```
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
```

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

replacing blanks with 0 as tenure is 0 and no total charges are recorded

```
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()
```

```
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)
```

i converted 0 to 1 values of senior citizen to yes or no to make it easier to understand

```
df.head(30)
```

```
    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
21  1680-VDCWW    Male            no     Yes          No      12
Yes
22  1066-JKSGK    Male            no      No          No       1
Yes
23  3638-WEABW  Female            no     Yes          No      58
Yes
24  6322-HRPFA    Male            no     Yes         Yes      49
Yes
25  6865-JZNKO  Female            no      No          No      30
Yes
26  6467-CHFZW    Male            no     Yes         Yes      47
Yes
27  8665-UTDHZ    Male            no     Yes         Yes       1
No
28  5248-YGIJN    Male            no     Yes          No      72
Yes
29  8773-HHUOZ  Female            no      No         Yes      17
Yes

       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  ...
21               No              No  No internet service  ...
22               No              No  No internet service  ...
23              Yes             DSL                    No  ...
24               No             DSL                   Yes  ...
25               No             DSL                   Yes  ...
26              Yes     Fiber optic                    No  ...
27  No phone service             DSL                    No  ...
28              Yes             DSL                   Yes  ...
29               No             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
21  No internet service  No internet service  No internet service
22  No internet service  No internet service  No internet service
23                   No                  Yes                   No
24                   No                  Yes                   No
25                   No                   No                   No
26                   No                   No                  Yes
27                   No                   No                   No
28                  Yes                  Yes                  Yes
29                   No                   No                  Yes

        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
```

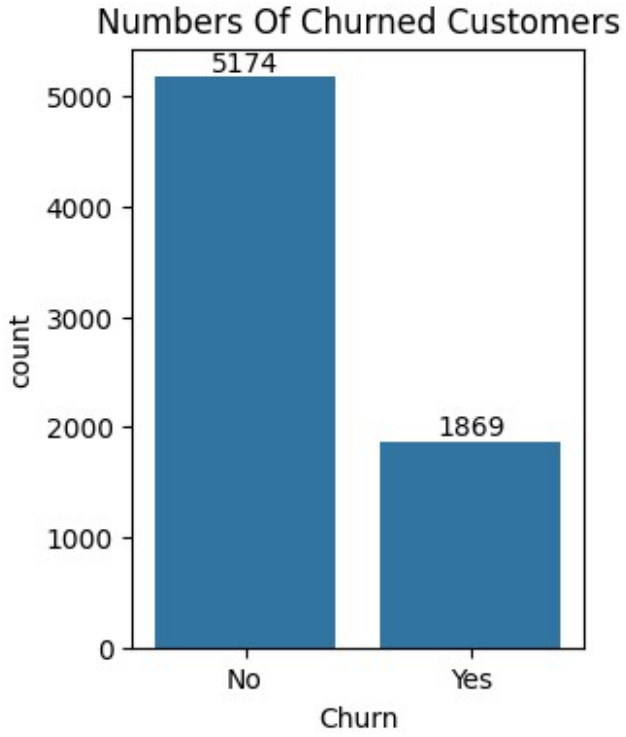
5	Yes	Month-to-month	Yes
6	No	Month-to-month	Yes
7	No	Month-to-month	No
8	Yes	Month-to-month	Yes
9	No	One year	No
10	No	Month-to-month	Yes
11	No internet service	Two year	No
12	Yes	One year	No
13	Yes	Month-to-month	Yes
14	Yes	Month-to-month	Yes
15	Yes	Two year	No
16	No internet service	One year	No
17	Yes	Two year	No
18	No	Month-to-month	No
19	Yes	Month-to-month	Yes
20	Yes	Month-to-month	Yes
21	No internet service	One year	No
22	No internet service	Month-to-month	No
23	No	Two year	Yes
24	No	Month-to-month	No
25	No	Month-to-month	Yes
26	Yes	Month-to-month	Yes
27	No	Month-to-month	No
28	Yes	Two year	Yes
29	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	Bank transfer (automatic)	19.80	202.25	No

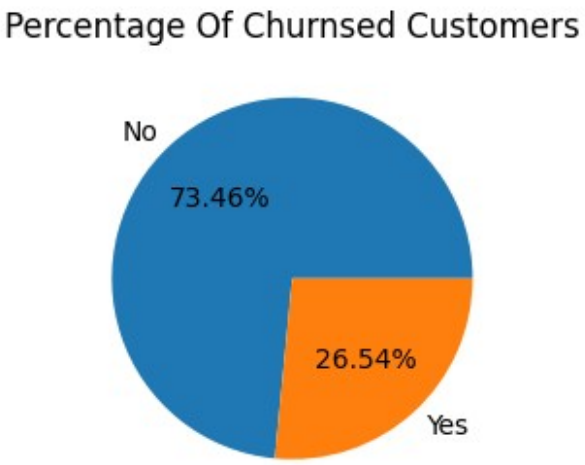
```
22                Mailed check          20.15         20.15    Yes
23    Credit card (automatic)          59.90       3505.10     No
24    Credit card (automatic)          59.60       2970.30     No
25  Bank transfer (automatic)          55.30       1530.60     No
26            Electronic check          99.35       4749.15    Yes
27            Electronic check          30.20         30.20    Yes
28    Credit card (automatic)          90.25       6369.45     No
29                Mailed check          64.70       1093.10    Yes

[30 rows x 21 columns]
```

```
plt.figure(figsize=(3,4))
ax = sns.countplot(x = 'Churn', data = df)
ax.bar_label(ax.containers[0])
plt.title("Numbers Of Churned Customers")
plt.show
```

```
<function matplotlib.pyplot.show(close=None, block=None)>
```



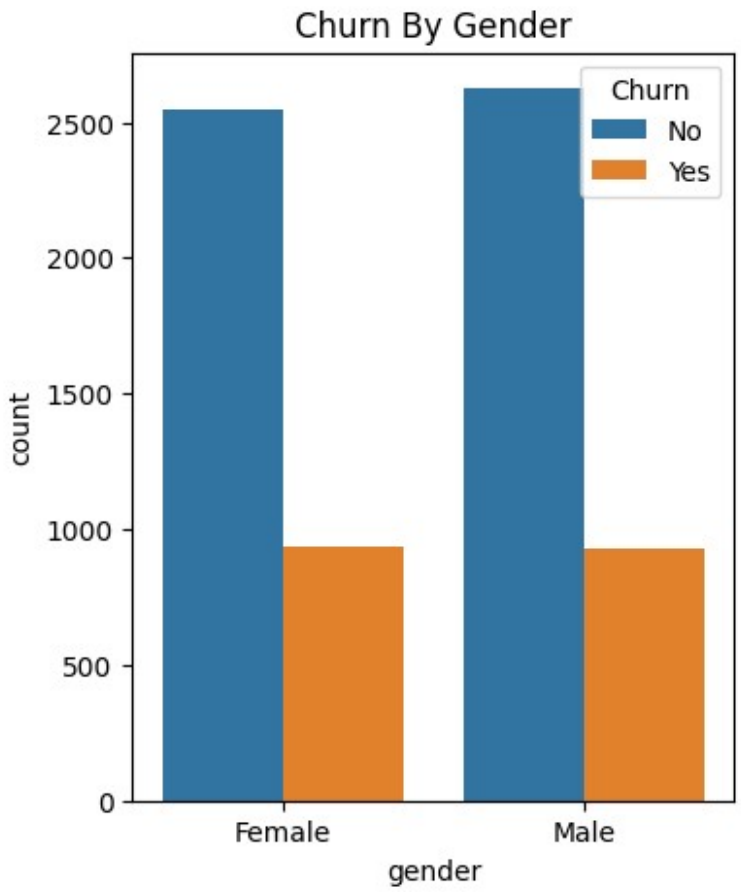

```
plt.figure(figsize=(3,4))
gb = df.groupby("Churn").agg({'Churn':"count"})
plt.pie(gb['Churn'], labels = gb.index, autopct = "%1.2f%%")
plt.title("Percentage Of Churnsed Customers")
plt.show()
```



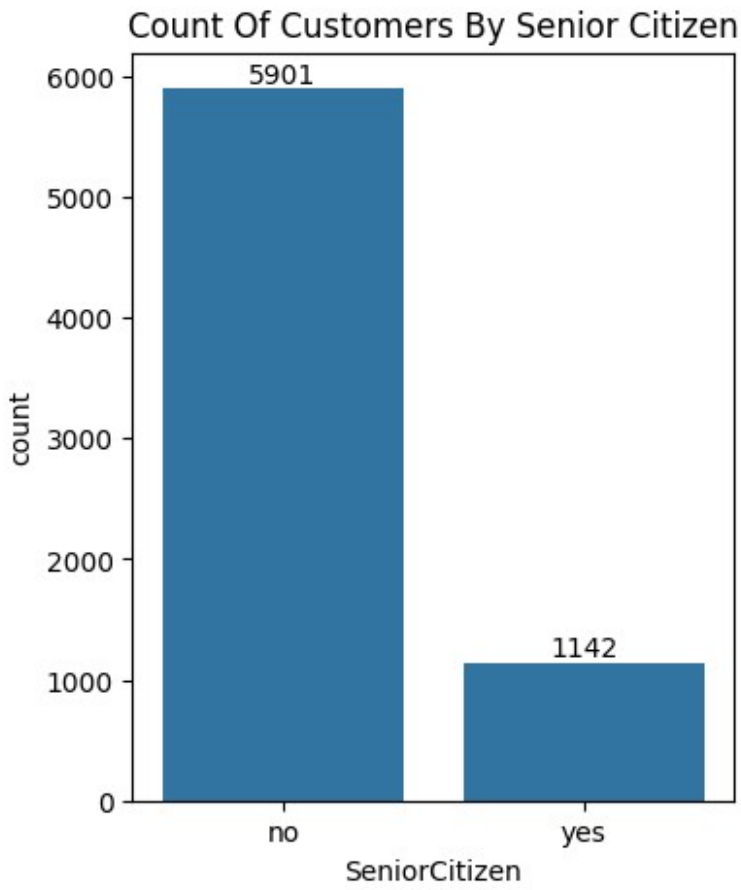
from the given pie chart we can conclude that 26.54% of our customers have churned out

now lets explore the reason behind it.

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

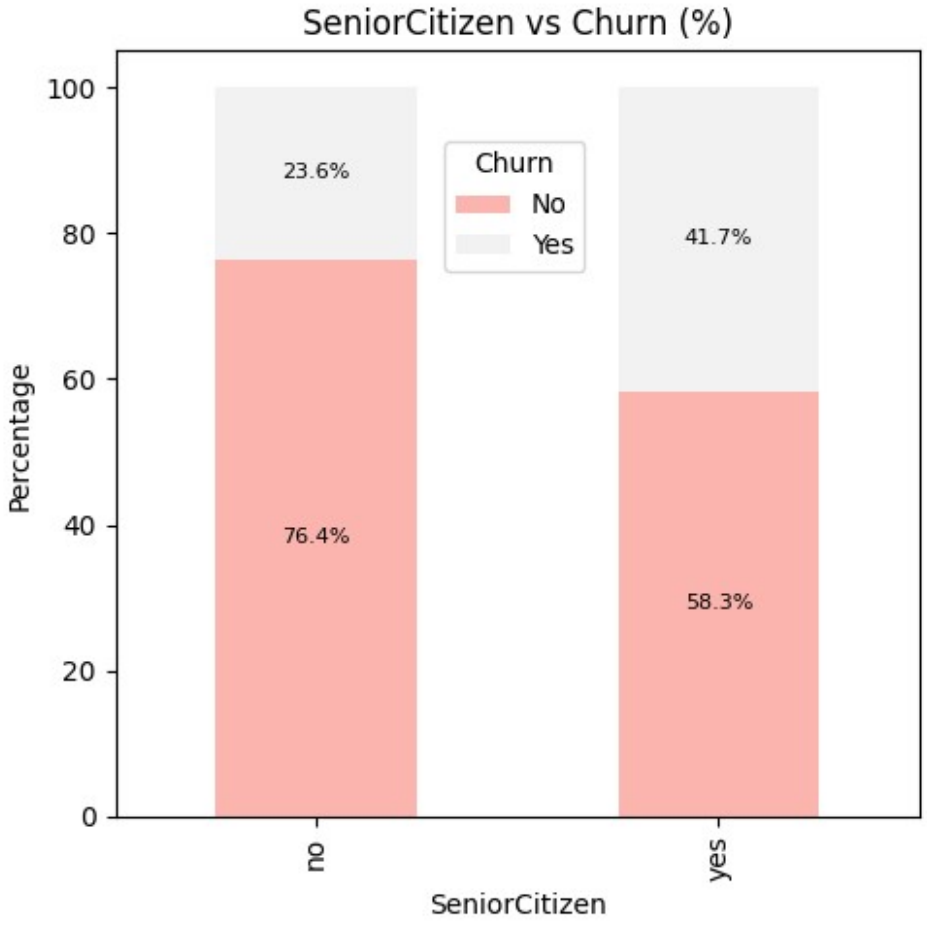



```
plt.figure(figsize= (4,5))
ax = sns.countplot(x = "SeniorCitizen",data = df )
ax.bar_label(ax.containers[0])
plt.title("Count Of Customers By Senior Citizen")
plt.show()
```



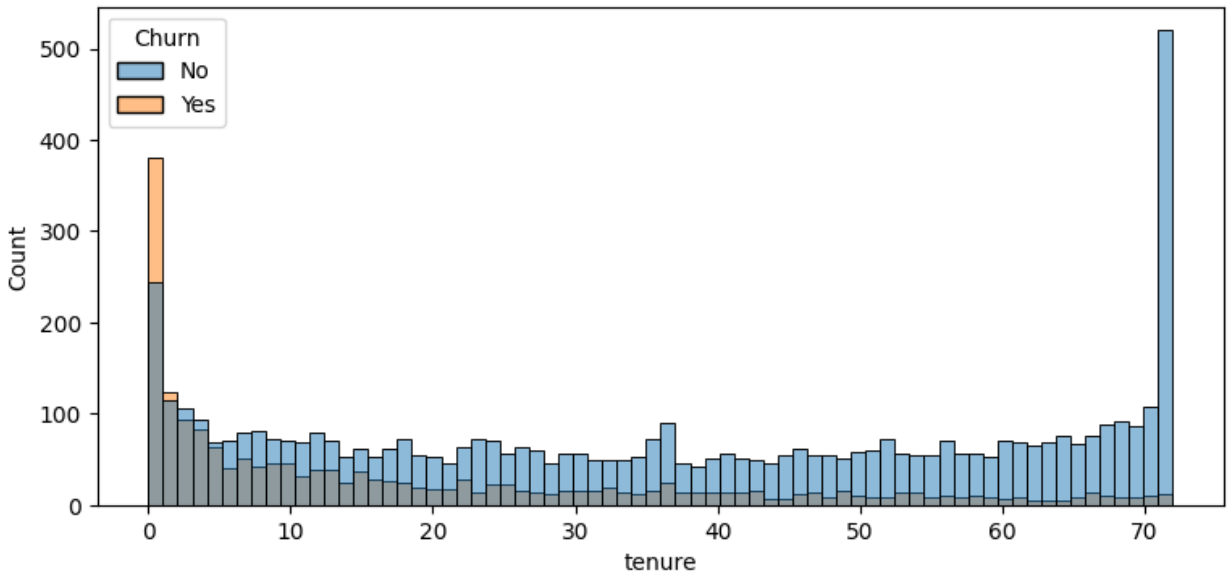

```
import pandas as pd
import matplotlib.pyplot as plt


ct = pd.crosstab(df['SeniorCitizen'], df['Churn'], normalize='index')
* 100


ax = ct.plot(kind='bar', stacked=True, figsize=(5,5),
colormap='Pastel1')


for container in ax.containers:
    ax.bar_label(container, fmt='%.1f%%', label_type='center',
fontsize=8)

plt.title('SeniorCitizen vs Churn (%)')
plt.ylabel('Percentage')
plt.xlabel('SeniorCitizen')
plt.legend(title='Churn')
plt.tight_layout()
plt.legend(title= 'Churn', bbox_to_anchor = (0.6,0.9))
```

```
plt.show()
```



comparatively a greater percentage of people in senior citizen have churned

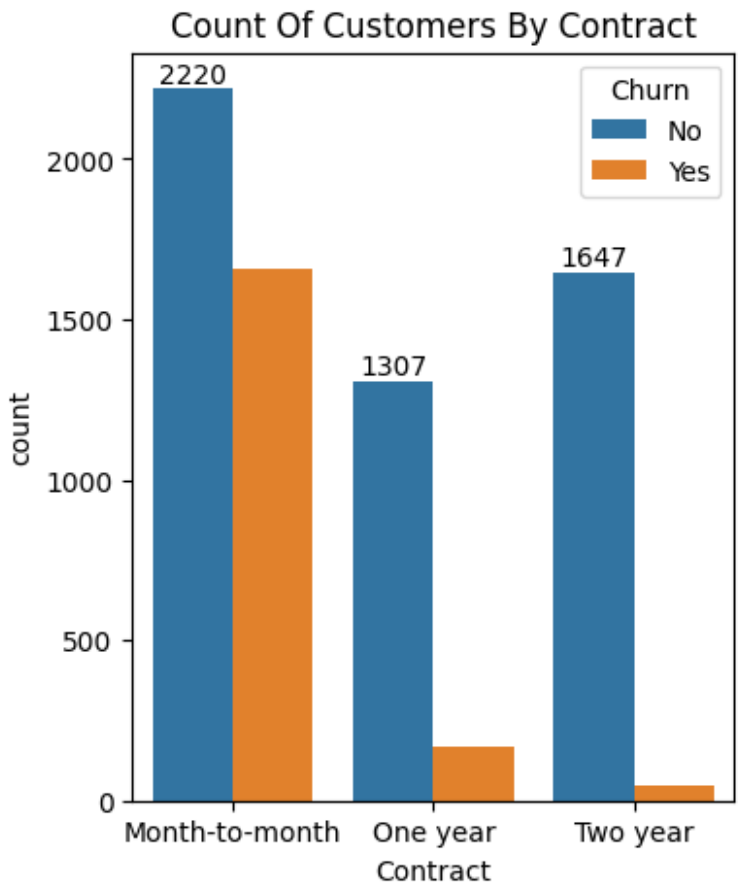
```
plt.figure(figsize = (9,4))
sns.histplot(x = "tenure", data = df, bins = 70, hue = "Churn")
plt.show()
```



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= (4,5))
ax = sns.countplot(x = "Contract",data = df, hue= "Churn")
ax.bar_label(ax.containers[0])
plt.title("Count Of Customers By Contract")
plt.show()
```



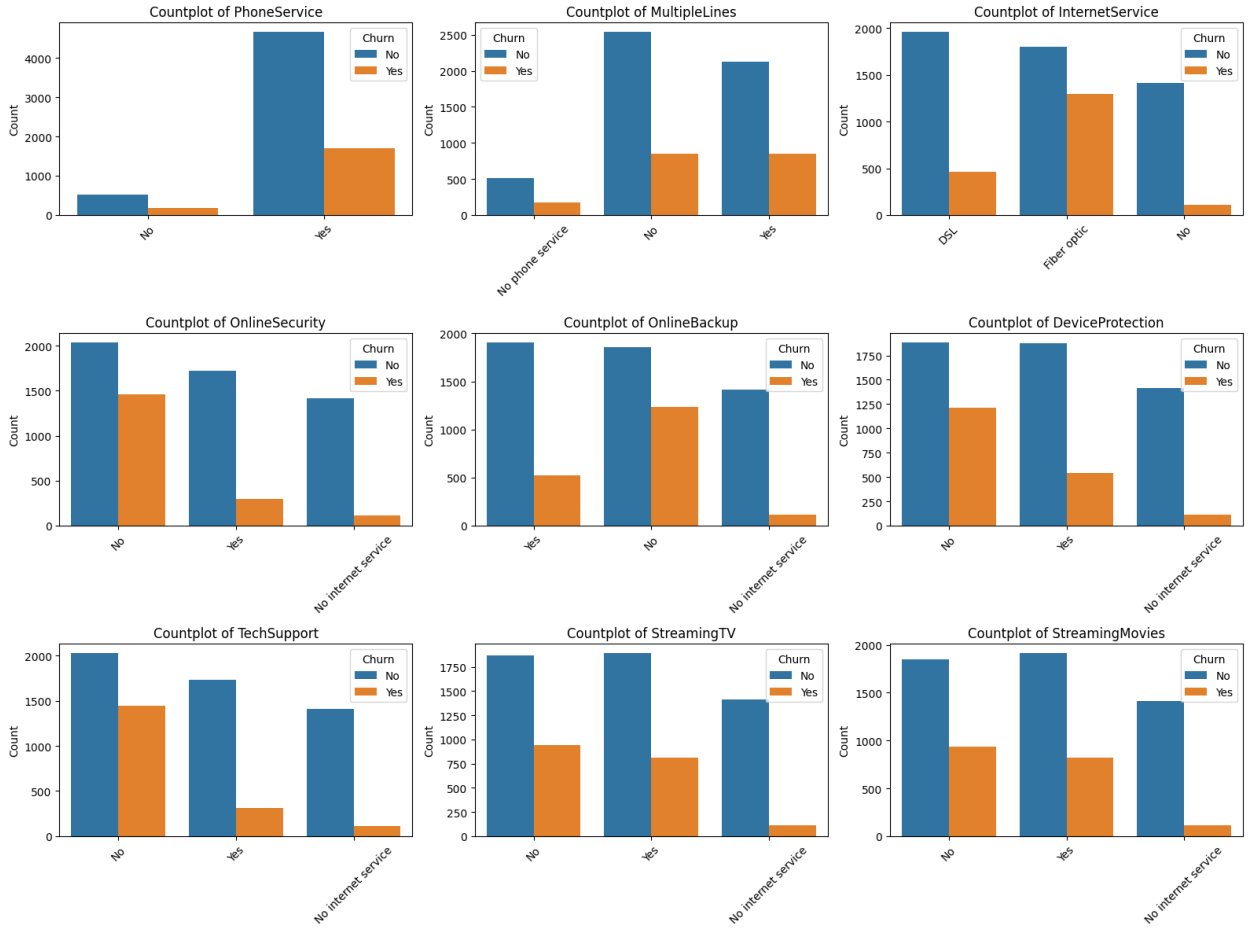
peple who have month to month churned than who have one year or two year contract

```
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


columns = [
    'PhoneService', 'MultipleLines', 'InternetService',
    'OnlineSecurity', 'OnlineBackup', 'DeviceProtection',
```

```
    'TechSupport', 'StreamingTV', 'StreamingMovies'
]


fig, axes = plt.subplots(3, 3, figsize=(16, 12))  # 3 rows, 3 columns
axes = axes.flatten()  # Flatten to easily loop

for i, col in enumerate(columns):
    sns.countplot(x=col, data=df, ax=axes[i], hue = "Churn")
    axes[i].set_title(f'Countplot of {col}')
    axes[i].set_xlabel('')
    axes[i].set_ylabel('Count')
    axes[i].tick_params(axis='x', rotation=45)

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

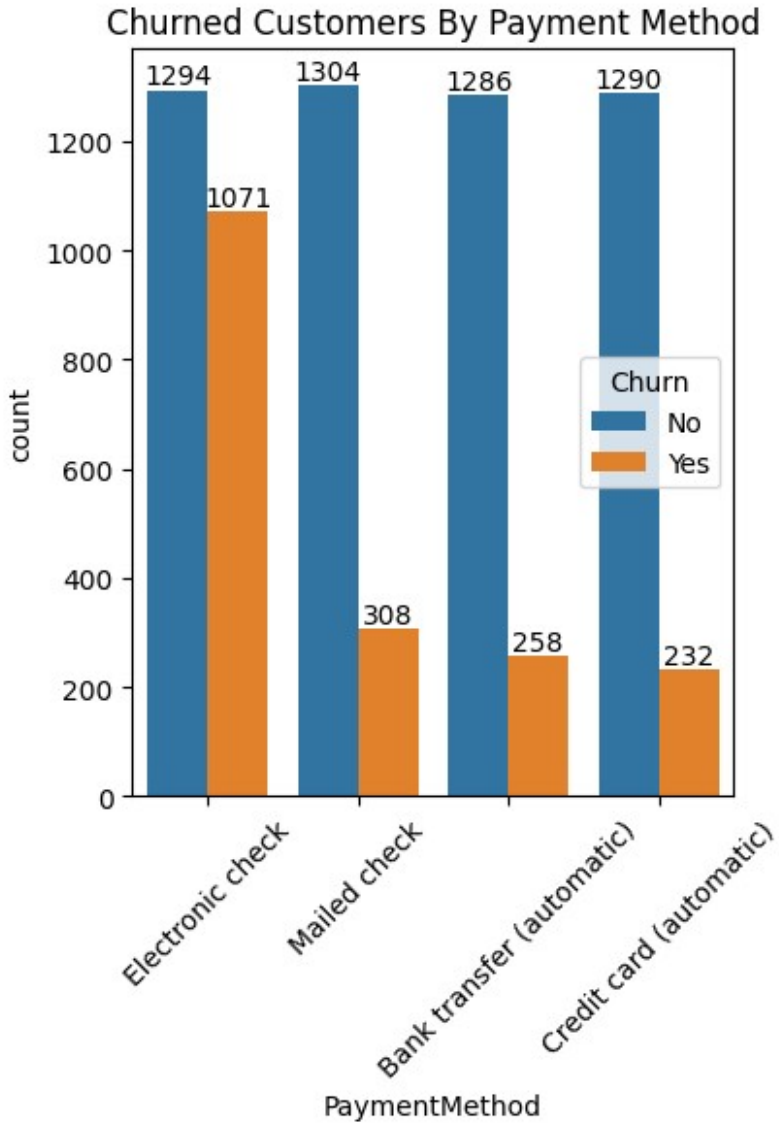


#VThe visualizations show the relationship between customer churn and various services like PhoneService,

#InternetService, OnlineSecurity, and StreamingTV. Customers without additional services (like OnlineSecurity

#churn compared to DSL users. Overall, lack of value-added services is linked to increased customer churn.

```
plt.figure(figsize= (4,5))
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 customer is using electronic check as payment