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

df = pd.read_csv('Documents/Data Analytics/Exploratory Data Analysis
Project (Customer Churn)/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
```

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.info()
```

```
<class 'pandas.core.frame.DataFrame'>
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Data columns (total 21 columns):
 #   Column            Non-Null Count  Dtype
---  ------            --------------  -----
 0   customerID        7043 non-null   object
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 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()

      customerID  gender  SeniorCitizen  Partner  Dependents
tenure  \
0          False   False          False    False       False   False

1          False   False          False    False       False   False

2          False   False          False    False       False   False

3          False   False          False    False       False   False

4          False   False          False    False       False   False

...          ...     ...            ...      ...         ...     ...

7038       False   False          False    False       False   False

7039       False   False          False    False       False   False

7040       False   False          False    False       False   False
```

```
7041       False   False          False    False       False   False

7042       False   False          False    False       False   False


      PhoneService  MultipleLines  InternetService
OnlineSecurity  ...  \
0            False          False            False
False  ...
1            False          False            False
False  ...
2            False          False            False
False  ...
3            False          False            False
False  ...
4            False          False            False
False  ...
...            ...            ...              ...              ...  ..
.
7038         False          False            False
False  ...
7039         False          False            False
False  ...
7040         False          False            False
False  ...
7041         False          False            False
False  ...
7042         False          False            False
False  ...

      DeviceProtection  TechSupport  StreamingTV  StreamingMovies
Contract  \
0                False        False        False            False
False
1                False        False        False            False
False
2                False        False        False            False
False
3                False        False        False            False
False
4                False        False        False            False
False
...                ...          ...          ...              ...
...
7038             False        False        False            False
False
7039             False        False        False            False
False
7040             False        False        False            False
False
```

```
7041              False        False        False             False
False
7042              False        False        False             False
False

      PaperlessBilling  PaymentMethod  MonthlyCharges  TotalCharges
Churn
0                 False          False           False         False
False
1                 False          False           False         False
False
2                 False          False           False         False
False
3                 False          False           False         False
False
4                 False          False           False         False
False
...                 ...            ...             ...           ...
...
7038              False          False           False         False
False
7039              False          False           False         False
False
7040              False          False           False         False
False
7041              False          False           False         False
False
7042              False          False           False         False
False

[7043 rows x 21 columns]
```

```
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)
```

#Converted 0 and 1 values of Senior citizen to Yes/No for better understanding

```
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
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Yes

      MultipleLines InternetService OnlineSecurity  ...
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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
```
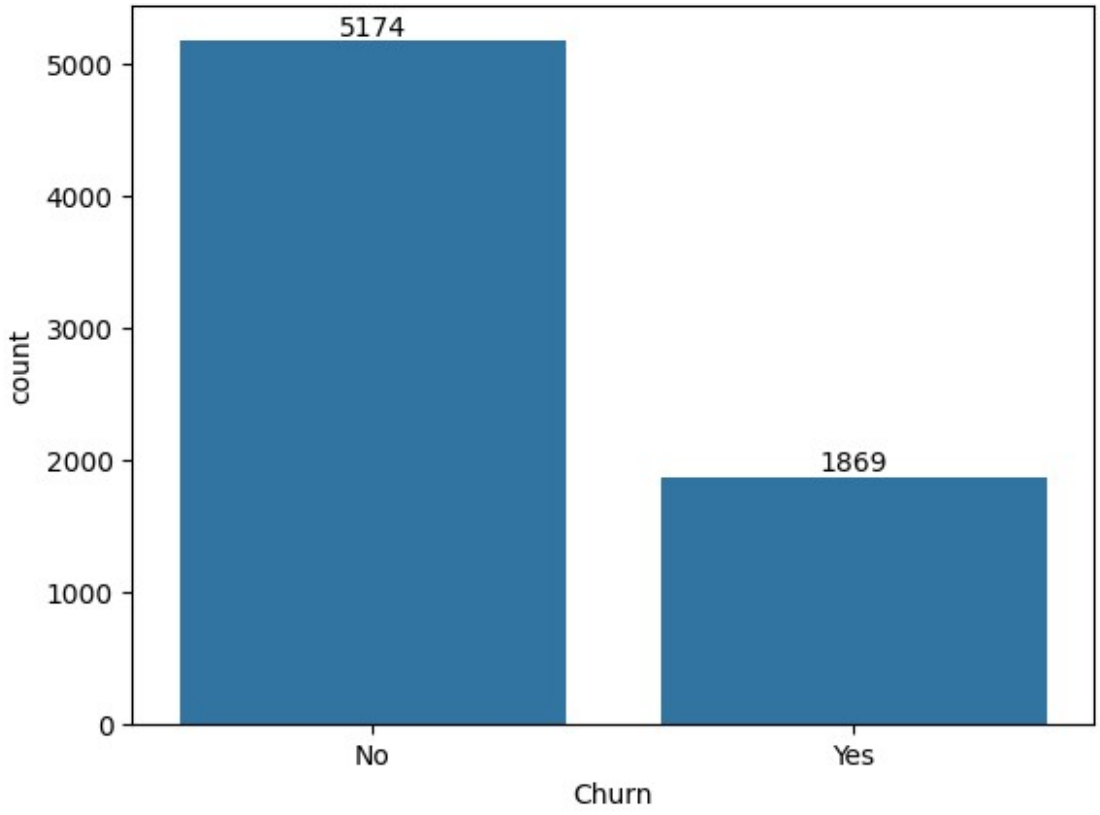

```
0           Electronic check          29.85         29.85    No
1               Mailed check          56.95        1889.5    No
2               Mailed check          53.85        108.15   Yes
3  Bank transfer (automatic)          42.30       1840.75    No
4           Electronic check          70.70        151.65   Yes

[5 rows x 21 columns]
```

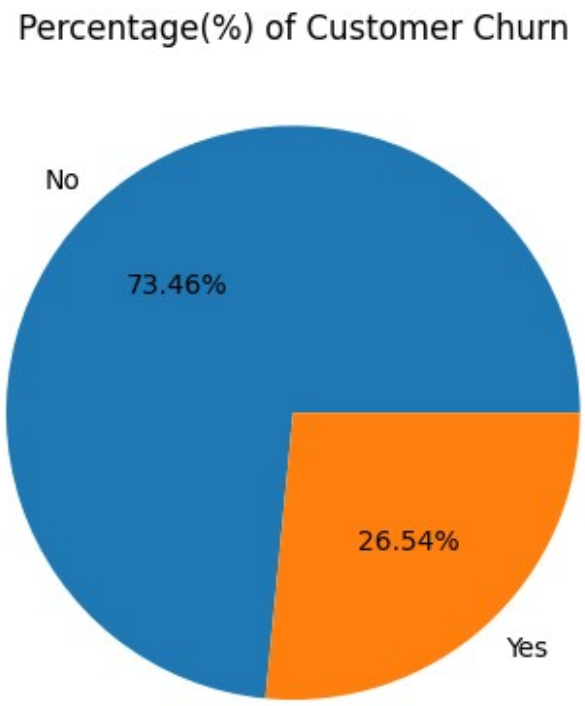
```
ax= sns.countplot(x='Churn', data = df)
ax.bar_label(ax.containers[0])
plt.show()
```




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

```
       Churn
Churn
No      5174
Yes     1869
```

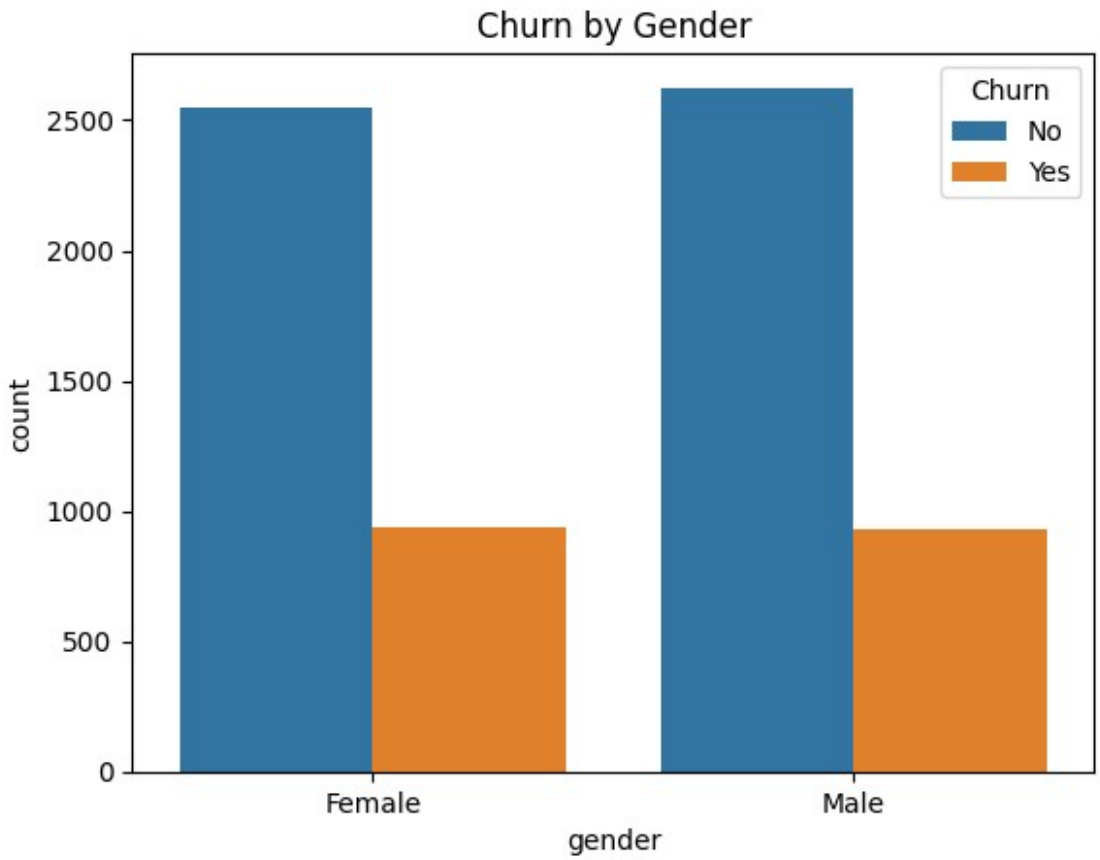
```
count = df["Churn"].value_counts() # counting the values of the churn
plt.pie(count, labels = gb.index, autopct = "%1.2f%%")
plt.title("Percentage(%) of Customer Churn")
plt.show()
```



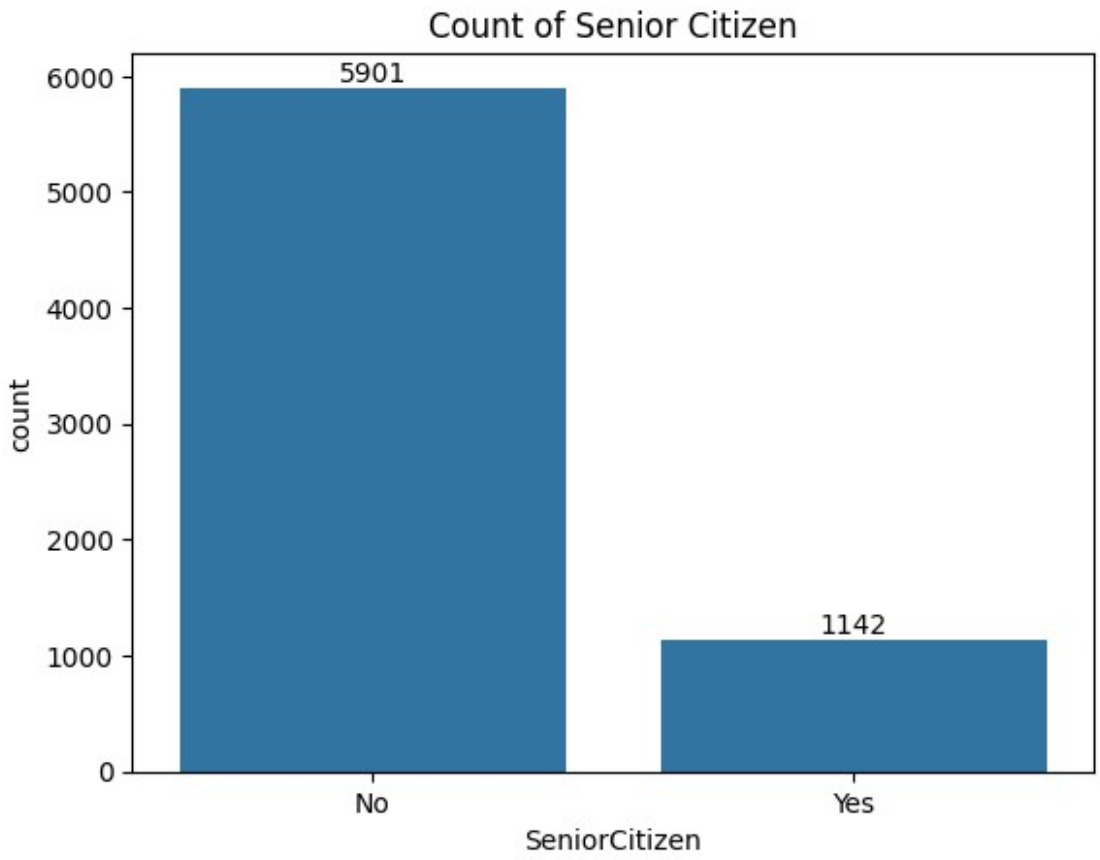
#from the given pie chart we can conclude that 26.54% of our customers have churned out

#now let's explore the reason behind it

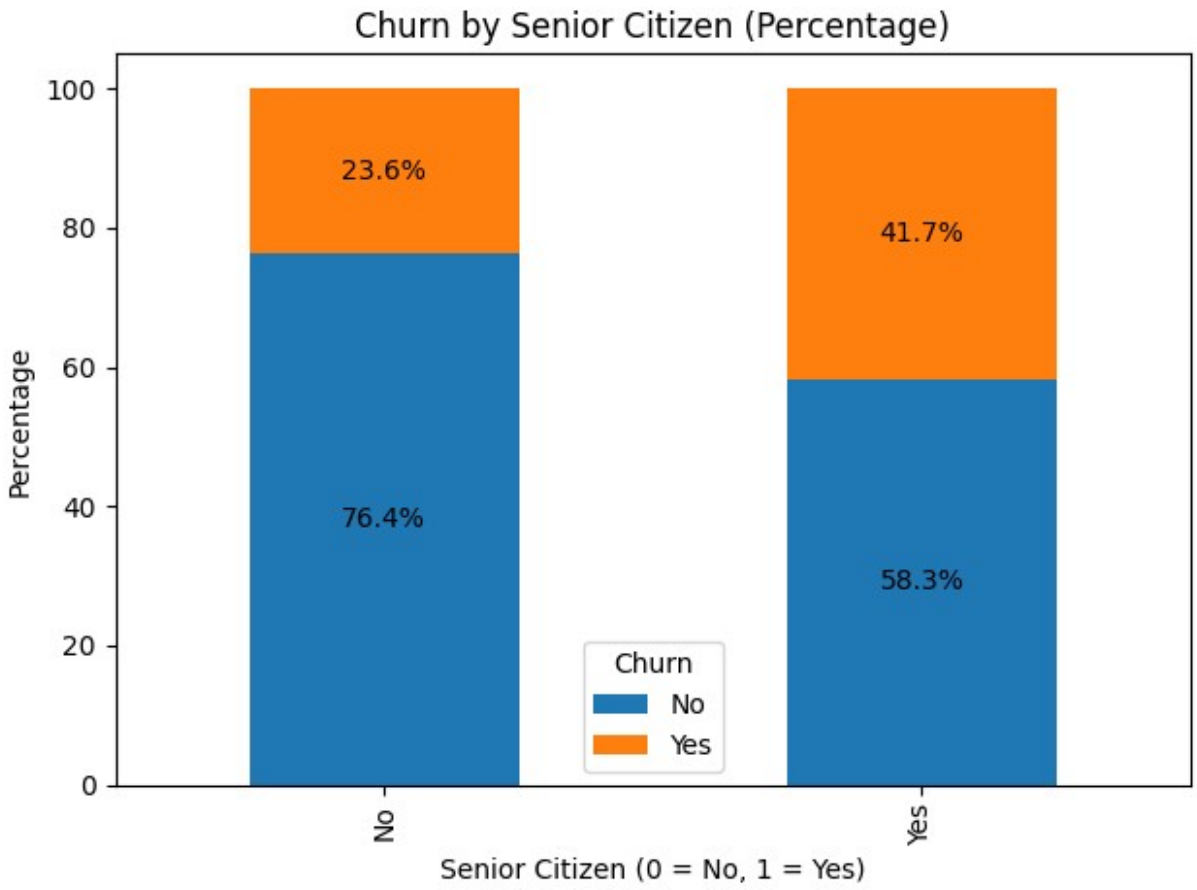
```
sns.countplot(x = "gender", data = df, hue= "Churn")
plt.title("Churn by Gender")
plt.show()
```




```
ax = sns.countplot(x = "SeniorCitizen", data = df)
ax.bar_label(ax.containers[0])
plt.title("Count of Senior Citizen")
plt.show()
```

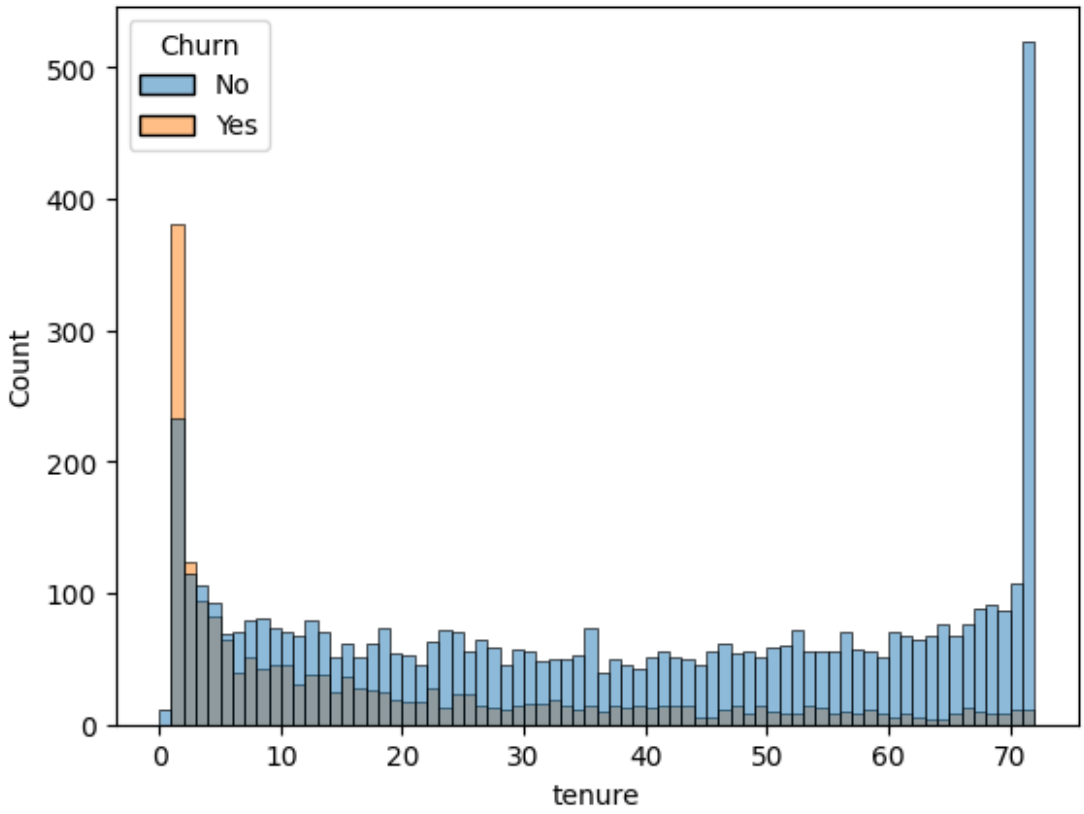



```
# Create a crosstab (contingency table)
ct = pd.crosstab(df['SeniorCitizen'], df['Churn'], normalize='index')
* 100

# Plot stacked bar chart
ax = ct.plot(kind='bar', stacked=True)

# Add percentage labels
for container in ax.containers:
    ax.bar_label(container, fmt='%.1f%%', label_type='center')

# Customize plot
plt.title('Churn by Senior Citizen (Percentage)')
plt.xlabel('Senior Citizen (0 = No, 1 = Yes)')
plt.ylabel('Percentage')
plt.legend(title='Churn')
plt.tight_layout()
plt.show()
```



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

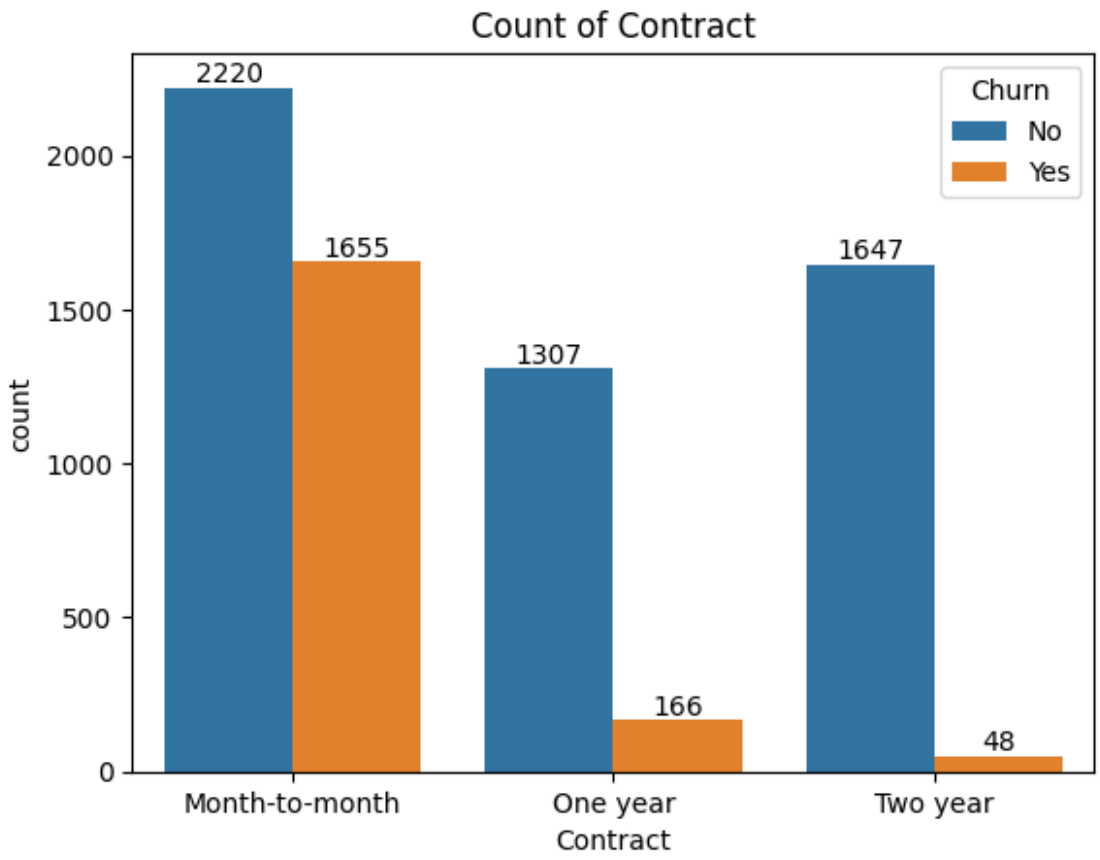
```
sns.histplot(x = "tenure", data = df, bins= 72, hue= "Churn")
plt.show()
```



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 out

```
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 Contract")
plt.show()
```

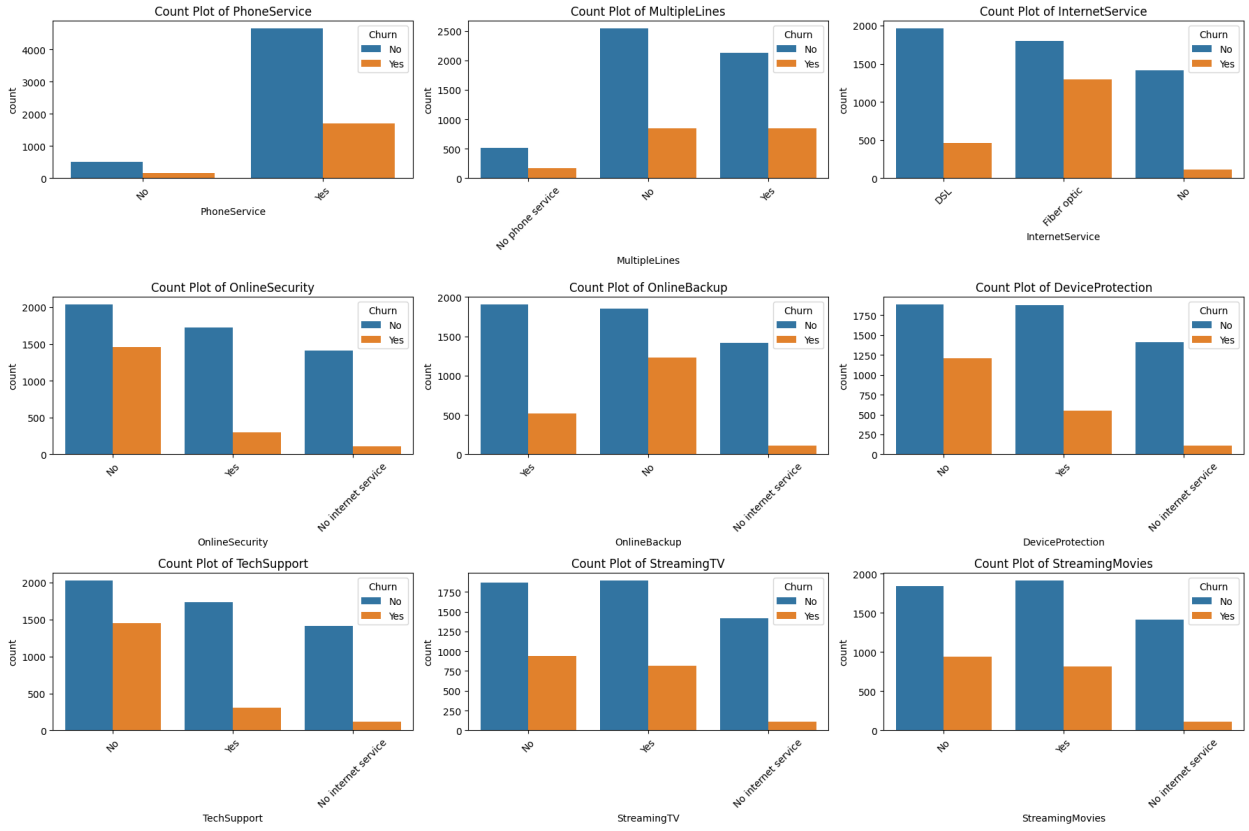


people who have month to month contract are likely to churn

from people who have 1 to 2 years contract

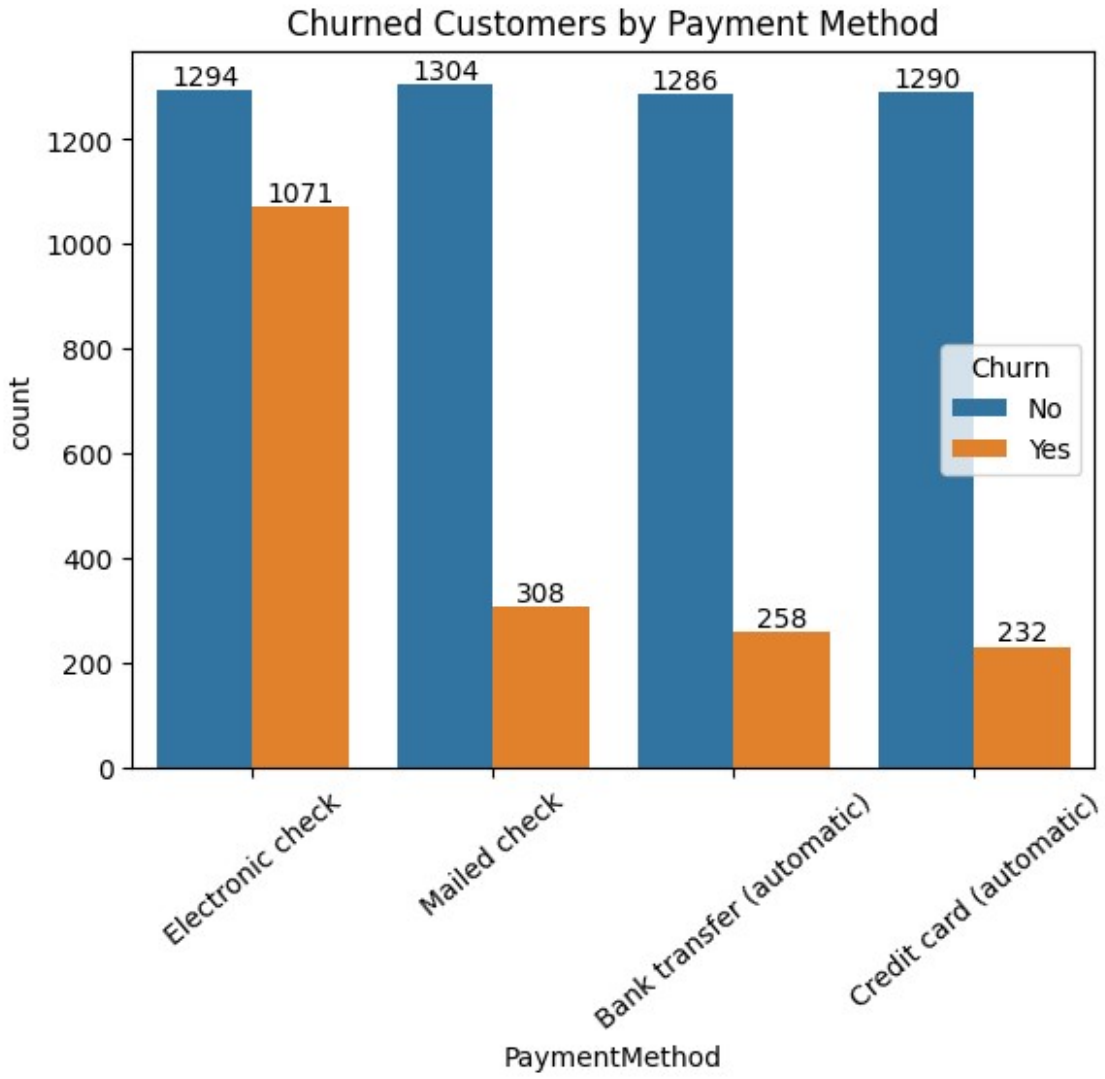
```
df.columns.values

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

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

```
]

n_cols = 3
n_rows = (len(cols) + n_cols - 1) // n_cols

fig, axes = plt.subplots(n_rows, n_cols, figsize=(18, n_rows * 4))
axes = axes.flatten()

for i, col in enumerate(cols):
    # Setting hue=col and legend=False as per future-proof requirement
    sns.countplot(x=col, data=df, ax=axes[i],
hue=df["Churn"],legend=True)
    axes[i].set_title(f'Count Plot of {col}')
    axes[i].tick_params(axis='x', rotation=45)

for j in range(i + 1, len(axes)):
    fig.delaxes(axes[j])

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




```
ax = sns.countplot(x = "PaymentMethod", data = df, hue= "Churn")
ax.bar_label(ax.containers[0])
ax.bar_label(ax.containers[1])
```

```
plt.xticks(rotation = 40)
plt.title("Churned Customers by Payment Method")
plt.show()
```



customer is likely to churn when they are using electronic as payment method