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

df = pd.read_csv('C:\\Users\\User\\Downloads\\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]
```

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")
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
1889.50
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
1990.50
7039               Yes    Credit card (automatic)         103.20
7362.90
7040               Yes           Electronic check           29.60
346.45
7041               Yes               Mailed check           74.40
306.60
7042               Yes  Bank transfer (automatic)         105.65
6844.50

      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]
```

Data type of total charges has been changed to float from object.

```
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().sum()
```

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

```
0
```

```
df["customerID"].duplicated().sum()     #Check for customer data
because it is unique
```

```
0
```

Converting the values of column senior cityzen in to 'yes' and 'no' from 0 and 1 using function conv

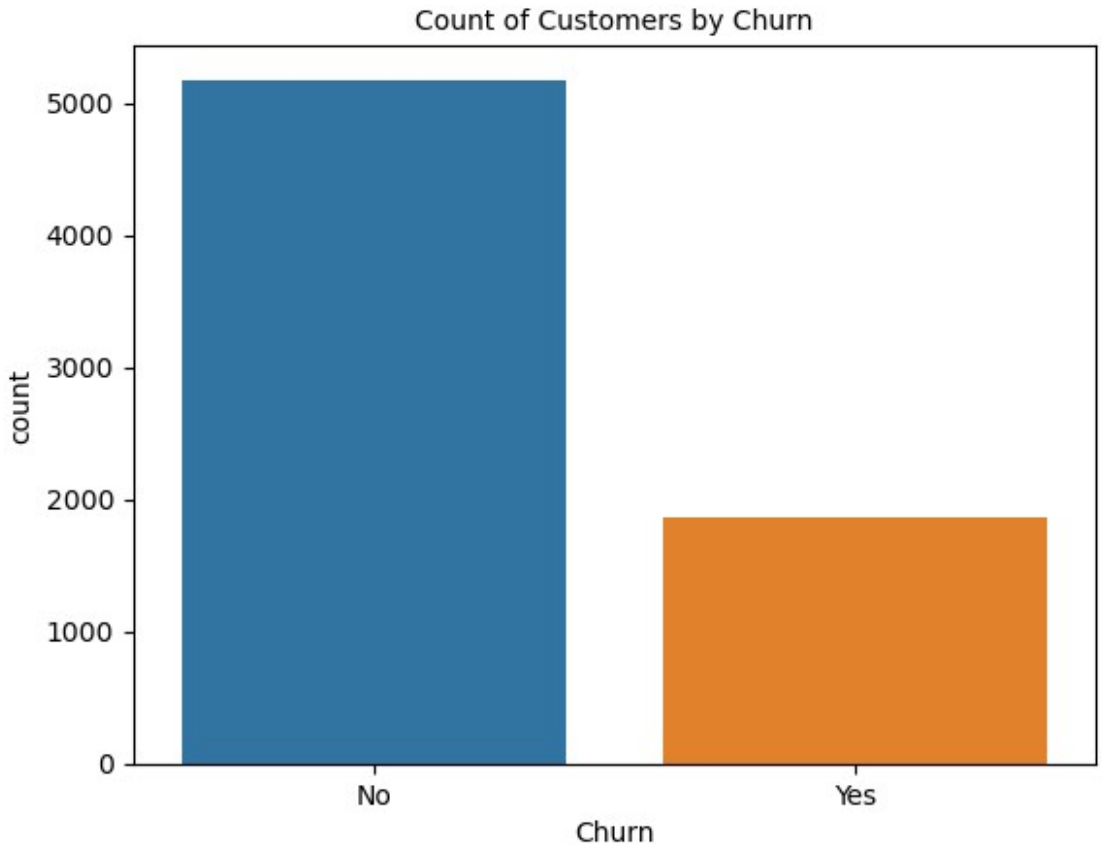
```
def conv(value):
    if value == 1:
        return 'Yes'
    else :
```

```
        return 'No'
df["SeniorCitizen"]  = df["SeniorCitizen"].apply(conv)

df.head()
```

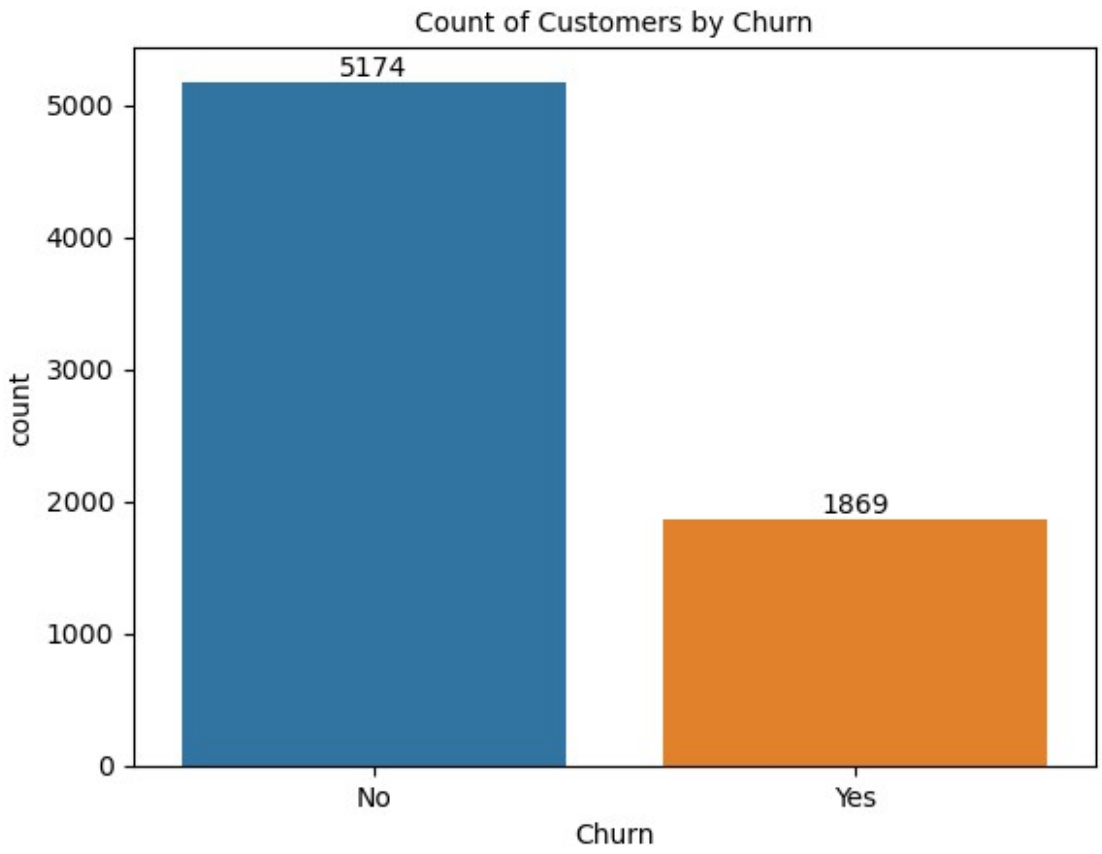
```
   customerID  gender SeniorCitizen Partner Dependents  tenure
PhoneService  \
0  7590-VHVEG  Female             No     Yes         No       1
No
1  5575-GNVDE    Male             No      No         No      34
Yes
2  3668-QPYBK    Male             No      No         No       2
Yes
3  7795-CFOCW 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

```
sns.countplot(x = 'Churn', data = df)
plt.title("Count of Customers by Churn",fontsize = 10)
plt.show()
```



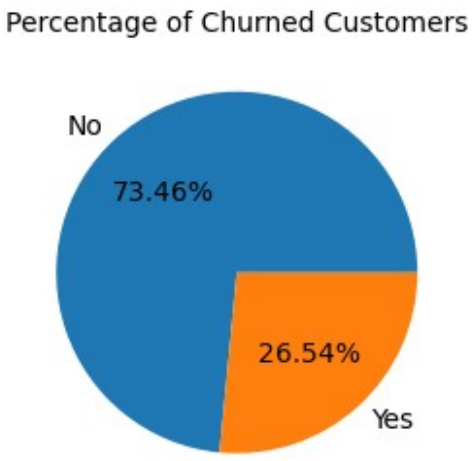

```
ax = sns.countplot(x = 'Churn', data = df)

ax.bar_label(ax.containers[0])
plt.title("Count of Customers by Churn",fontsize = 10)
plt.show()
```




```
gb = df.groupby('Churn').agg({'Churn':'count'})
gb
```

Churn	Churn
No	5174
Yes	1869

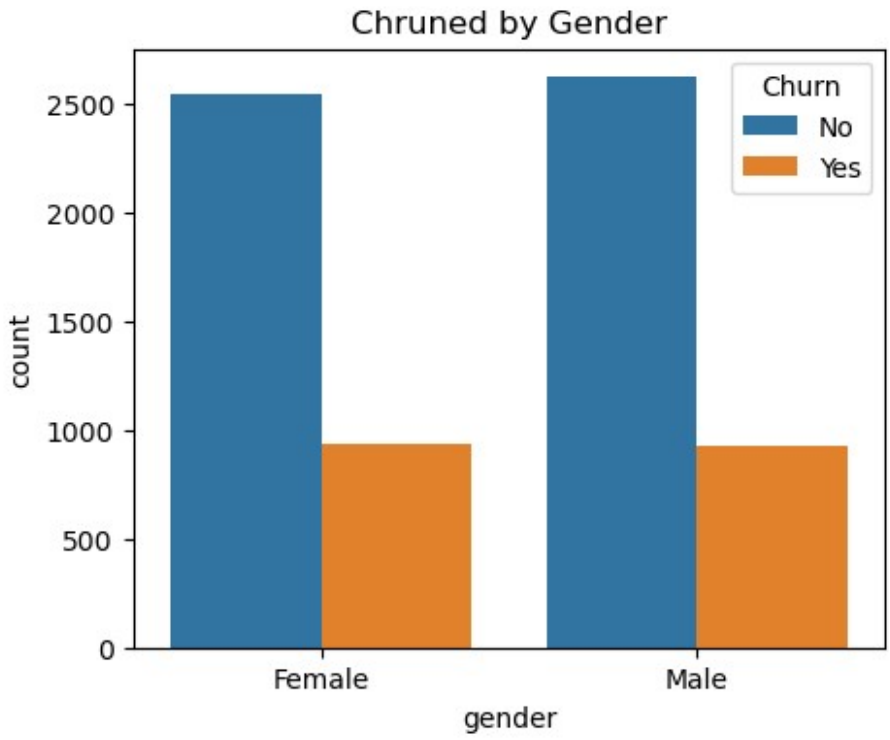
```
plt.figure(figsize = (3,4))
plt.pie(gb['Churn'],labels = gb.index, autopct = "%1.2f%%")
plt.title("Percentage of Churned Customers",fontsize = 10)
plt.show()
```



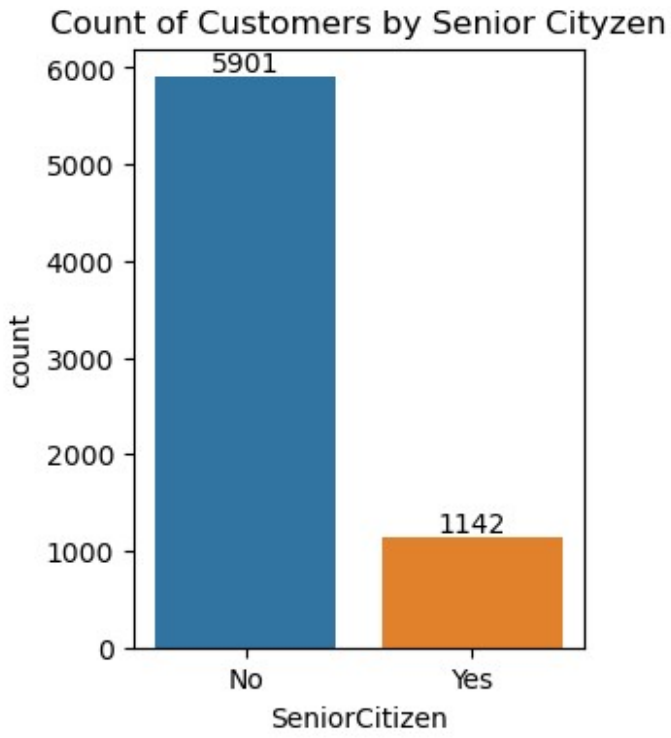
From the given Pie Chart we can conclude that 26.54% of customers have churned out.

Now lets explore the reason behind it.

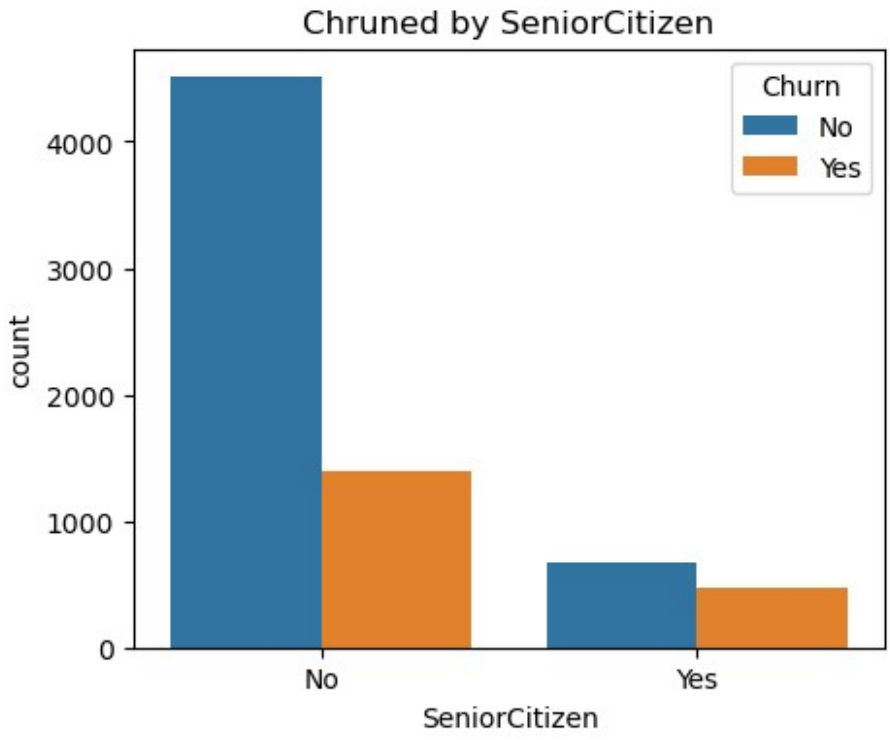
```
plt.figure(figsize = (5,4))
sns.countplot(x = 'gender', data = df, hue = "Churn")
plt.title("Chruned by Gender")
plt.show()
```




```
plt.figure(figsize = (3,4))
ax = sns.countplot(x = "SeniorCitizen", data = df)
ax.bar_label(ax.containers[0])
plt.title("Count of Customers by Senior Cityzen")
plt.show()
```

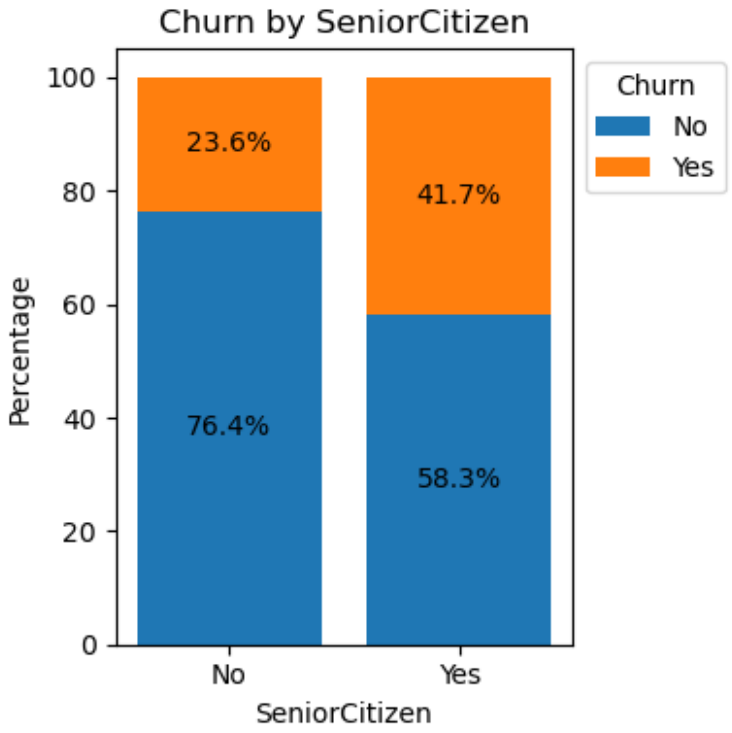



```
plt.figure(figsize = (5,4))
sns.countplot(x = 'SeniorCitizen', data = df, hue = "Churn")
plt.title("Chruned by SeniorCitizen")
plt.show()
```



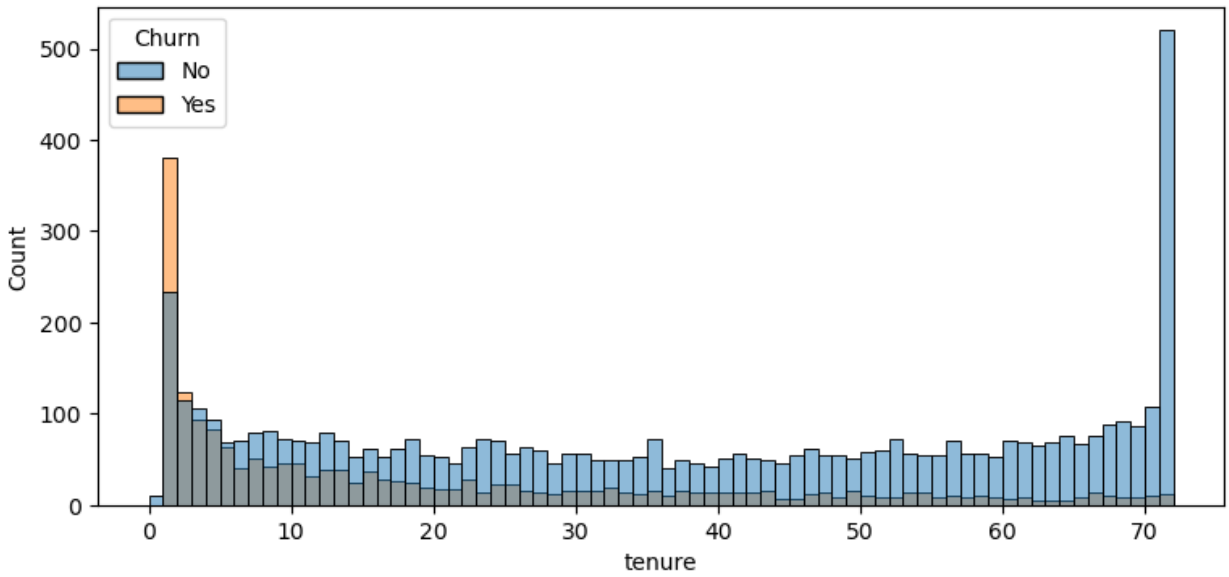

```
grouped = df.groupby(['SeniorCitizen',
'Churn']).size().reset_index(name='count')
total = grouped.groupby('SeniorCitizen')['count'].transform('sum')
grouped['percentage'] = (grouped['count'] / total * 100).round(1)

# Pivot for stacked bar chart
pivot = grouped.pivot(index='SeniorCitizen', columns='Churn',
values='percentage').fillna(0)

# Plot
fig, ax = plt.subplots(figsize=(4, 4))

# Stacked bar chart
bottom = None
for churn in pivot.columns:
    ax.bar(pivot.index, pivot[churn], label=churn, bottom=bottom)
    bottom = pivot[churn] if bottom is None else bottom + pivot[churn]

# Add percentage labels
for i, senior_citizen in enumerate(pivot.index):
    cumulative = 0
    for churn in pivot.columns:
        percentage = pivot.loc[senior_citizen, churn]
        if percentage > 0:
            ax.text(i, cumulative + percentage / 2, f"{percentage}%",
ha='center', va='center', fontsize=10)
            cumulative += percentage
```

```
# Formatting
plt.title("Churn by SeniorCitizen")
plt.xlabel("SeniorCitizen")
plt.ylabel("Percentage")
plt.xticks(pivot.index, labels=pivot.index.astype(str), rotation=0)
plt.legend(title="Churn", bbox_to_anchor = (1,1))
plt.tight_layout()

# Show plot
plt.show()
```



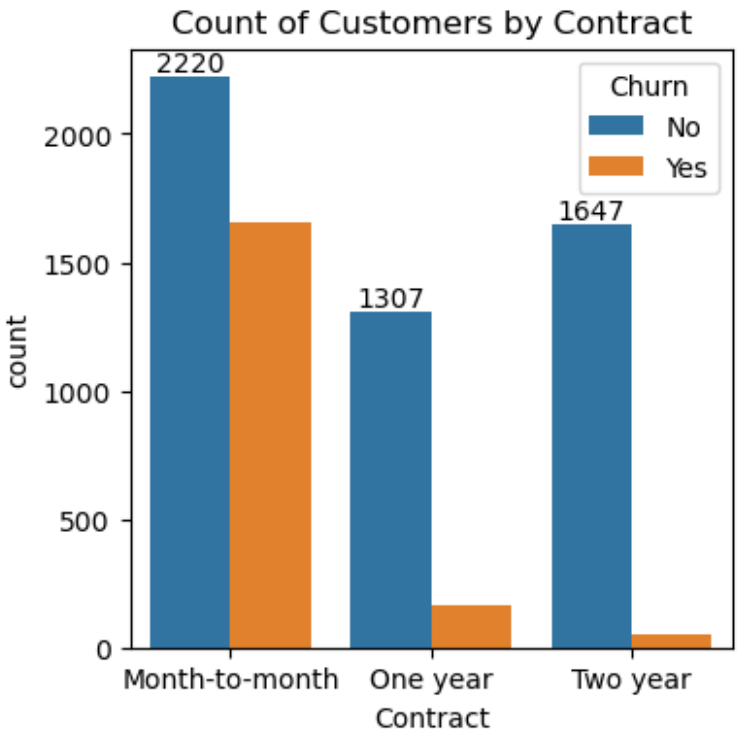
Comparatively a greater percentage of senoir cityzen have churned

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



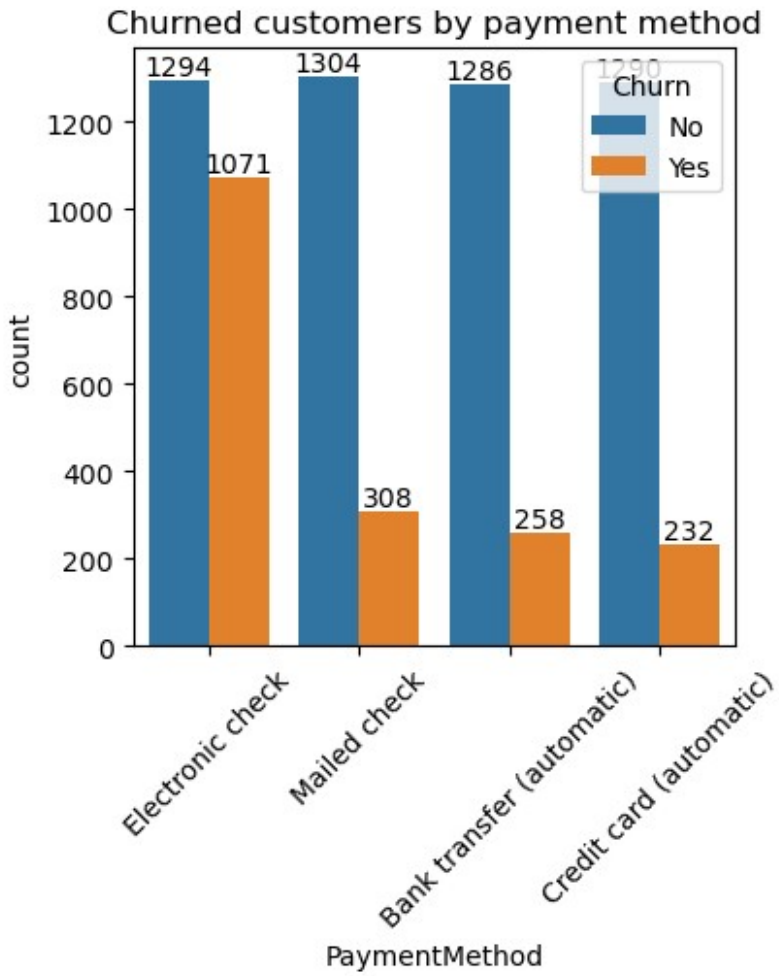
People who have used our services for long time have stayed and people who have used our services for one or two months have curned

```
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()
```



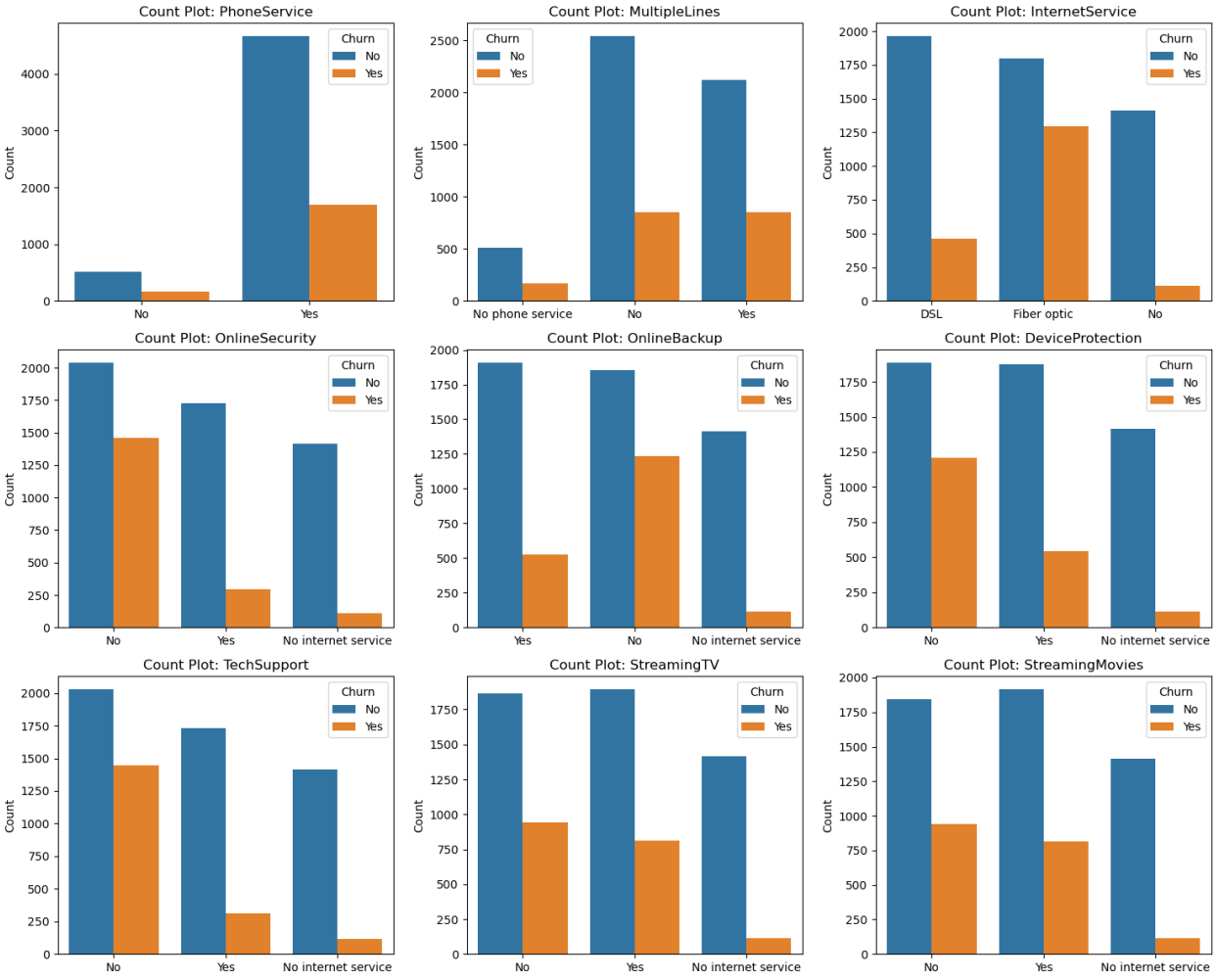
People who have month to month contract likely to churn than those who have 1 or 2 years of contract.

```
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)

plt.figure(figsize=(4, 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)  # Corrected method name
plt.show()
```




```
# List of columns to plot
columns1 = ['PhoneService', 'MultipleLines', 'InternetService',
           'OnlineSecurity', 'OnlineBackup', 'DeviceProtection',
           'TechSupport', 'StreamingTV', 'StreamingMovies']

n_cols = 3
n_rows = (len(columns) + n_cols-1)//n_cols  #calculate the number of
rows needed
# Create subplots
fig, axes = plt.subplots(n_rows, n_cols, figsize=(15, n_rows*4))  #
Adjust figsize as needed ,3x3 grid for 9 columns
axes = axes.flatten()  # Flatten axes array for easy iteration

# Generate 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: {col}')
    axes[i].set_xlabel('')
```

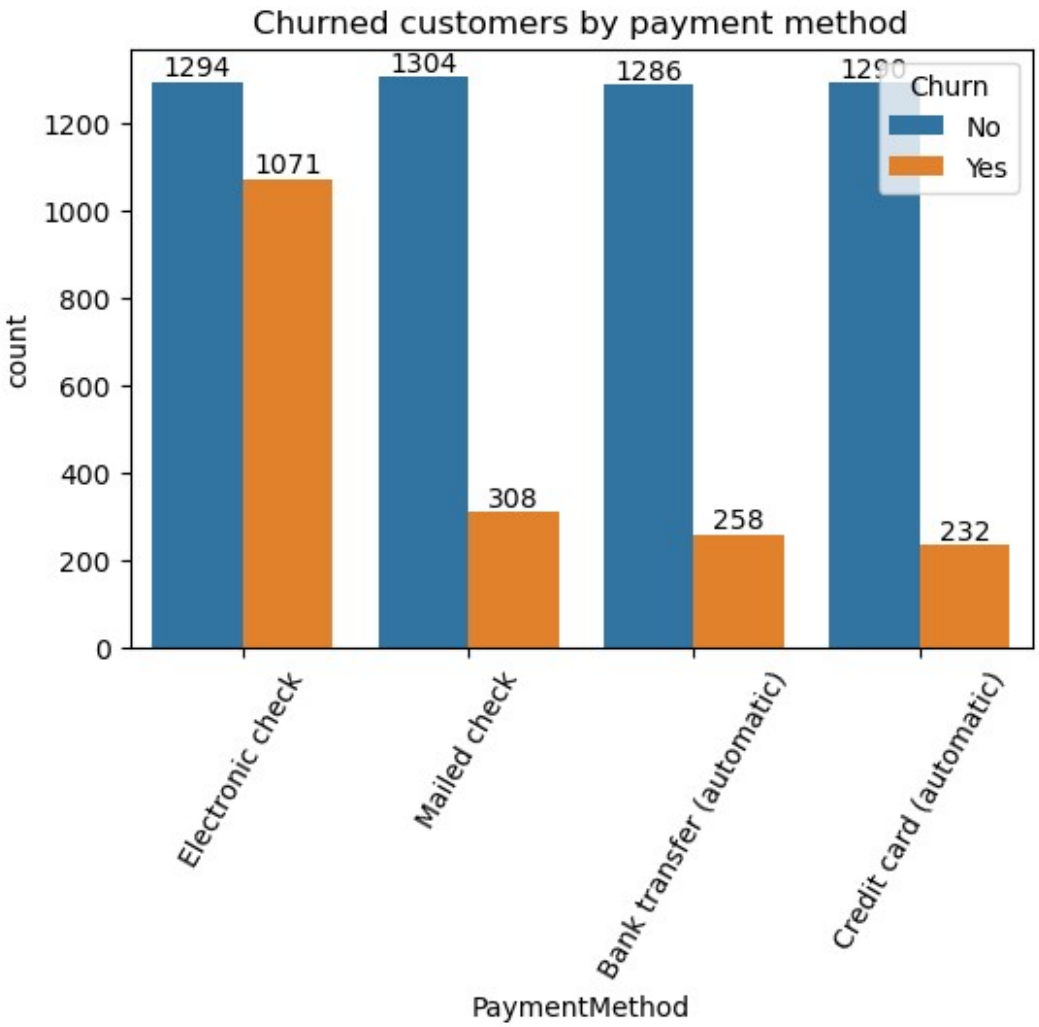
```
    axes[i].set_ylabel('Count')

# Hide any unused subplots (if columns < grid slots)
for j in range(len(columns), len(axes)):
    axes[j].axis('off')

# Adjust layout
plt.tight_layout()
plt.show()
```



The mejority of customer who do not churn tend to have services like phone service , internet service(DSL),and online security enabled.

for services like online backup,tech support and streaming tv churn rates are noticebly higher when these services are not useed or 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=60)  # Corrected method name
plt.show()
```



Customers are likely to churn when they are are using electronic check as a payment method.