```
pip install numpy
```

```
Requirement already satisfied: numpy in c:\users\asus\anaconda3\lib\
site-packages (1.26.4)
Note: you may need to restart the kernel to use updated packages.
```

```
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.shape
```

```
(7043, 21)
```

```
df.columns= df.columns.str.lower()
```

```
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.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().any()
```

```
False
```

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

```
0
```

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

df["seniorcitizen"] = df["seniorcitizen"].apply(conv)
```

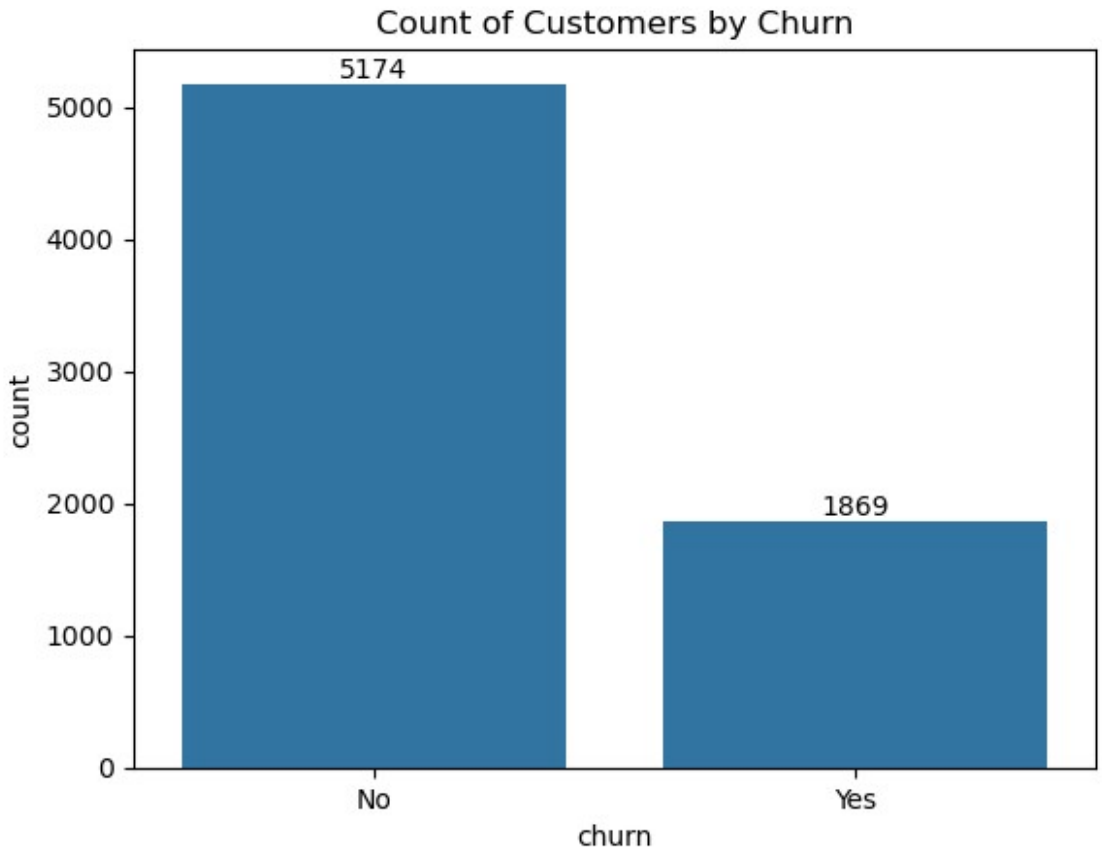
converted 0 and 1 values of senior citizen to yes/no to make it easier to understand

```
df.head()
```

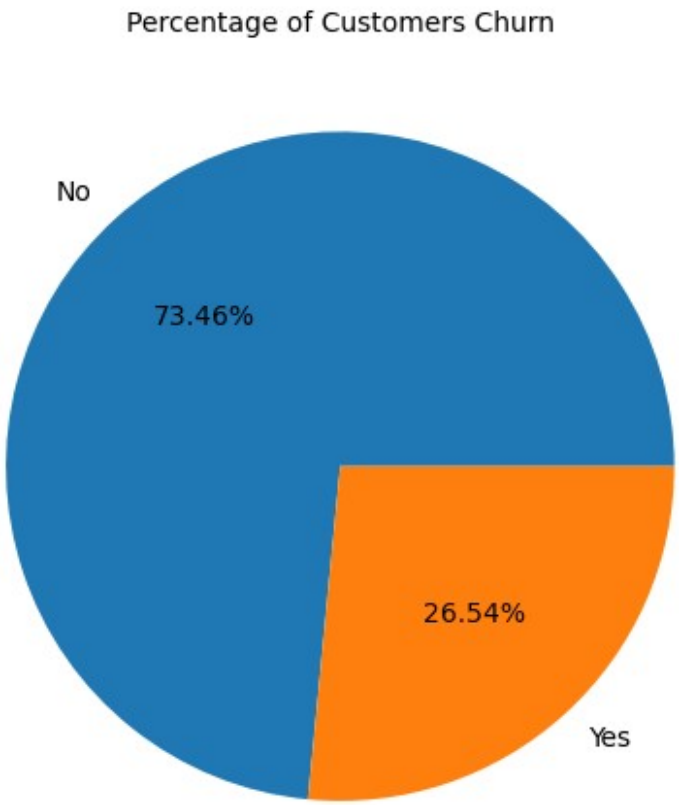
```
   customerid  gender seniorcitizen partner dependents  tenure
phoneservice  \
0  7590-VHVEG  Female            no     Yes         No       1
No
1  5575-GNVDE    Male            no      No         No      34
Yes
2  3668-QPYBK    Male            no      No         No       2
Yes
3  7795-CFOCW    Male            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]
```

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

ax.bar_label(ax.containers[0])
plt.title('Count of Customers by Churn')
plt.show()
```

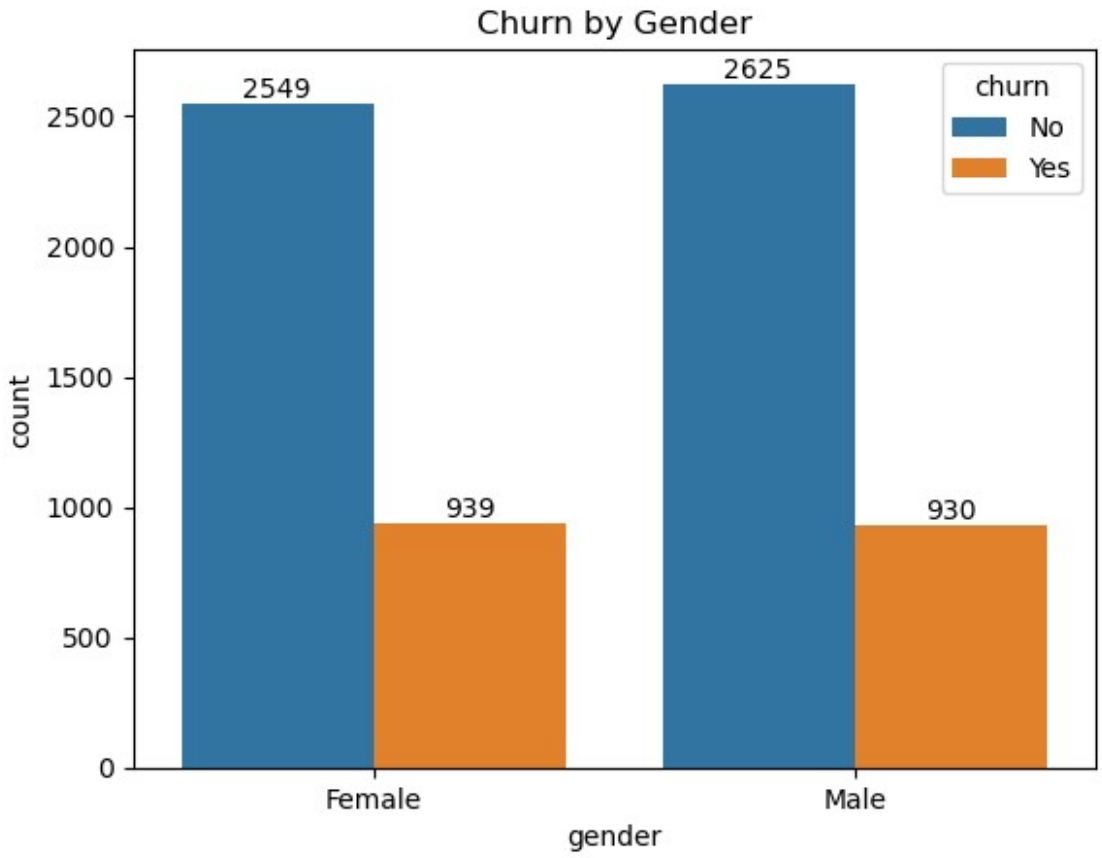



```
gb= df.groupby('churn').agg({'churn':'count'})

plt.pie(gb['churn'], labels=gb.index, autopct= '%1.2f%%' )
plt.title('Percentage of Customers Churn', fontsize= 10)
plt.tight_layout()
plt.show()
```

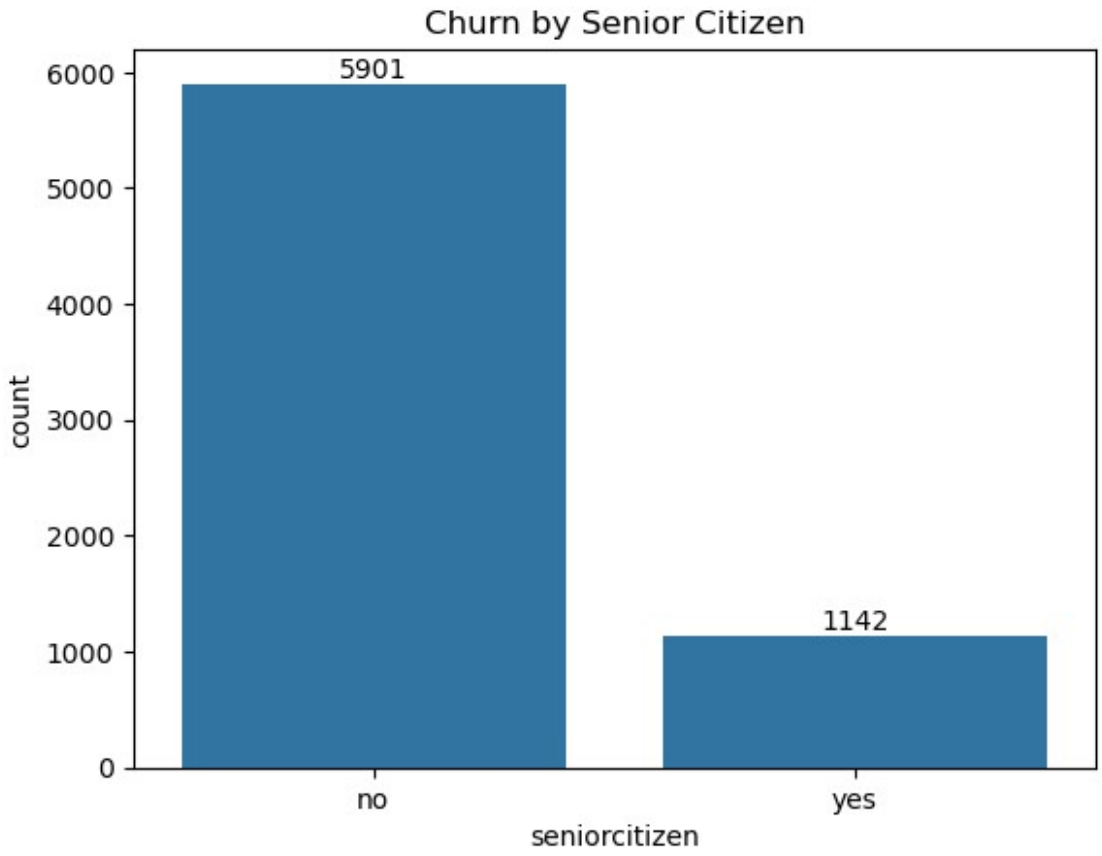



from the given pie chart we can see that 25.54% of customers have churned out

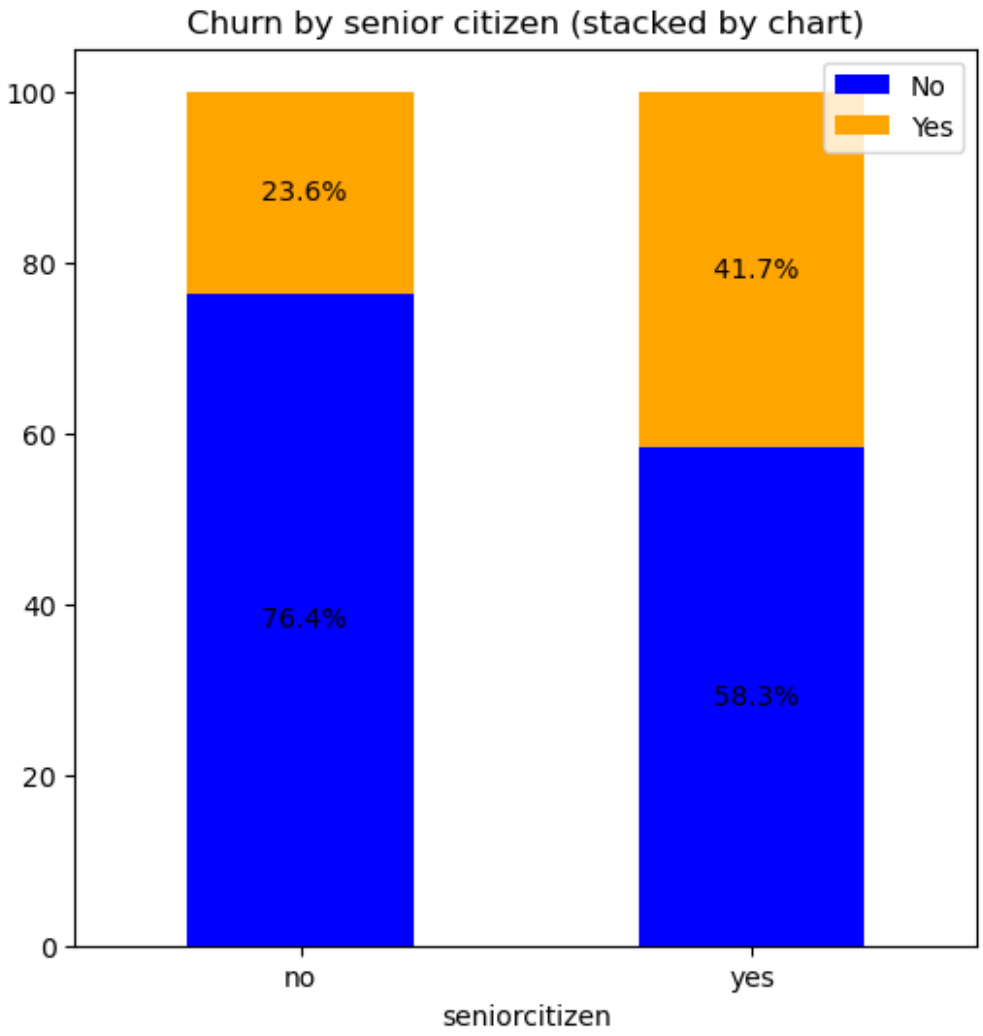
```
ax=sns.countplot(x= 'gender', data= df, hue= 'churn')

ax.bar_label(ax.containers[0])
ax.bar_label(ax.containers[1])

plt.title('Churn by Gender')
plt.show()
```




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

ax.bar_label(ax.containers[0])
plt.title('Churn by Senior Citizen')
plt.show()
```

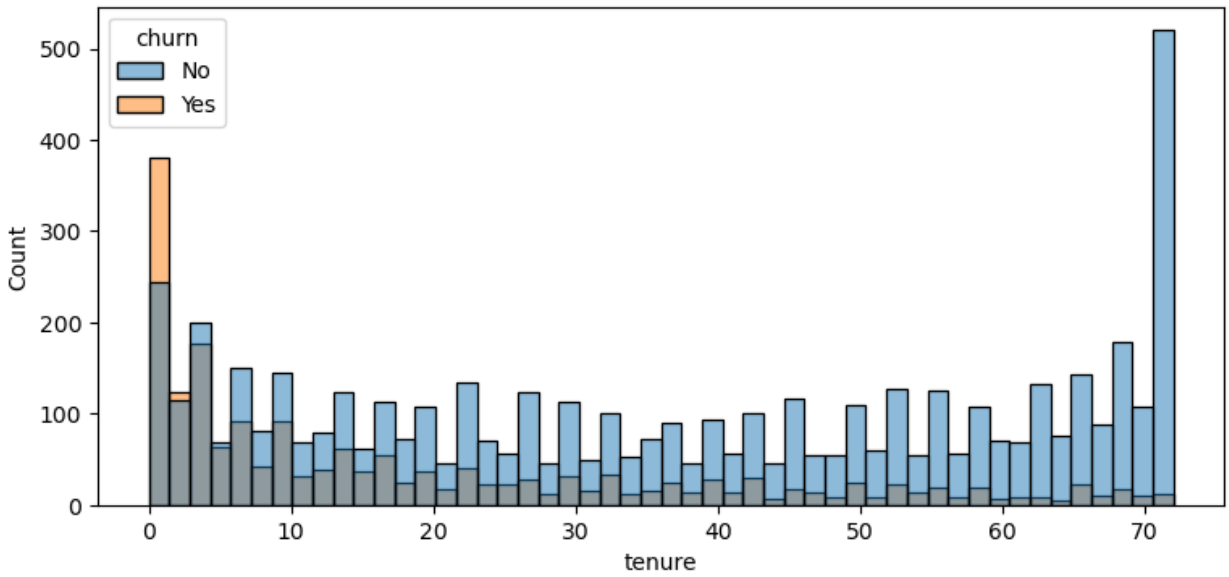



```
total_counts = df.groupby('seniorcitizen')
['churn'].value_counts(normalize= True).unstack() * 100

#plot
fig, ax= plt.subplots(figsize=(6,6))

#plot the bars
total_counts.plot(kind = 'bar', stacked= True, ax= ax, color=['blue',
'orange'])

#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 by chart)')
plt.legend(loc='upper right')
plt.xticks(rotation=0)
plt.show()
```



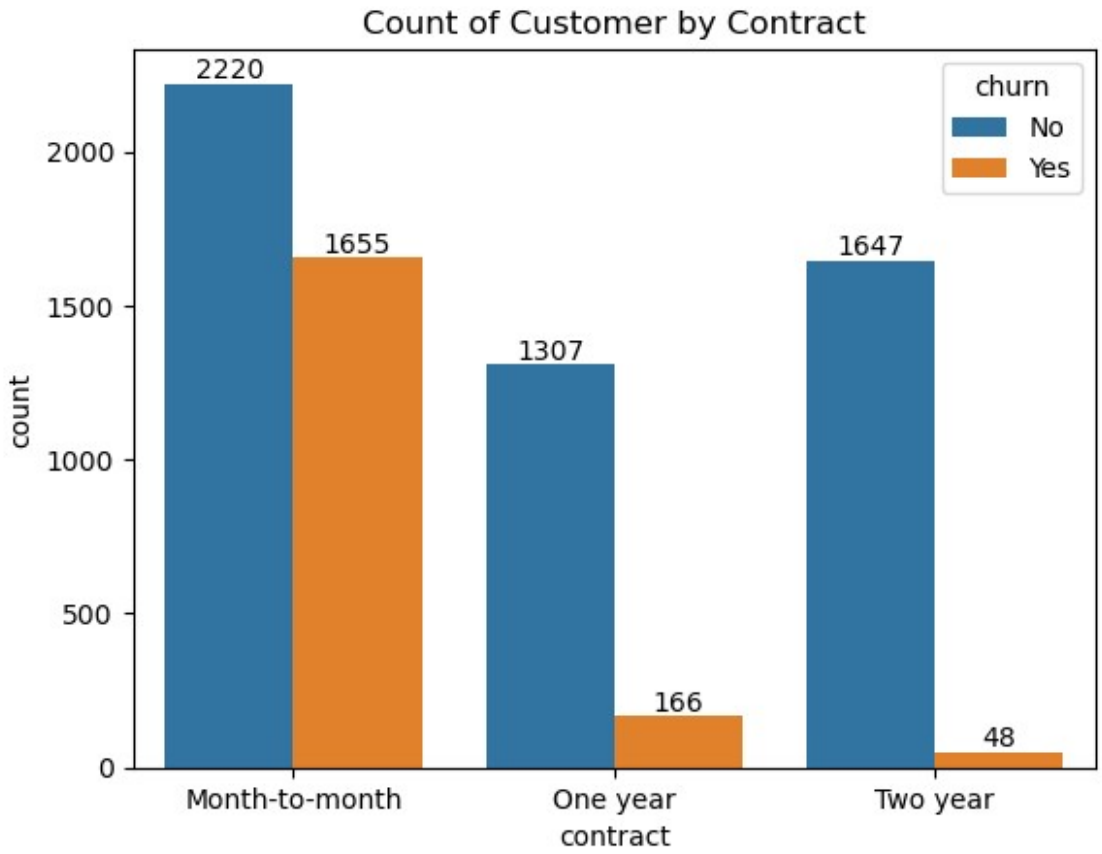

comparatively a greater % of people in senior citizen category have churned

```
plt.figure(figsize = (9,4))
sns.histplot(x= 'tenure', data= df, bins= 50, hue ='churn')
plt.show()
```




people who have used our services for a long time have stayed and people who have used our services for 1-2 months have churn

```
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 Customer by Contract')
plt.show()
```



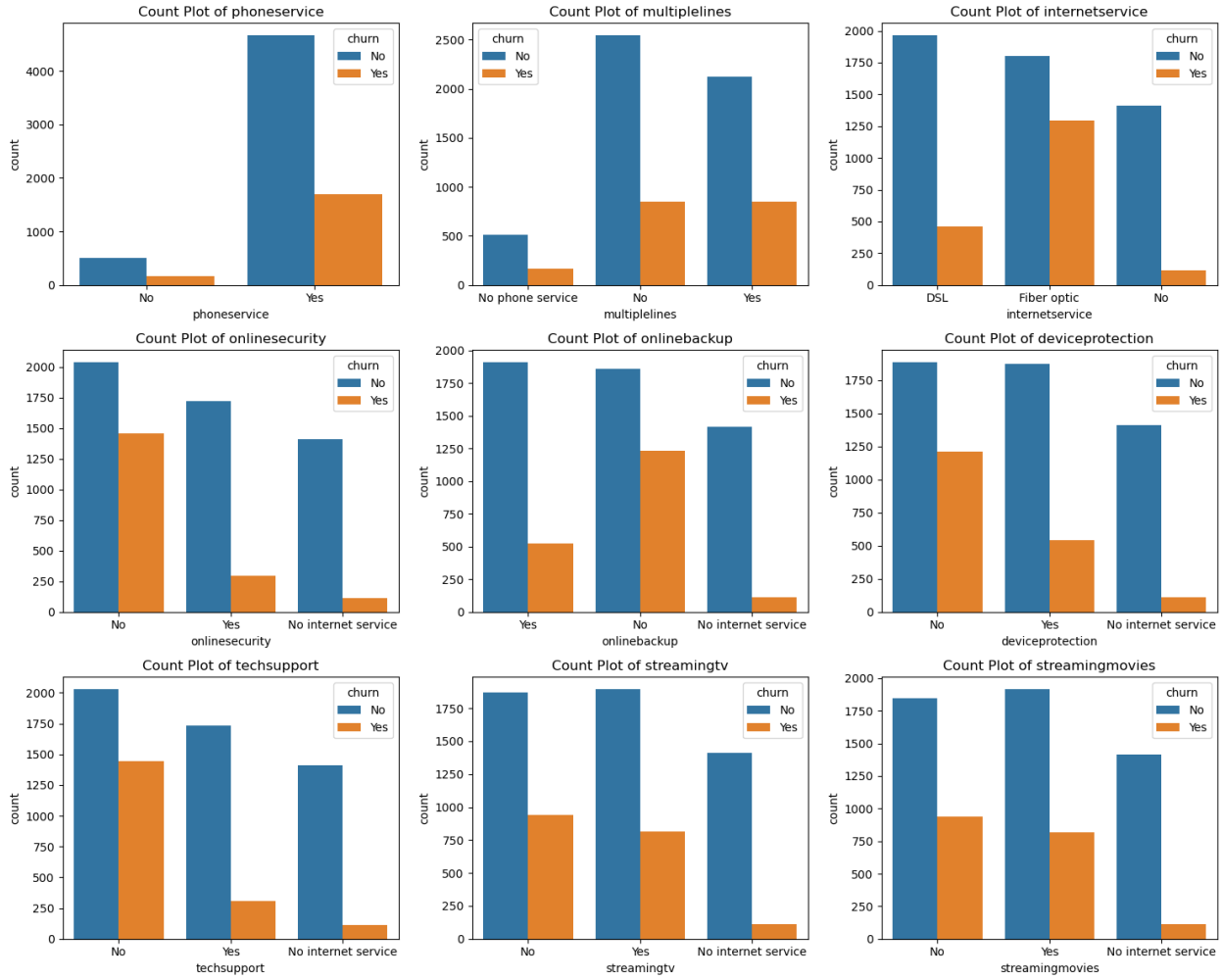

we can see that customer having contract with Month-to-month is likely to churn as compare to one year and Two year contract

```
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)
```

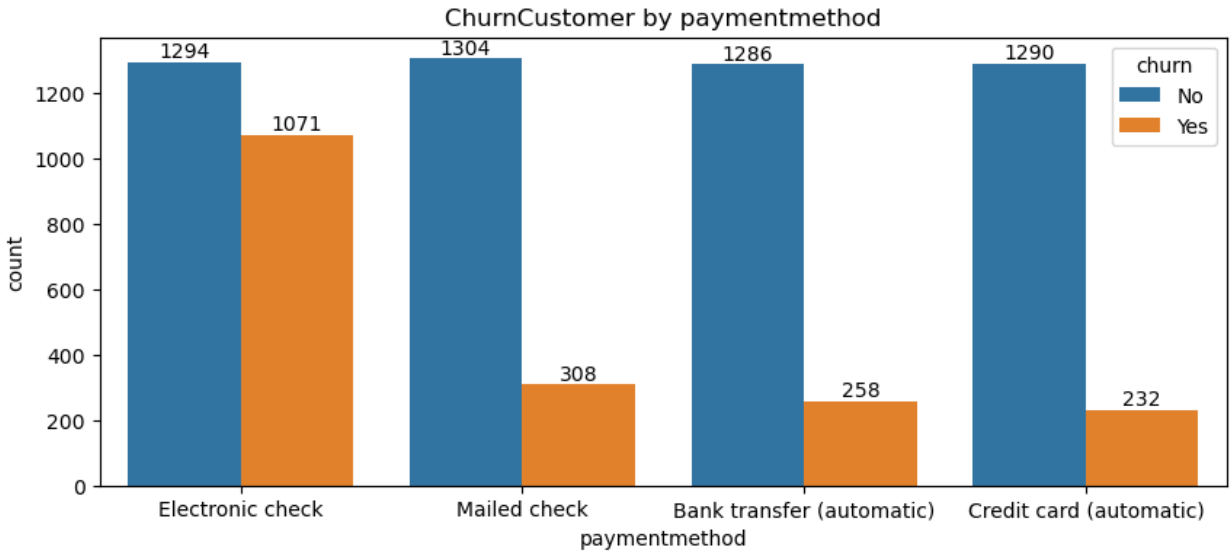
```
columns= ['phoneservice', 'multiplelines', 'internetservice',
       'onlinesecurity', 'onlinebackup', 'deviceprotection',
       'techsupport', 'streamingtv', 'streamingmovies']

#no of columns for the subplot grid (you can change this)
n_cols = 3
n_rows = (len(columns) + n_cols -1) // n_cols # calculate no 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()

#Iterator 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 =(10,4))
ax= sns.countplot(x= 'paymentmethod', data= df, hue= 'churn')

ax.bar_label(ax.containers[0])
ax.bar_label(ax.containers[1])
plt.title('ChurnCustomer by paymentmethod')
plt.show()
```




customer is likely to churn when they are using paymentmethod through electronic check

```
```