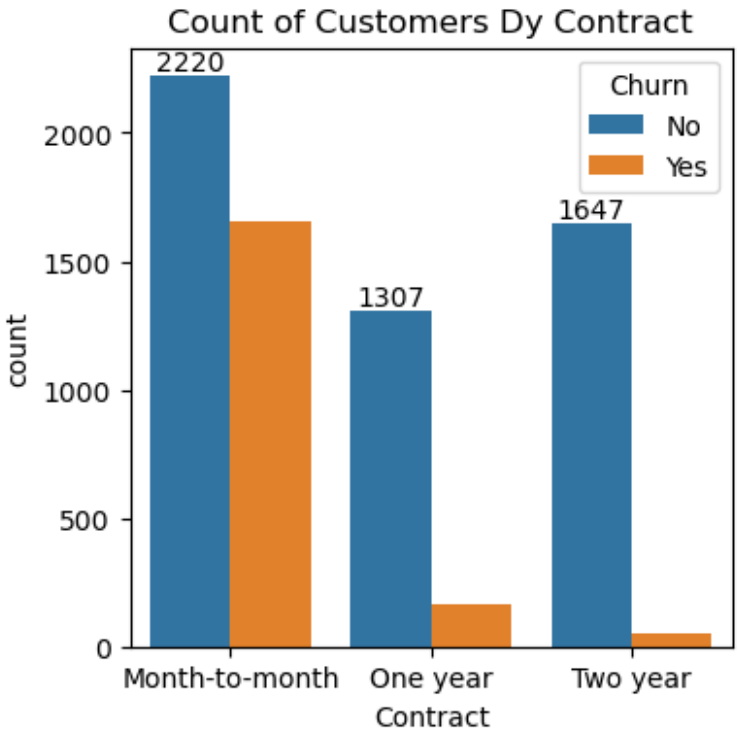

```
# Findings of above fig: 41.7% of Senior Citizen has churned out

plt.figure(figsize= (9,4))
sns.histplot(x = "tenure", data = df, bins = 72, hue = "Churn")
plt.show()
```




```
# Customer churned out most during the early stage

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 Dy Contract")
plt.show()
```



```
# People who have month to month contract are likely to chrun than to
those who have 1 or 2 years of contract

# List of columns for which we want to create count plots
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

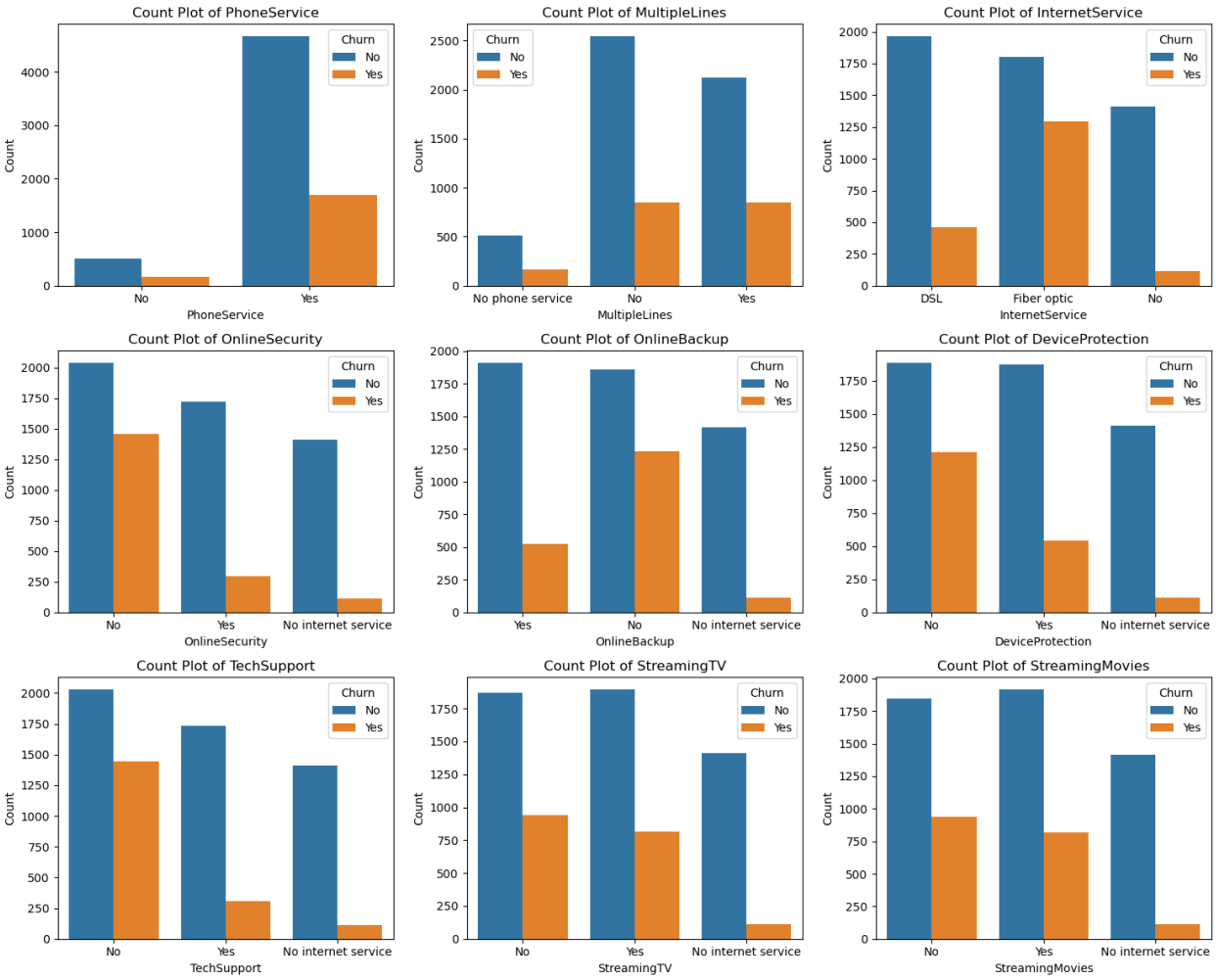
# Create subplots
fig, axes = plt.subplots(n_rows, n_cols, figsize=(15, n_rows * 4)) #
Adjust figsize as needed

# 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')

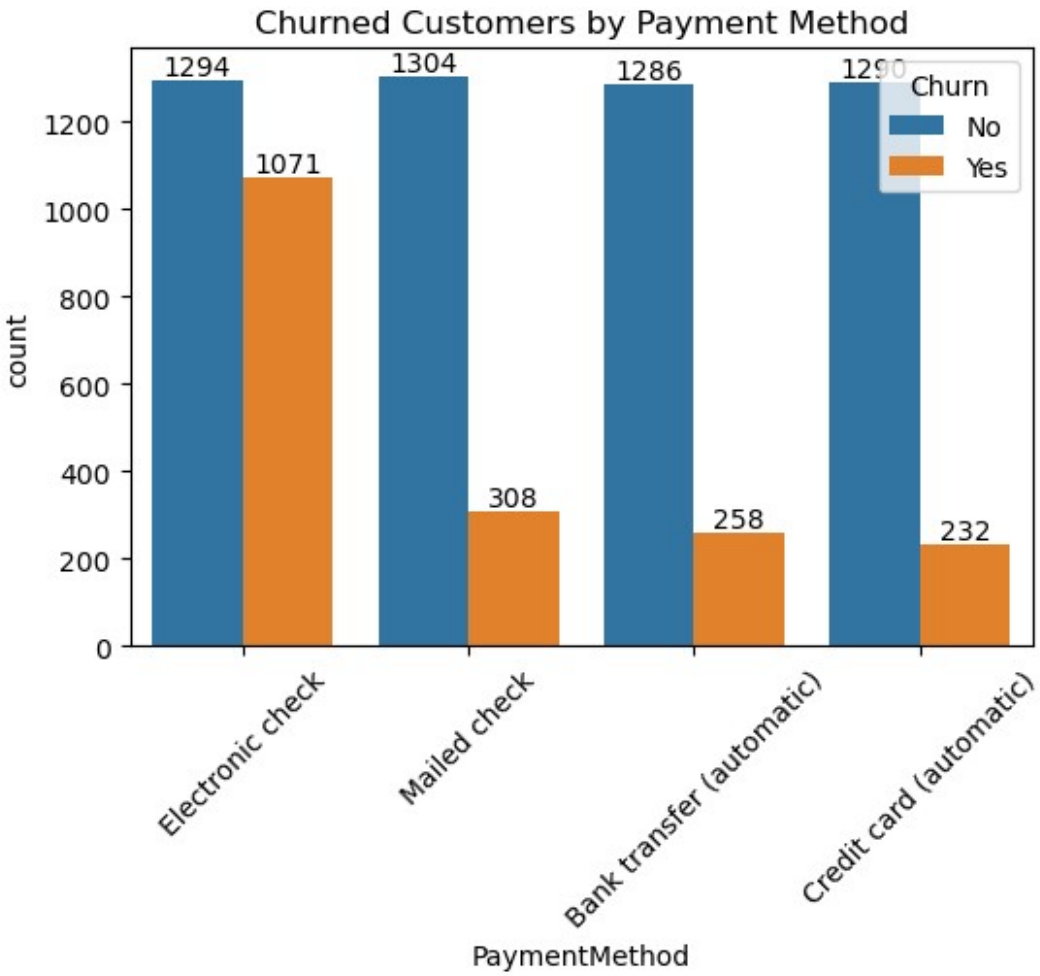
# Remove empty subplots (if any)
for j in range(i + 1, len(axes)):
    fig.delaxes(axes[j])

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 = (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 Customers by Payment Method")
plt.xticks(rotation = 45)
plt.show()
```




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