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

df = pd.read_csv("WA_Fn-UseC_-Telco-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]
```

```
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
```

```
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
```

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

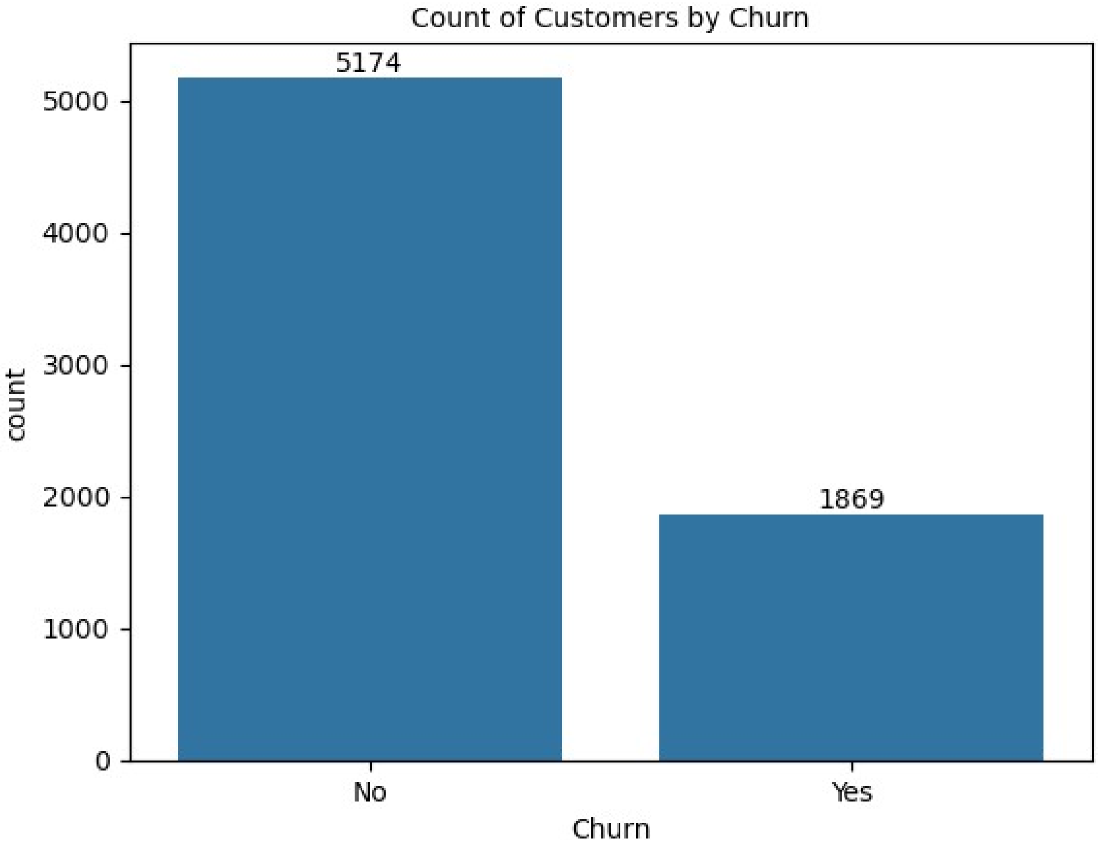
```
np.int64(0)
```

```
def conv(value):
    if value==1:
        return "Yes"
    else:
        return "No"

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

df.head()
```

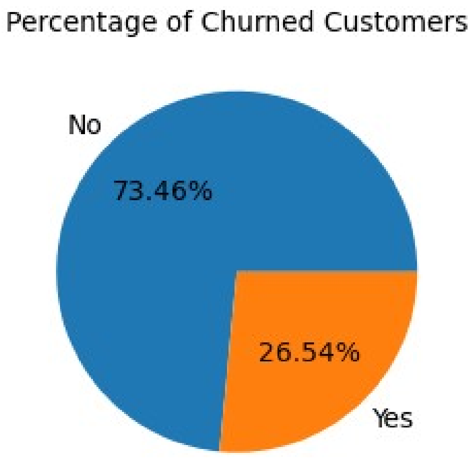
```
   customerID  gender SeniorCitizen Partner Dependents  tenure
PhoneService  \
0  7590-VHVEG  Female            No     Yes         No       1
No
1  5575-GNVDE    Male            No      No         No      34
Yes
2  3668-QPYBK    Male            No      No         No       2
Yes
3  7795-CFOCW    Male            No      No         No      45
No
4  9237-HQITU  Female            No      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       1889.50     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]
```

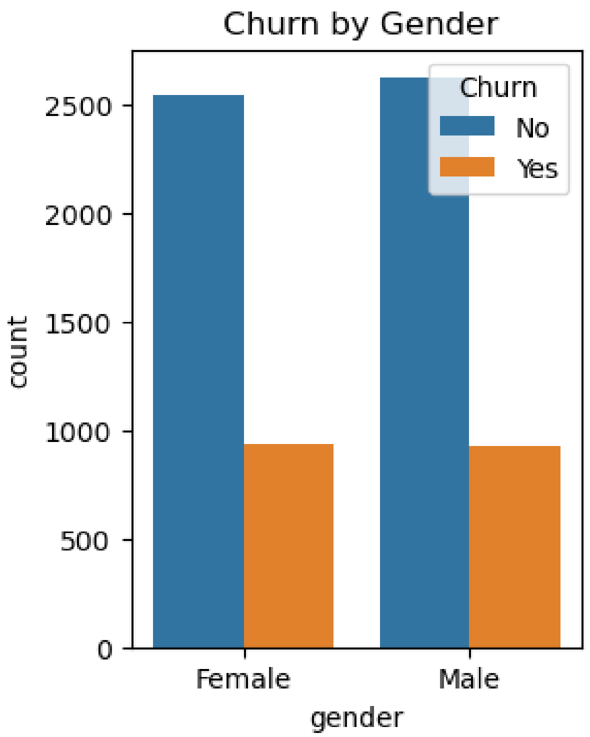
```
import seaborn as sns
import matplotlib.pyplot as plt
ax = sns.countplot(x='Churn', data=df)
ax.bar_label(ax.containers[0])
plt.title("Count of Customers by Churn",fontsize=10)
plt.show()
```



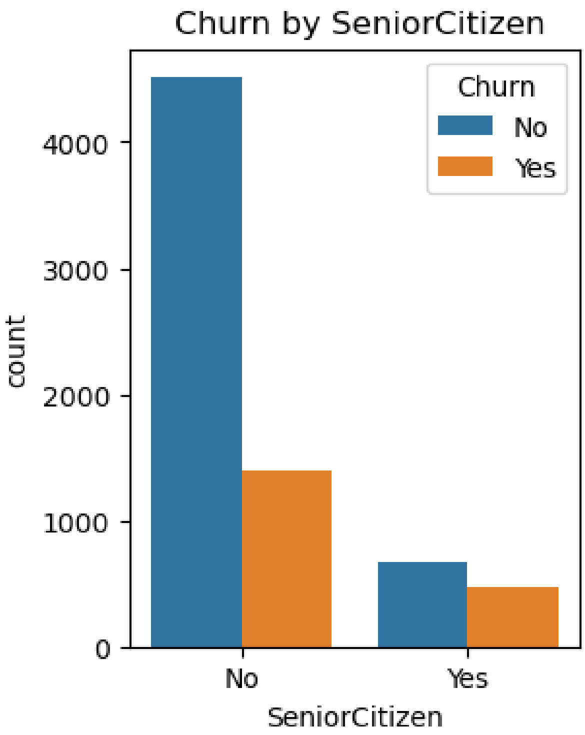
```
plt.figure(figsize = (3,4))
gb = df.groupby("Churn").agg({'Churn':"count"})
plt.pie(gb['Churn'],labels = gb.index , autopct = "%1.2f%%")
plt.title("Percentage of Churned Customers",fontsize=10)
plt.show()
```



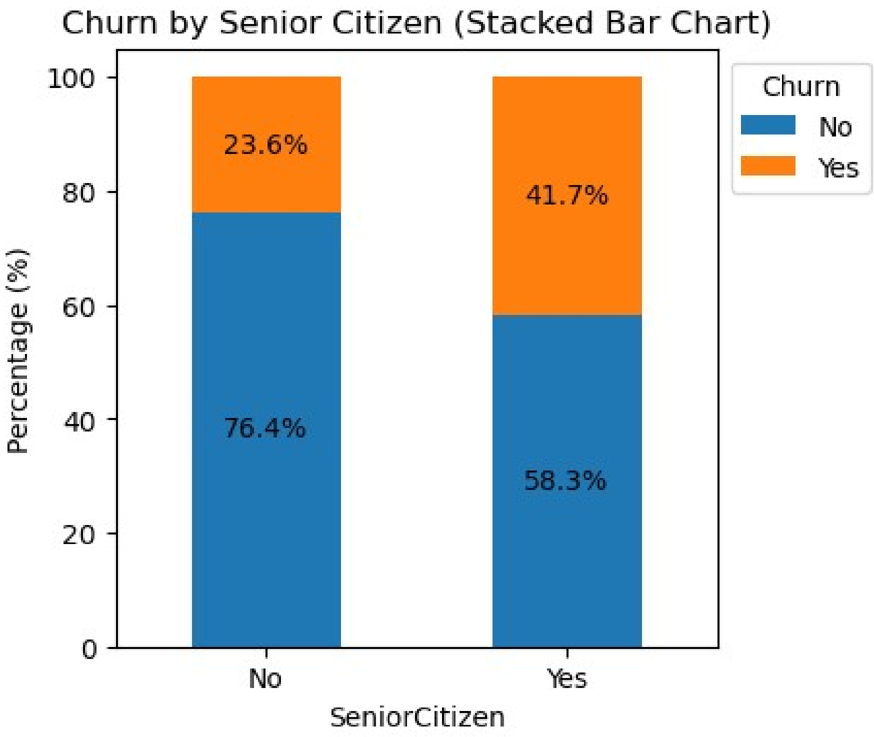
```
plt.figure(figsize=(3,4))
sns.countplot(x='gender', data=df, hue = "Churn")
plt.title(" Churn by Gender")
plt.show()
```



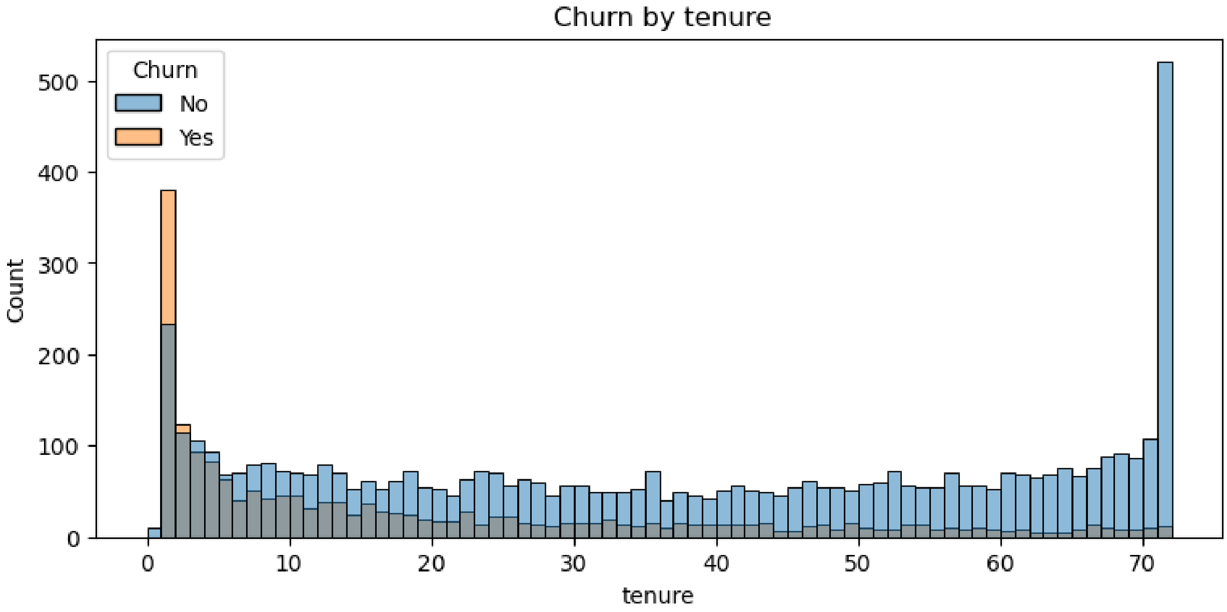
```
plt.figure(figsize=(3,4))
sns.countplot(x='SeniorCitizen', data=df, hue = "Churn")
plt.title(" Churn by SeniorCitizen")
plt.show()
```



```
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')

# Titles and labels
plt.title('Churn by Senior Citizen (Stacked Bar Chart)')
plt.xlabel('SeniorCitizen')
plt.ylabel('Percentage (%)')
plt.xticks(rotation=0)

# Legend
plt.legend(title='Churn', bbox_to_anchor = (1,1))  # Customize Legend
Location

plt.show()
```



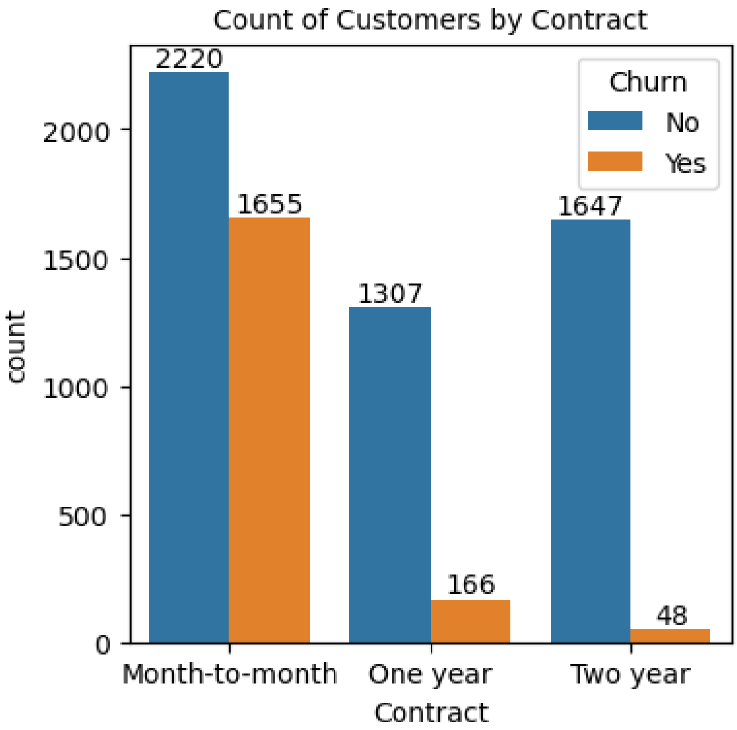
```
plt.figure(figsize=(9,4))
sns.histplot(x='tenure', data=df,bins = 72,hue = "Churn")
plt.title(" Churn by tenure")
plt.show()
```



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

---

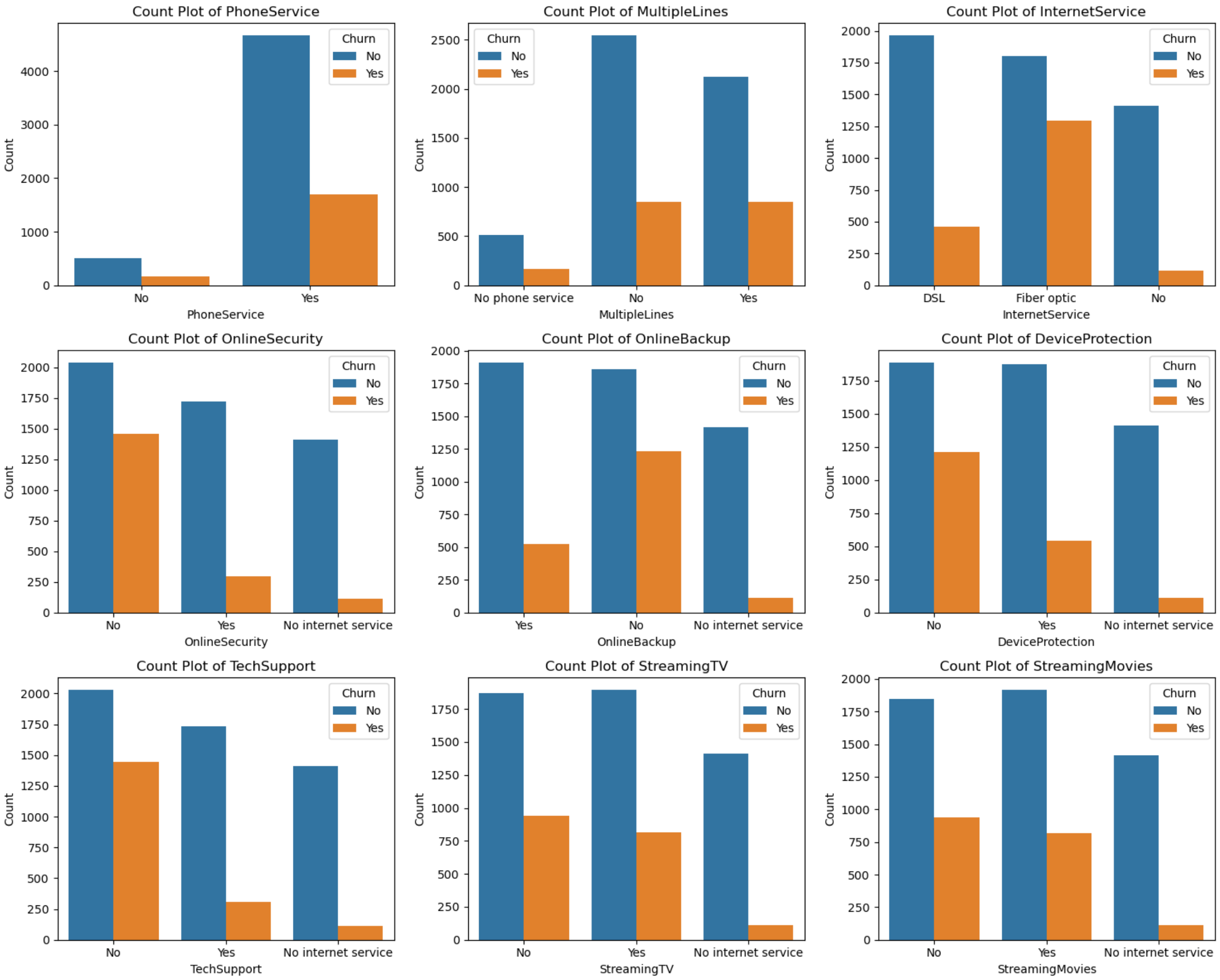
```
plt.figure(figsize=(4,4))
ax = sns.countplot(x='Contract', data=df,hue = "Churn")
ax.bar_label(ax.containers[0])
ax.bar_label(ax.containers[1])
plt.title("Count of Customers by Contract",fontsize=10)
plt.show()
```



people who have month to month contract are likely to churn then form those who have 1 or 2 yrs of contract.

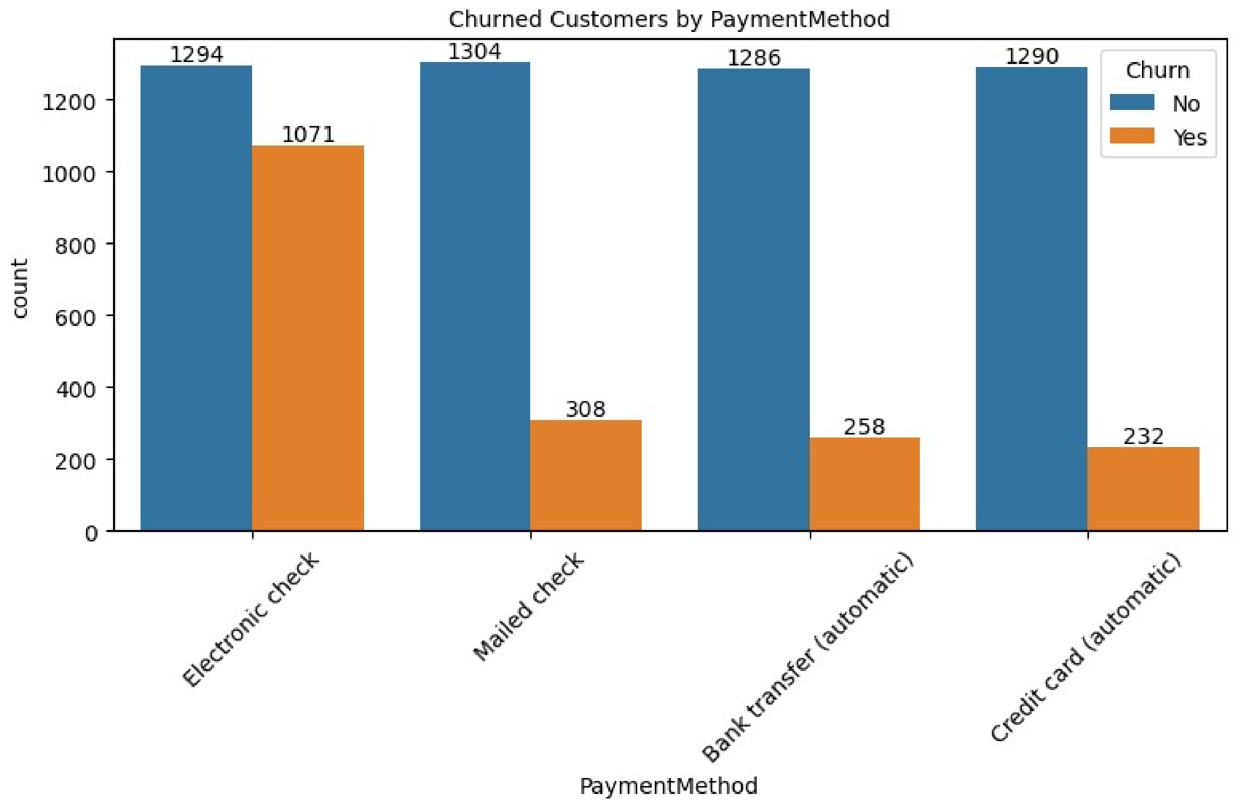
```
df.columns.values

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

# List of columns for which we want to create count plots
columns = [
    'PhoneService', 'MultipleLines', 'InternetService',
'OnlineSecurity',
    'OnlineBackup', 'DeviceProtection', 'TechSupport', 'StreamingTV',
'StreamingMovies'
```

```python
]

# Number of columns for the subplot grid
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 (works for 2D and 1D 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 ="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()
```


Count Plot of PhoneService
Count
0
1000
2000
3000
4000
No
Yes
PhoneService
Churn
No
Yes
Count Plot of MultipleLines
0
500
1000
1500
2000
2500
No phone service
No
Yes
MultipleLines
Count Plot of InternetService
0
250
500
750
1000
1250
1500
1750
2000
DSL
Fiber optic
No
InternetService
Count Plot of OnlineSecurity
No
Yes
No internet service
OnlineSecurity
Count Plot of OnlineBackup
Yes
No
No internet service
OnlineBackup
Count Plot of DeviceProtection
No
Yes
No internet service
DeviceProtection
Count Plot of TechSupport
No
Yes
No internet service
TechSupport
Count Plot of StreamingTV
No
Yes
No internet service
StreamingTV
Count Plot of StreamingMovies
No
Yes
No internet service
StreamingMovies

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=(9,4))
ax = sns.countplot(x='PaymentMethod', data=df,hue = "Churn")
ax.bar_label(ax.containers[0])
ax.bar_label(ax.containers[1])
plt.xticks(rotation = 45)
plt.title("Churned Customers by PaymentMethod",fontsize=10)
plt.show()
```



Customer is likely to churn while he is using electronic check as a payment method