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

df=pd.read_csv("Telco_Customer_churn.csv")
print(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.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.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 senior citizen to yes/no to make it easier to understand

```
df.head(21)
```

```
    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
5   9305-CDSKC  Female            no       No          No        8
Yes
6   1452-KIOVK    Male            no       No         Yes       22
Yes
7   6713-OKOMC  Female            no       No          No       10
No
8   7892-POOKP  Female            no      Yes          No       28
Yes
9   6388-TABGU    Male            no       No         Yes       62
Yes
10  9763-GRSKD    Male            no      Yes         Yes       13
Yes
11  7469-LKBCI    Male            no       No          No       16
Yes
12  8091-TTVAX    Male            no      Yes          No       58
Yes
13  0280-XJGEX    Male            no       No          No       49
Yes
14  5129-JLPIS    Male            no       No          No       25
Yes
15  3655-SNQYZ  Female            no      Yes         Yes       69
Yes
16  8191-XWSZG  Female            no       No          No       52
Yes
17  9959-WOFKT    Male            no       No         Yes       71
Yes
18  4190-MFLUW  Female            no      Yes         Yes       10
Yes
19  4183-MYFRB  Female            no       No          No       21
Yes
20  8779-QRDMV    Male           yes       No          No        1
No

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

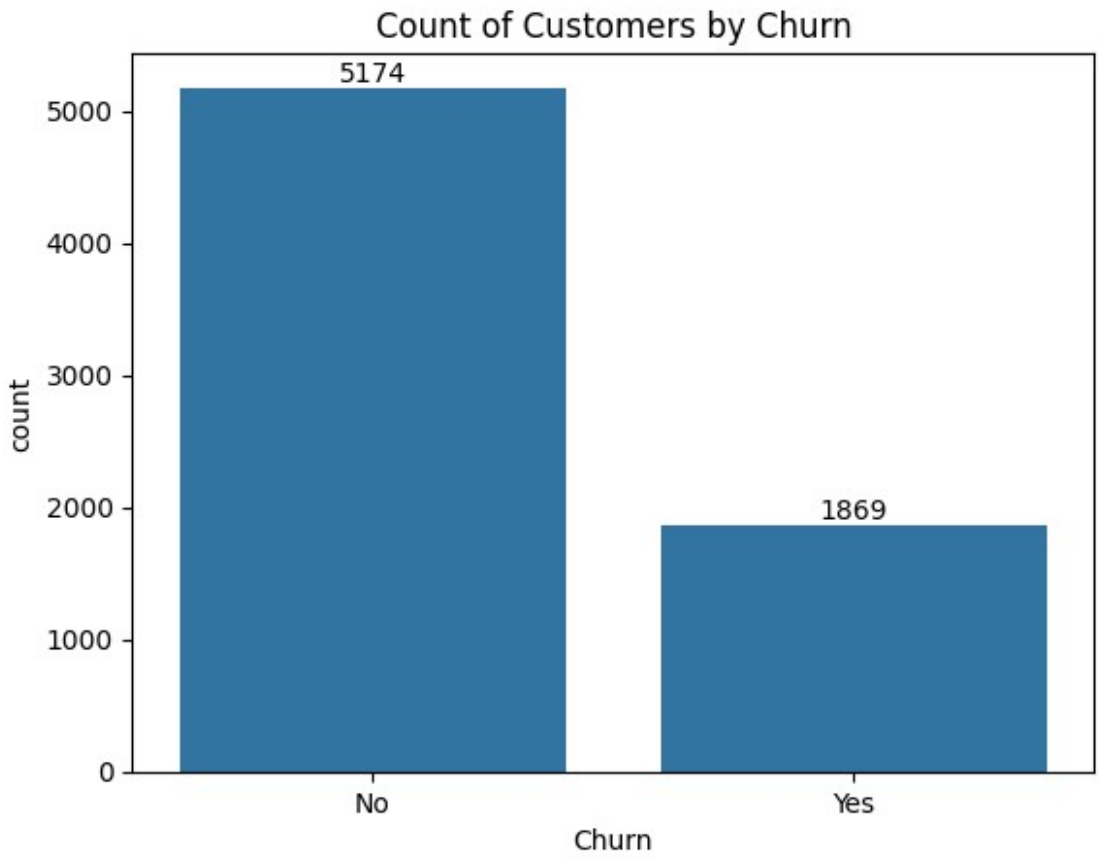
```
7   No phone service             DSL                  Yes  ...
8                Yes     Fiber optic                   No  ...
9                 No             DSL                  Yes  ...
10                No             DSL                  Yes  ...
11                No              No  No internet service  ...
12               Yes     Fiber optic                   No  ...
13               Yes     Fiber optic                   No  ...
14                No     Fiber optic                  Yes  ...
15               Yes     Fiber optic                  Yes  ...
16                No              No  No internet service  ...
17               Yes     Fiber optic                  Yes  ...
18                No             DSL                   No  ...
19                No     Fiber optic                   No  ...
20  No phone service             DSL                   No  ...

       DeviceProtection          TechSupport          StreamingTV  \
0                    No                   No                   No
1                   Yes                   No                   No
2                    No                   No                   No
3                   Yes                  Yes                   No
4                    No                   No                   No
5                   Yes                   No                  Yes
6                    No                   No                  Yes
7                    No                   No                   No
8                   Yes                  Yes                  Yes
9                    No                   No                   No
10                   No                   No                   No
11  No internet service  No internet service  No internet service
12                  Yes                   No                  Yes
13                  Yes                   No                  Yes
14                  Yes                  Yes                  Yes
15                  Yes                  Yes                  Yes
16  No internet service  No internet service  No internet service
17                  Yes                   No                  Yes
18                  Yes                  Yes                   No
19                  Yes                   No                   No
20                  Yes                   No                   No

        StreamingMovies        Contract PaperlessBilling  \
0                    No  Month-to-month              Yes
1                    No        One year               No
2                    No  Month-to-month              Yes
3                    No        One year               No
4                    No  Month-to-month              Yes
5                   Yes  Month-to-month              Yes
6                    No  Month-to-month              Yes
7                    No  Month-to-month               No
8                   Yes  Month-to-month              Yes
9                    No        One year               No
```

```
10                   No  Month-to-month              Yes
11  No internet service        Two year               No
12                  Yes        One year               No
13                  Yes  Month-to-month              Yes
14                  Yes  Month-to-month              Yes
15                  Yes        Two year               No
16  No internet service        One year               No
17                  Yes        Two year               No
18                   No  Month-to-month               No
19                  Yes  Month-to-month              Yes
20                  Yes  Month-to-month              Yes
```

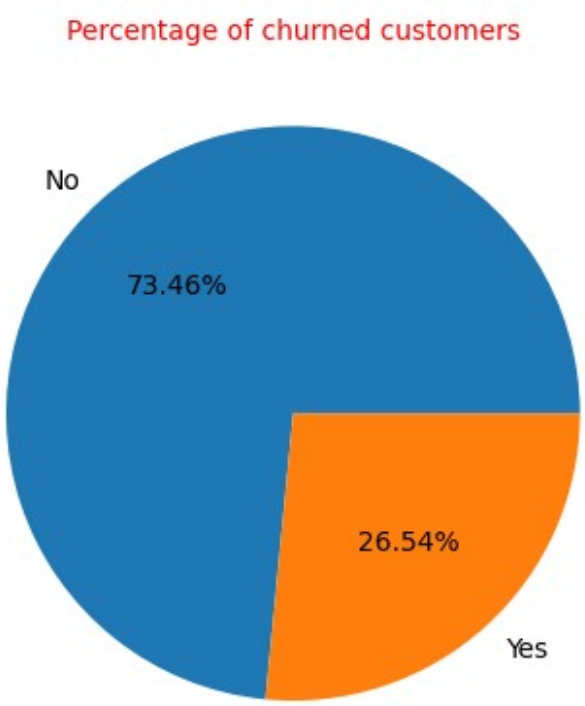
```
                PaymentMethod MonthlyCharges  TotalCharges  Churn
0            Electronic check          29.85         29.85     No
1                Mailed check          56.95       1889.50     No
2                Mailed check          53.85        108.15    Yes
3   Bank transfer (automatic)          42.30       1840.75     No
4            Electronic check          70.70        151.65    Yes
5            Electronic check          99.65        820.50    Yes
6     Credit card (automatic)          89.10       1949.40     No
7                Mailed check          29.75        301.90     No
8            Electronic check         104.80       3046.05    Yes
9   Bank transfer (automatic)          56.15       3487.95     No
10               Mailed check          49.95        587.45     No
11    Credit card (automatic)          18.95        326.80     No
12    Credit card (automatic)         100.35       5681.10     No
13  Bank transfer (automatic)         103.70       5036.30    Yes
14           Electronic check         105.50       2686.05     No
15    Credit card (automatic)         113.25       7895.15     No
16               Mailed check          20.65       1022.95     No
17  Bank transfer (automatic)         106.70       7382.25     No
18    Credit card (automatic)          55.20        528.35    Yes
19           Electronic check          90.05       1862.90     No
20           Electronic check          39.65         39.65    Yes
```

```
[21 rows x 21 columns]
```

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

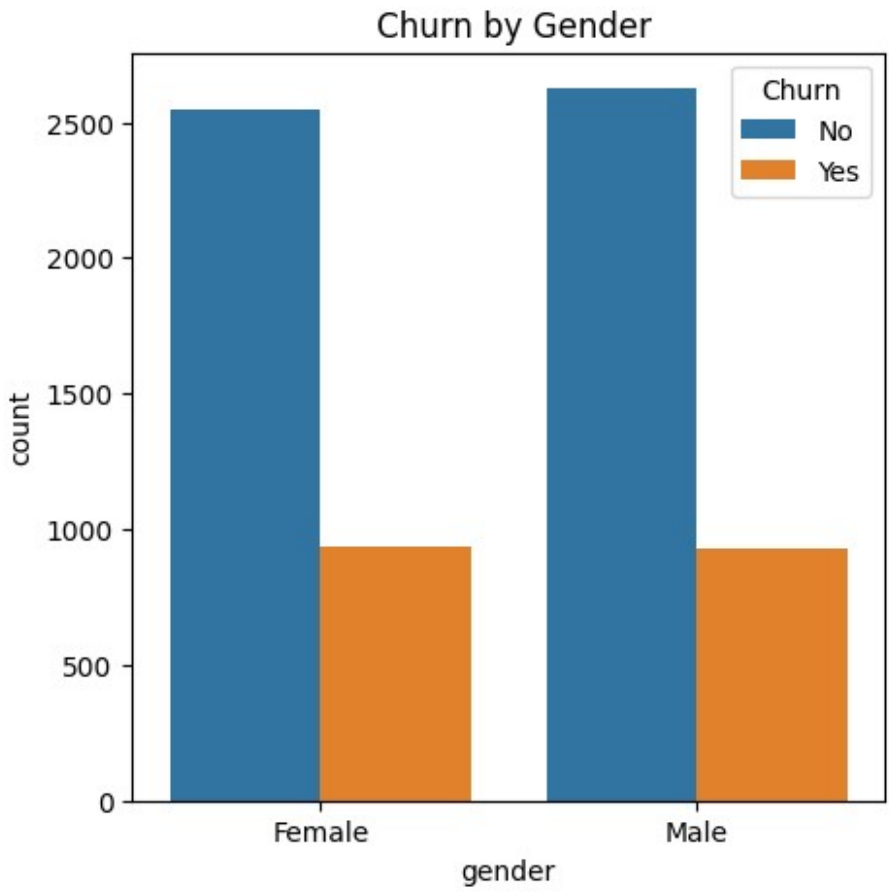



```
gb= df.groupby("Churn").agg({"Churn":"count"})
plt.pie(gb["Churn"],labels = gb.index , autopct="%1.2f%%")
plt.title("Percentage of churned customers", fontsize = 10 , color=
"red")
plt.show()
```



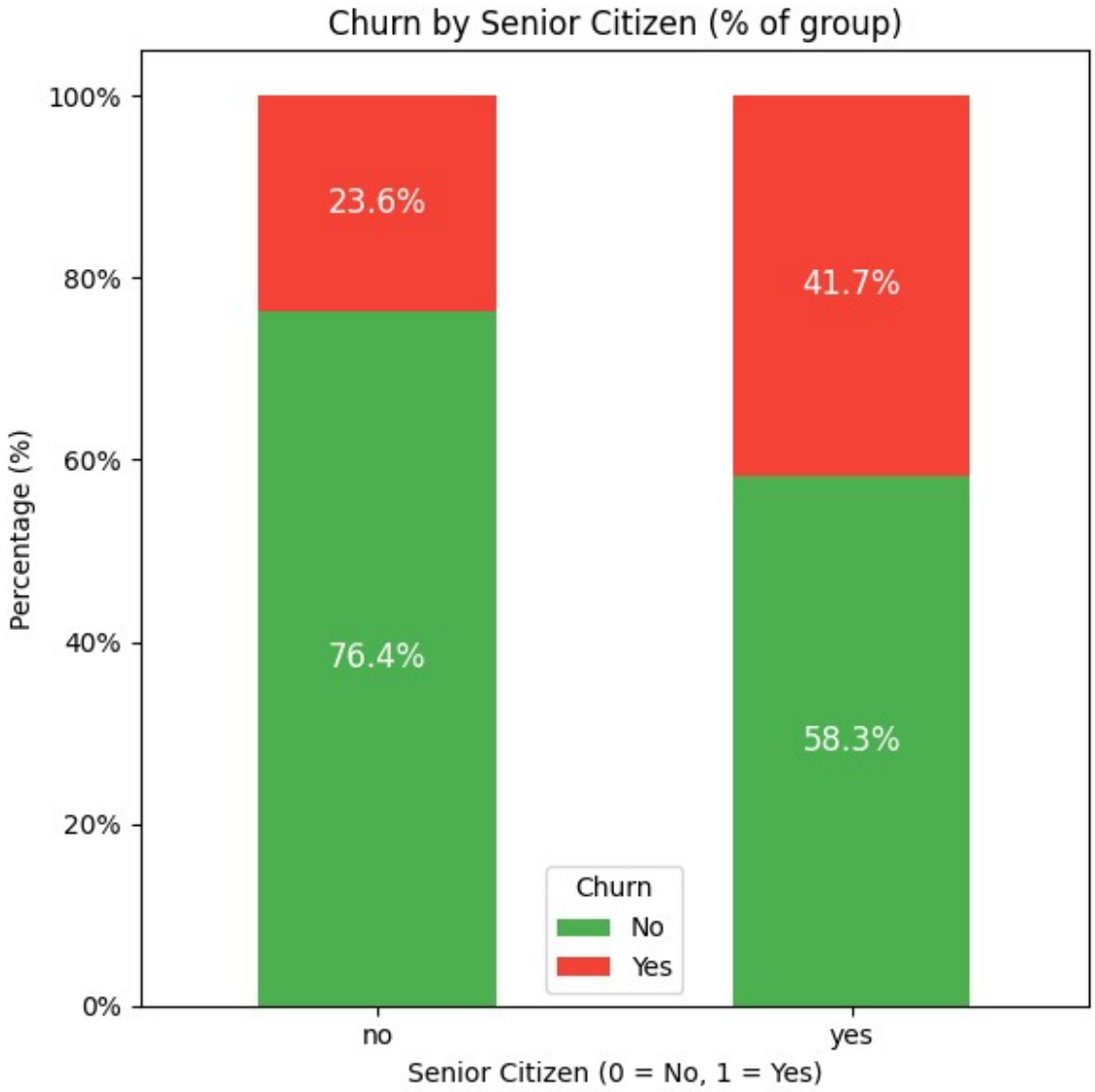
#26.54% of our customers are churned out

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



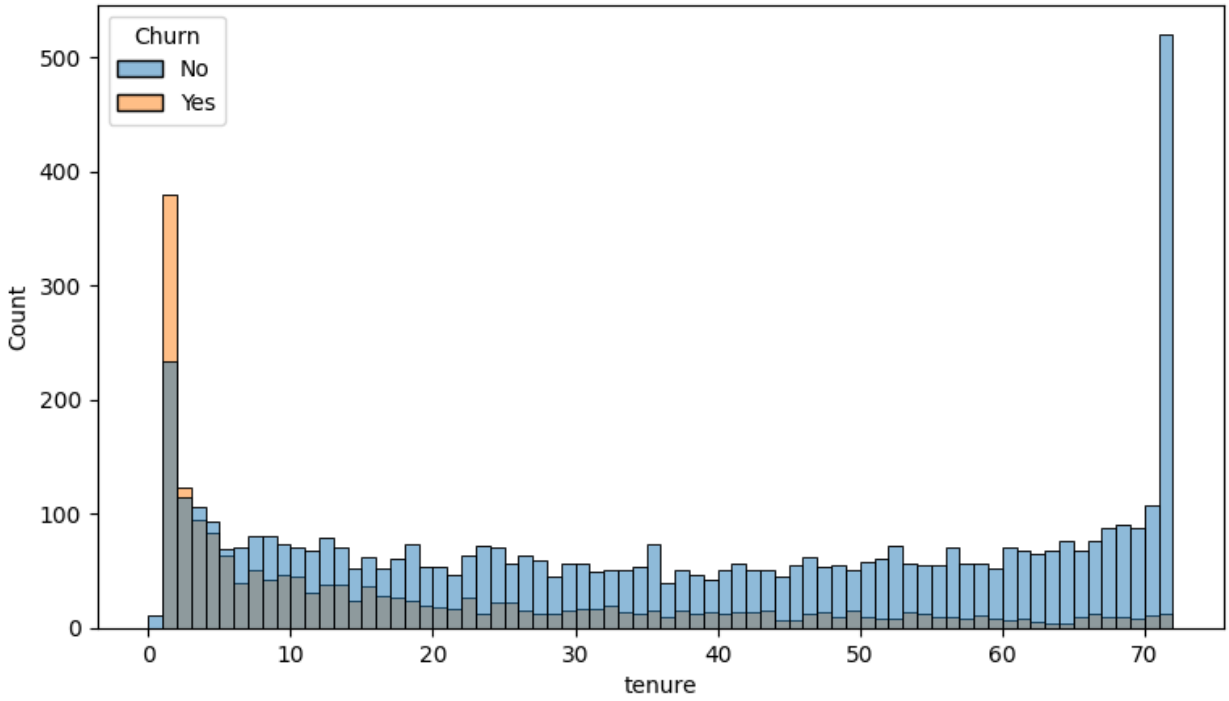

```
import pandas as pd
import matplotlib.pyplot as plt
import matplotlib.ticker as mtick

# Step 1: Calculate churn percentages per SeniorCitizen group
counts = df.groupby(['SeniorCitizen',
'Churn']).size().unstack(fill_value=0)
perc = counts.div(counts.sum(axis=1), axis=0) * 100

# Step 2: Plot the percentage-stacked bar chart
fig, ax = plt.subplots(figsize=(6,6))
perc.plot(kind='bar', stacked=True,
          color=['#4CAF50', '#F44336'], ax=ax)
ax.set_ylabel('Percentage (%)')
ax.set_xlabel('Senior Citizen (0 = No, 1 = Yes)')
ax.set_title('Churn by Senior Citizen (% of group)')
ax.yaxis.set_major_formatter(mtick.PercentFormatter())
ax.legend(title='Churn')

# Step 3: Annotate percentage labels in the center of each segment
for p in ax.patches:
    height = p.get_height()
```

```
    if height > 0:
        x = p.get_x() + p.get_width() / 2
        y = p.get_y() + height / 2
        ax.annotate(f'{height:.1f}%', (x, y),
                    ha='center', va='center',
                    color='white', fontsize=12)

plt.xticks(rotation=0)
plt.tight_layout()
plt.show()
```



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

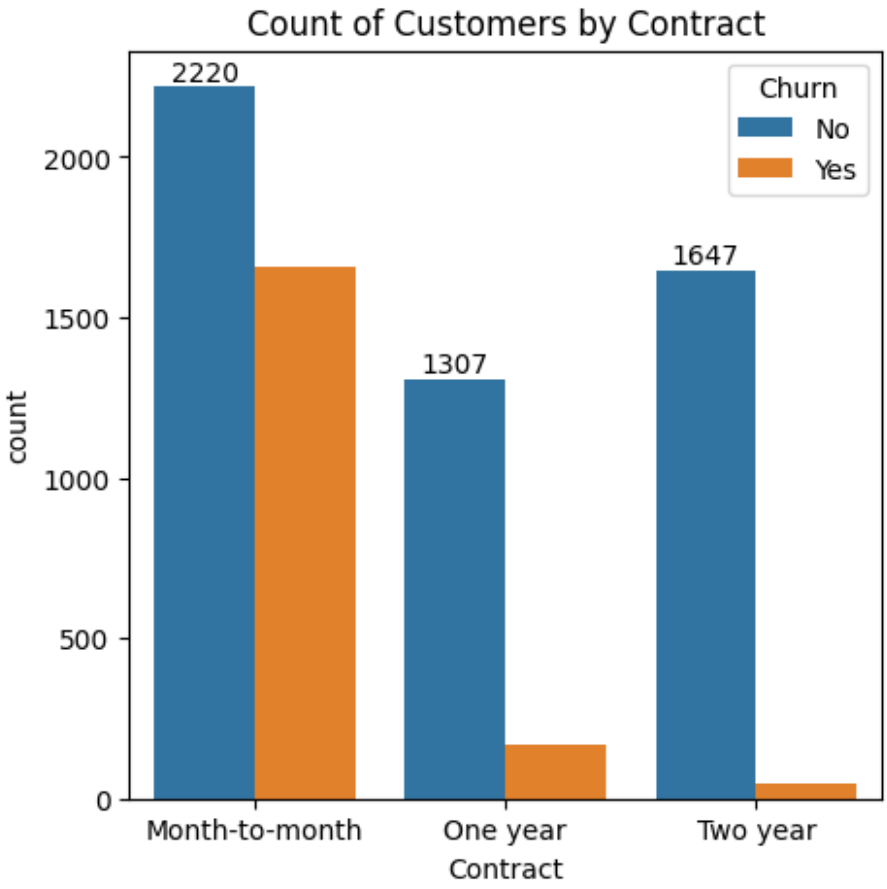
```
plt.figure(figsize = (9,5))
sns.histplot(x = "tenure" , data = df , bins = 72, hue="Churn")
plt.show()
```



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

```
plt.figure(figsize = (5,5))
ax= sns.countplot(x="Contract",data = df , hue ="Churn")
ax.bar_label(ax.containers[0])
plt.title("Count of Customers by Contract")
plt.show()plt.figure(figsize = (5,5))
ax= sns.countplot(x="Contract",data = df , hue ="Churn")
ax.bar_label(ax.containers[0])
plt.title("Count of Customers by Contract")
plt.show()plt.figure(figsize = (5,5))
ax= sns.countplot(x="Contract",data = df , hue ="Churn")
ax.bar_label(ax.containers[0])
plt.title("Count of Customers by Contract")
plt.show()plt.figure(figsize = (5,5))
ax= sns.countplot(x="Contract",data = df , hue ="Churn")
ax.bar_label(ax.containers[0])
```

```
plt.title("Count of Customers by Contract")
plt.show()
```

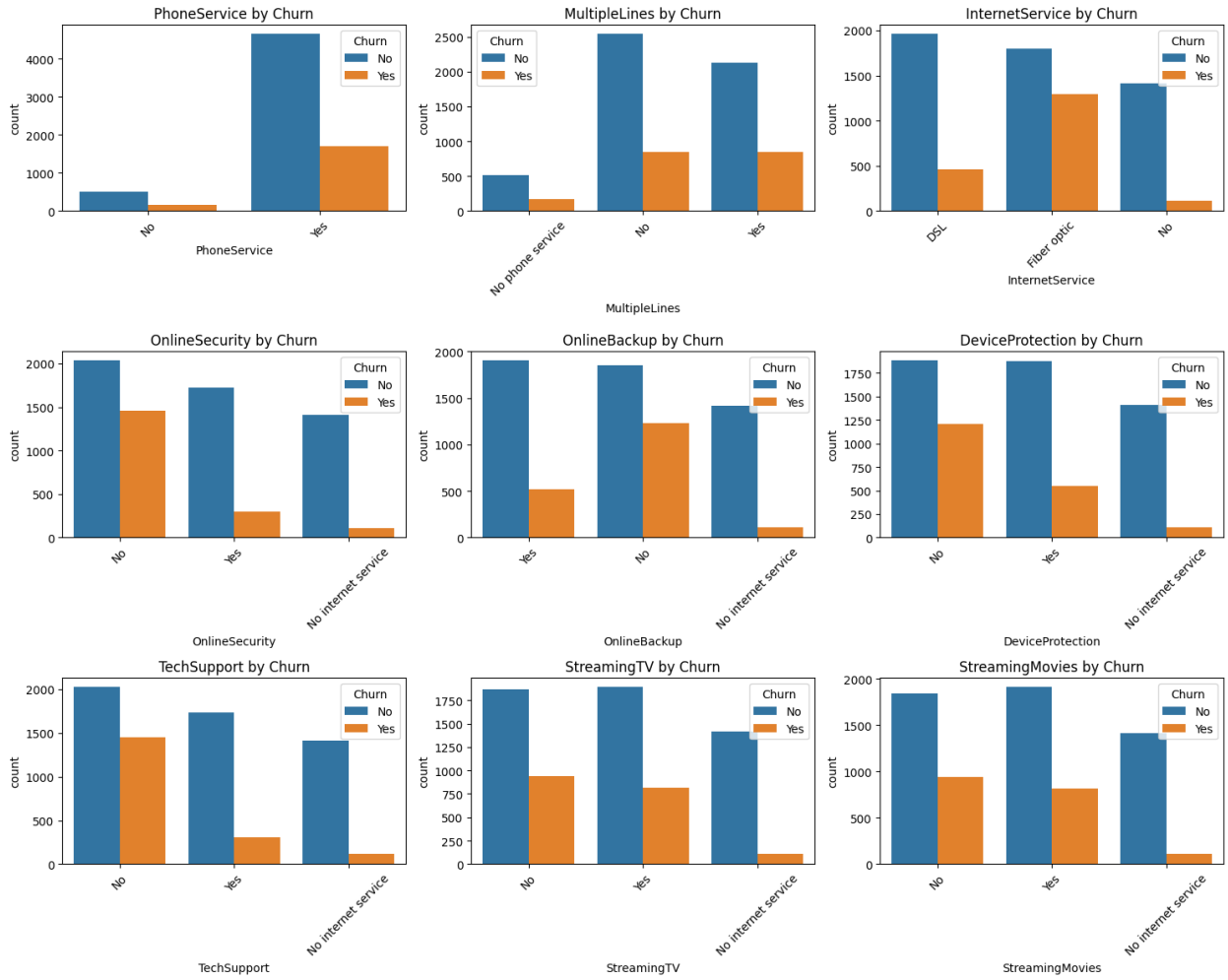


People who have month to month contract are likely to churn then from those who one or two year contract

```
df.columns.values
```

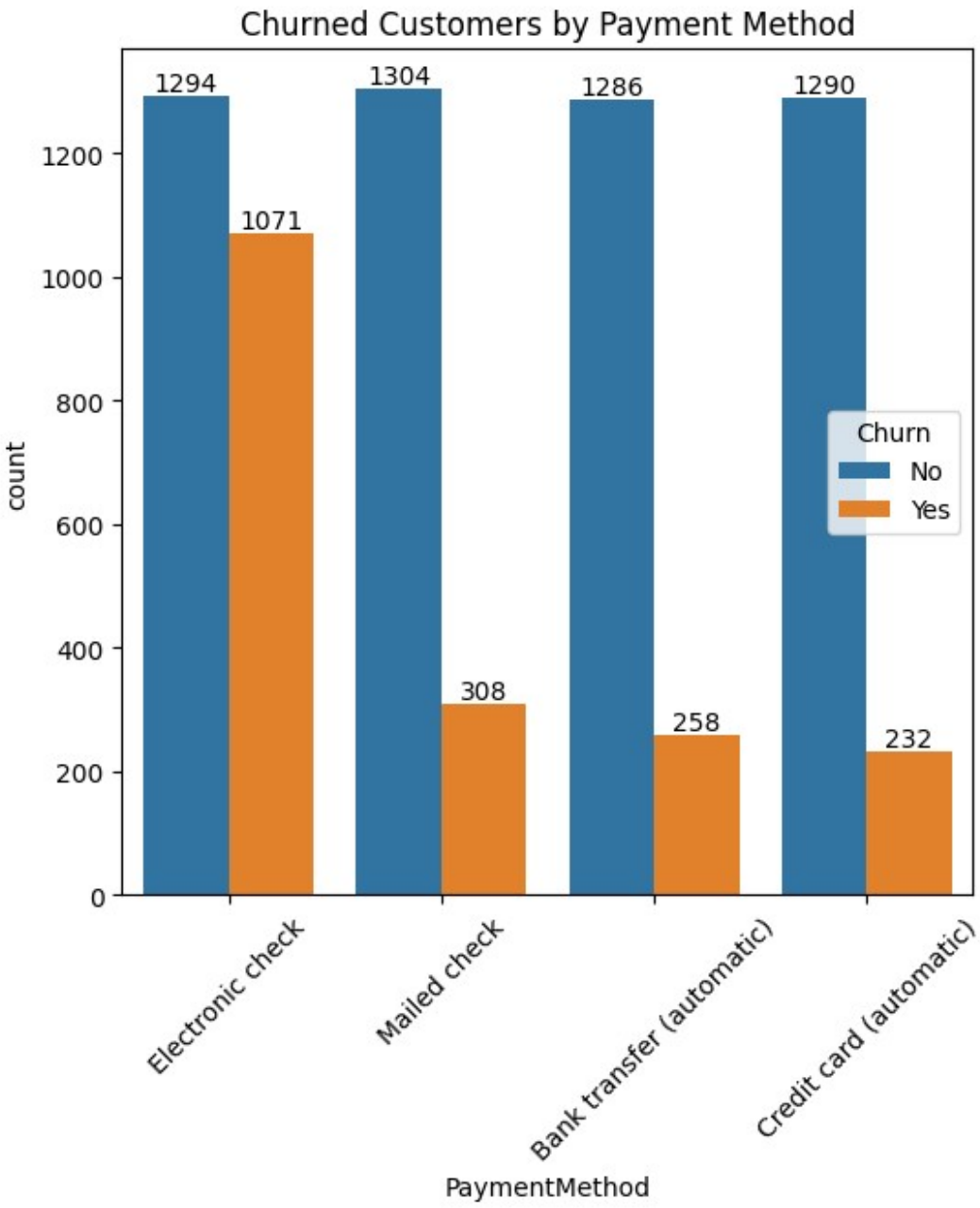
```
array(['customerID', 'gender', 'SeniorCitizen', 'Partner',
'Dependents',
       'tenure', 'PhoneService', 'MultipleLines', 'InternetService',
       'OnlineSecurity', 'OnlineBackup', 'DeviceProtection',
       'TechSupport', 'StreamingTV', 'StreamingMovies', 'Contract',
       'PaperlessBilling',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

```
import matplotlib.pyplot as plt
import seaborn as sns

cols = [
    'PhoneService', 'MultipleLines', 'InternetService',
    'OnlineSecurity', 'OnlineBackup', 'DeviceProtection',
    'TechSupport', 'StreamingTV', 'StreamingMovies'
]

n = len(cols)
cols_per_row = 3
rows = (n + cols_per_row - 1) // cols_per_row

fig, axes = plt.subplots(rows, cols_per_row, figsize=(5 *
cols_per_row, 4 * rows), sharey=False)
axes = axes.flatten()

for ax, col in zip(axes, cols):
    sns.countplot(x=col, hue='Churn', data=df, ax=ax)
    ax.set_title(f'{col} by Churn')
    ax.legend(title='Churn')
    ax.tick_params(axis='x', rotation=45)

# Hide any unused subplots
for ax in axes[len(cols):]:
    fig.delaxes(ax)

plt.tight_layout()
plt.show()
```



Customers on fiber-optic internet show the highest churn, while phone service and multiple lines have minimal churn impact. Not subscribing to extras like security, backup, device protection, or tech support increases churn risk, whereas streaming services moderately raise it. Bundled internet and add-ons tend to exhibit stronger churn dynamics.

```
plt.figure(figsize = (6,6))
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 payment check as a payemnt method