```
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
import seaborn as sns
df =
pd.read_csv("C:/Users/91827/OneDrive/Desktop/Churn_Analysis/EDA_Final.
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]
```

#replace blanks with 0 and tenure is 0 and no total charges are recorded

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

<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

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.duplicated().sum()
```

```
np.int64(0)
```

```
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(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
```

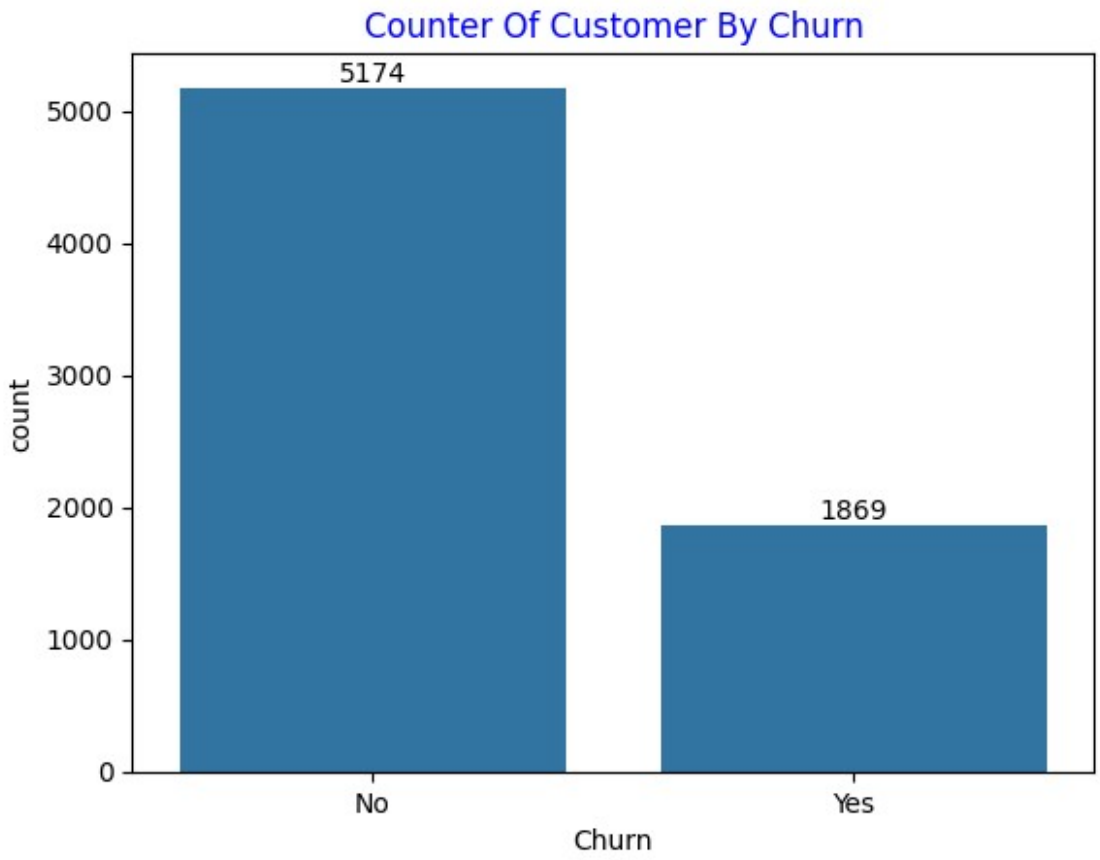
```
10  9763-GRSKD    Male            no      Yes         Yes       13
Yes
11  7469-LKBCI    Male            no       No          No       16
Yes
12  8091-TTVAX    Male            no      Yes          No       58
Yes
13  0280-XJGEX    Male            no       No          No       49
Yes
14  5129-JLPIS    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
```

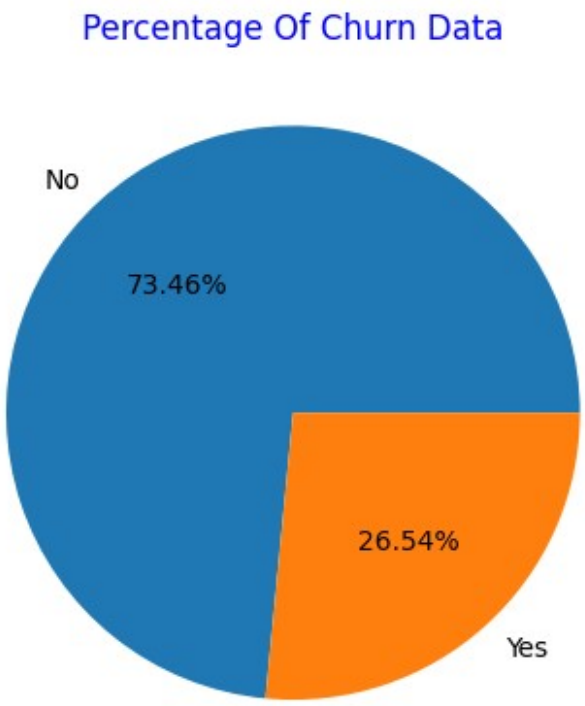
```
24                    No                   Yes                    No
25                    No                    No                    No
26                    No                    No                   Yes
27                    No                    No                    No
28                   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]
```

```
ax = sns.countplot(x="Churn", data=df)
ax.bar_label(ax.containers[0])
plt.title("Counter Of Customer By Churn", color = "blue")
plt.show()
```



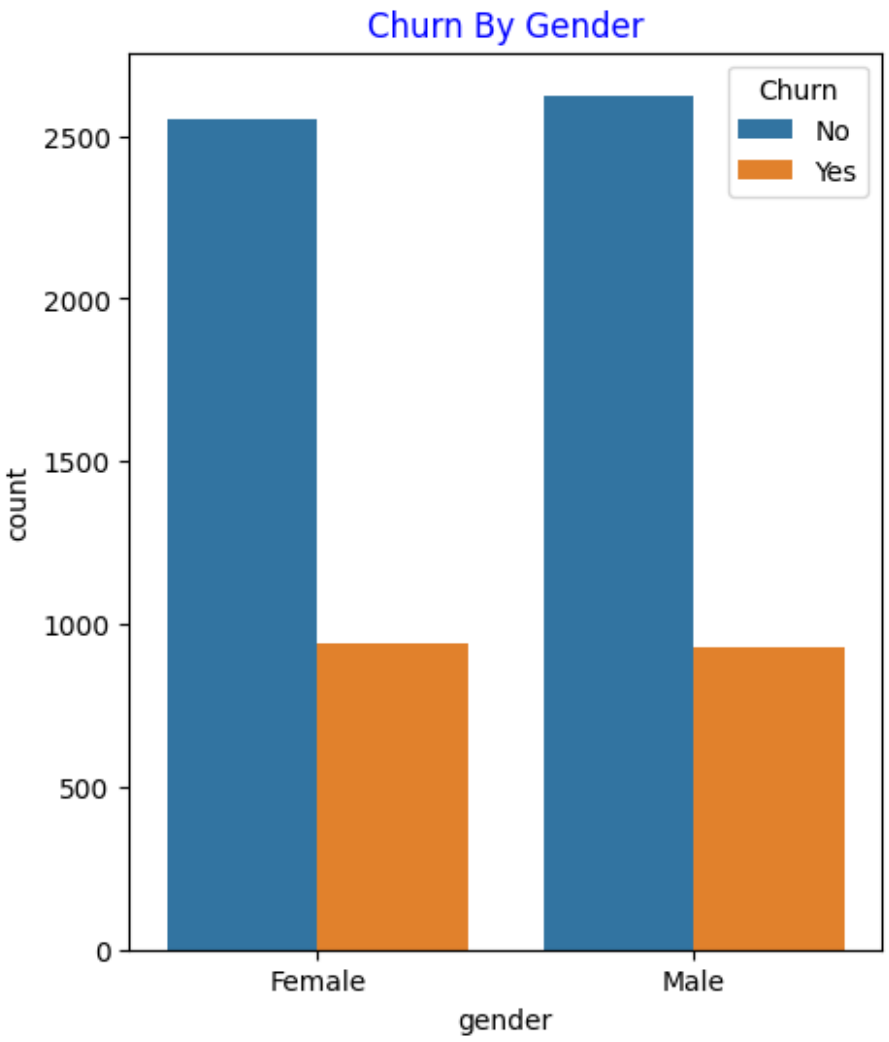

```
gb = df.groupby("Churn").agg({"Churn":"count"})
gb

plt.pie(gb['Churn'], labels = gb.index, autopct = "%1.2f%%")
plt.title("Percentage Of Churn Data", color = "blue")
plt.show()
```



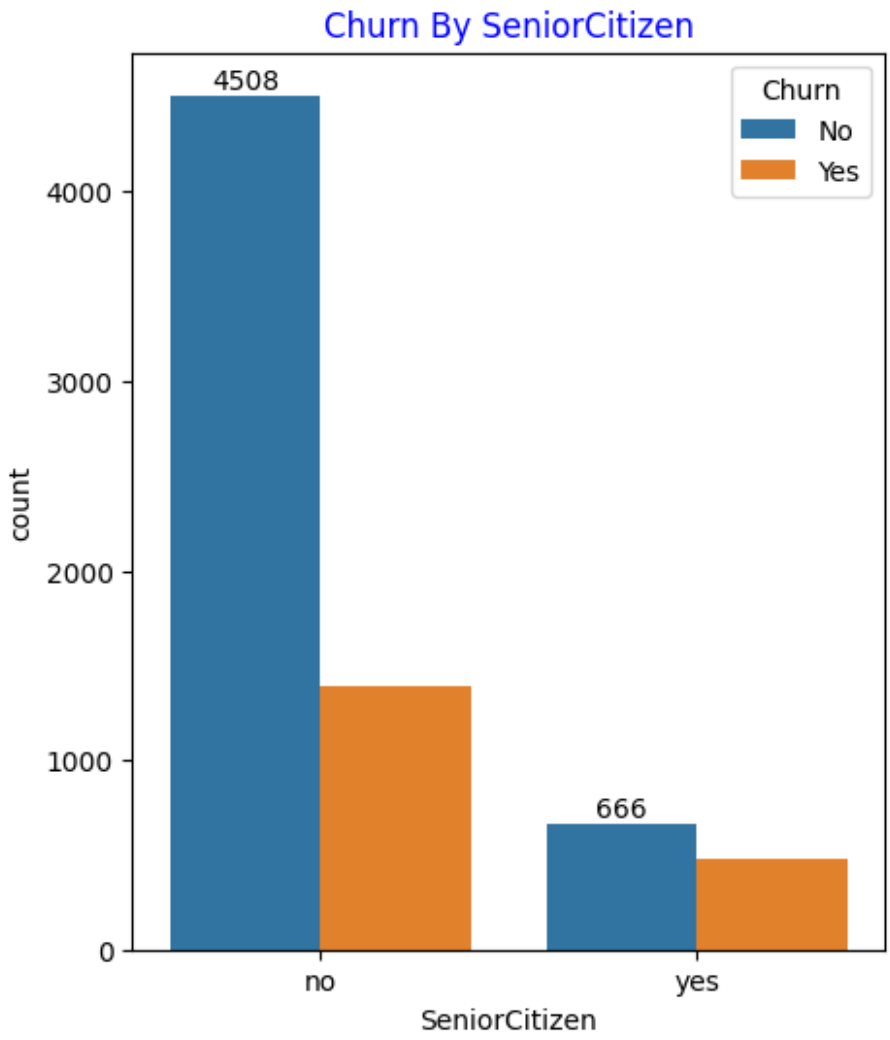
#from the given pie chart we can conclude that 26.54% of our customer have Churned out

now lets explore the reason behind it

```
plt.figure(figsize = (5,6))
sns.countplot(x = 'gender' , data = df, hue = "Churn")
plt.title("Churn By Gender", color = "blue")
plt.show()
```

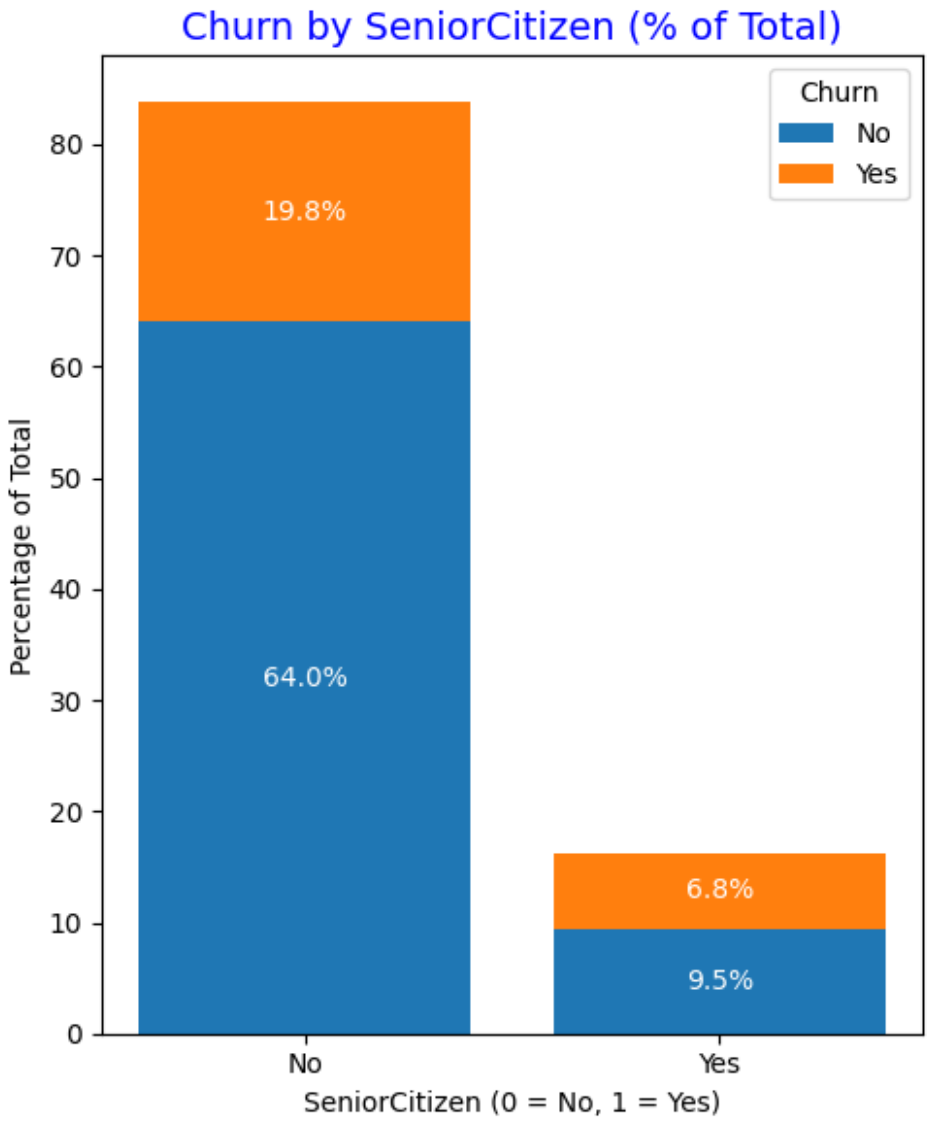



```
plt.figure(figsize = (5,6))

ax = sns.countplot(x = 'SeniorCitizen' , data = df, hue = "Churn")
ax.bar_label(ax.containers[0])

plt.title("Churn By SeniorCitizen", color = "blue")
plt.show()
```



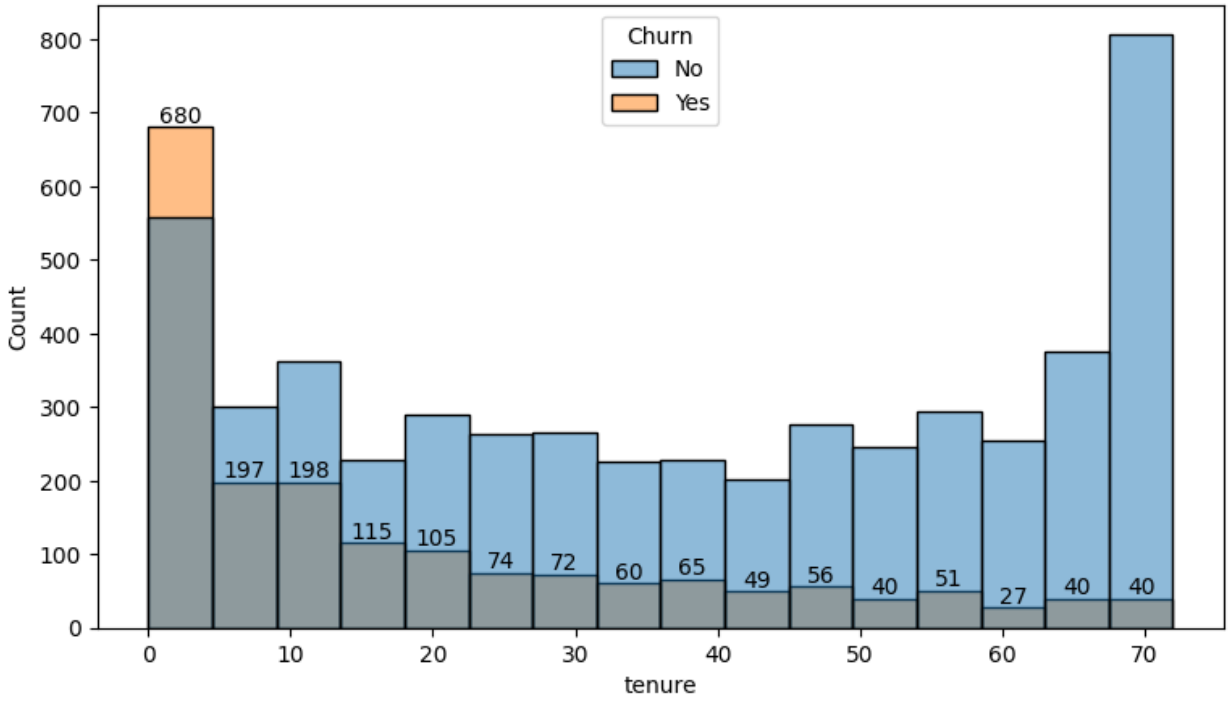

```
Churn_counts = pd.crosstab(df['SeniorCitizen'], df['Churn'])
total = Churn_counts.to_numpy().sum()
Churn_percent = (Churn_counts / total) * 100

# 3 Plot stacked bar chart
fig, ax = plt.subplots(figsize=(5, 6))
bottom = [0, 0]  # for stacking

colors = ['#1f77b4', '#ff7f0e']  # color for No/Yes

for idx, Churn_status in enumerate(Churn_percent.columns):
    values = Churn_percent[Churn_status].values
    ax.bar(Churn_percent.index, values, bottom=bottom,
label=Churn_status, color=colors[idx])

    # Add percentage labels
    for i in range(len(values)):
```

```
        ax.text(i, bottom[i] + values[i] / 2, f"{values[i]:.1f}%",
ha='center', va='center', color='white', fontsize=10)
        bottom[i] += values[i]

# 4 Formatting
ax.set_title("Churn by SeniorCitizen (% of Total)", fontsize=14,
color="blue")
ax.set_xlabel("SeniorCitizen (0 = No, 1 = Yes)")
ax.set_ylabel("Percentage of Total")
ax.set_xticks([0, 1])
ax.set_xticklabels(['No', 'Yes'])
ax.legend(title="Churn")
plt.tight_layout()
plt.show()
```



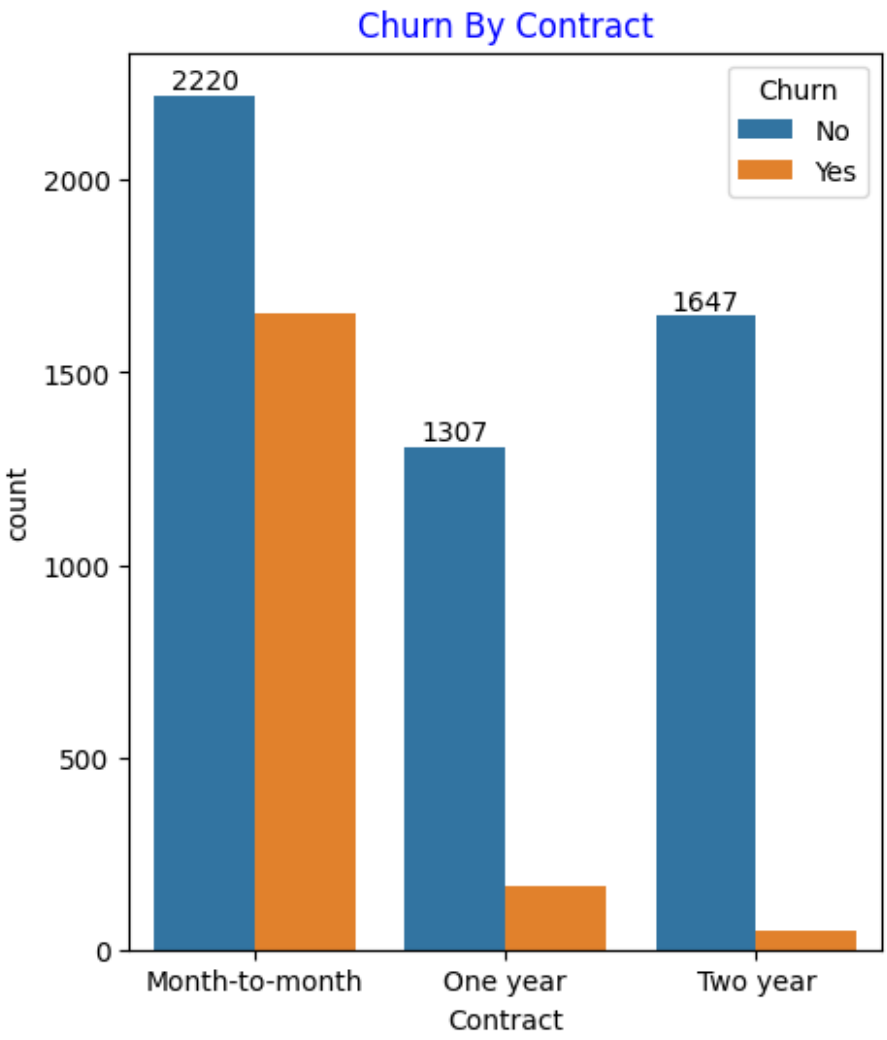
#comparative a greated percentage of people in senior citizen category have Churned out

```
plt.figure(figsize = (9,5))
ax = sns.histplot(x = "tenure", data = df, hue = "Churn")
ax.bar_label(ax.containers[0])
plt.show()
```



#people who have used our services for a long time have stayed and people who have used our services #1 or 2 months have churned

```
plt.figure(figsize = (5,6))

ax = sns.countplot(x = 'Contract' , data = df, hue = "Churn")
ax.bar_label(ax.containers[0])

plt.title("Churn By Contract", color = "blue")
plt.show()
```



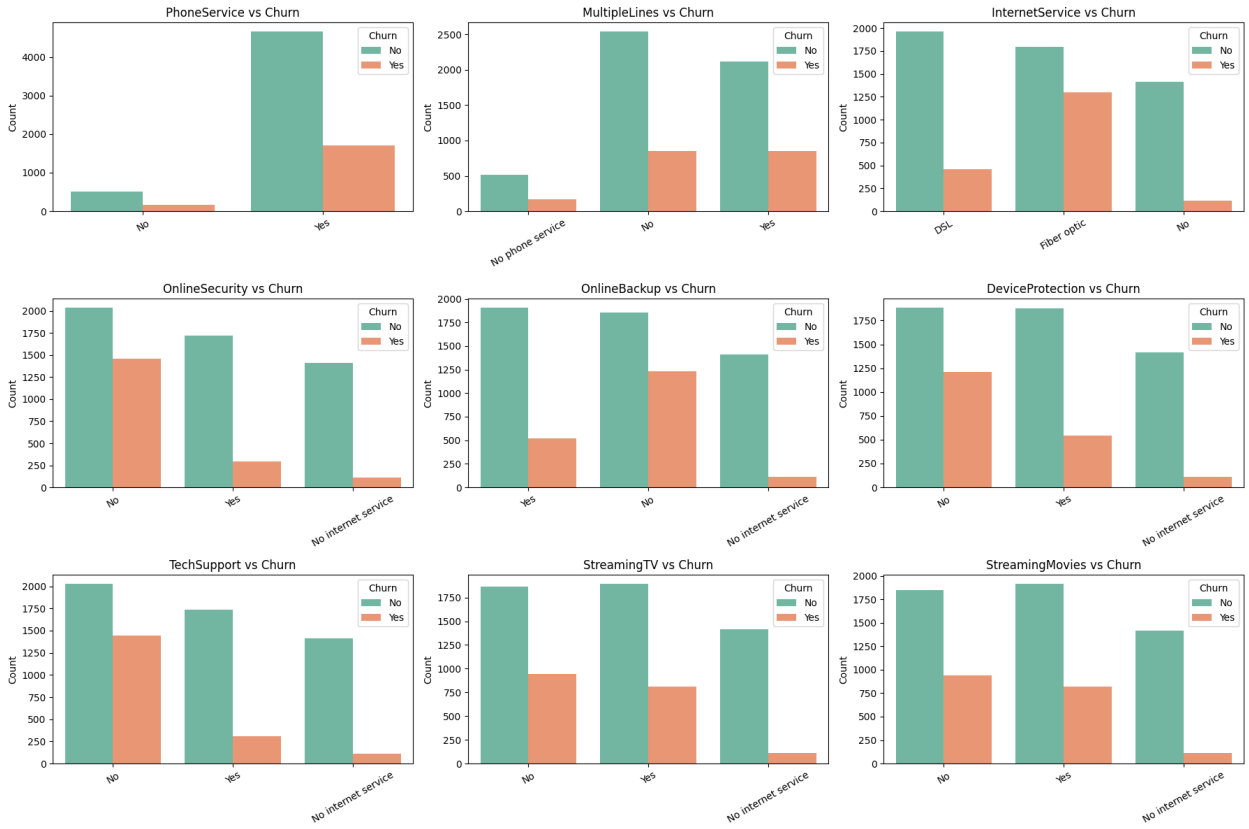
#people who have month to month contract are likely to churn then from those have 1 or 2 years of contract are stayed

```
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)
```

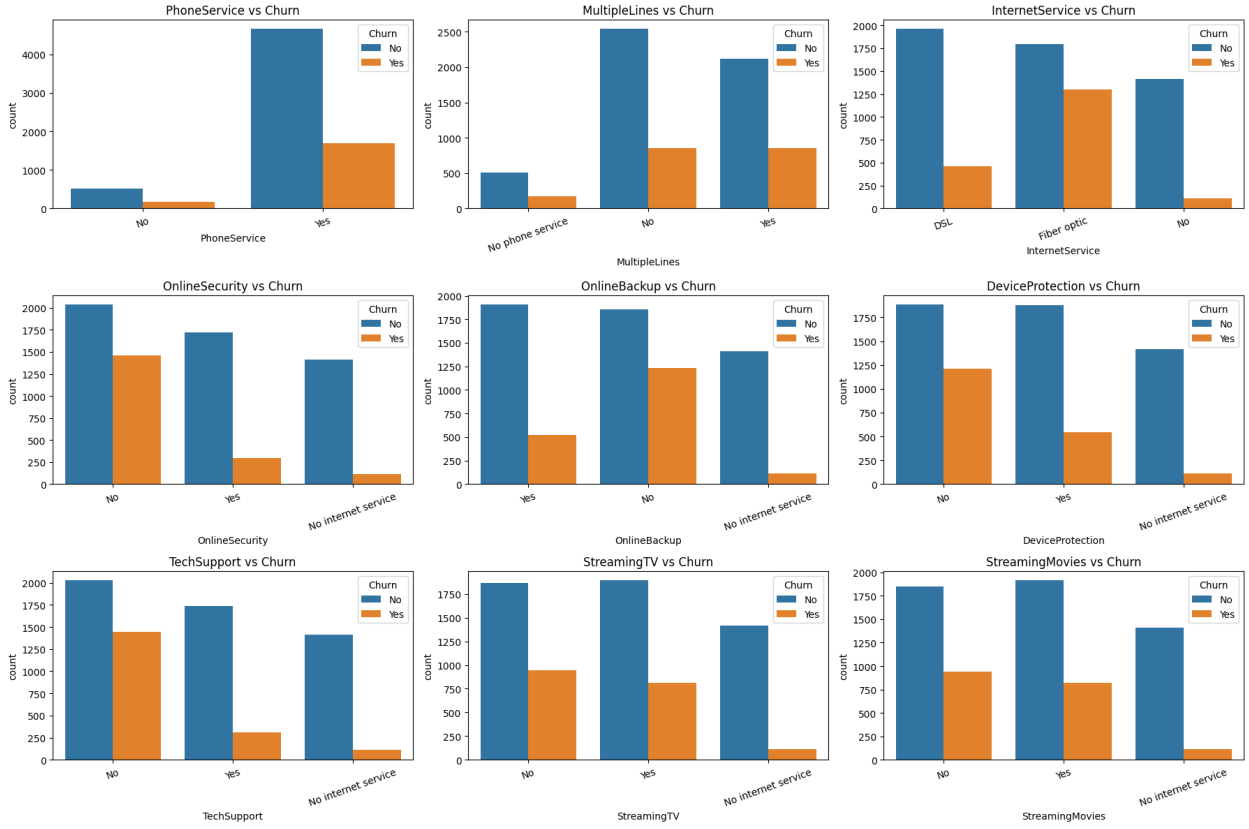
```
import matplotlib.pyplot as plt
import seaborn as sns

plot_cols = [
    'PhoneService', 'MultipleLines', 'InternetService',
```

```
    'OnlineSecurity', 'OnlineBackup', 'DeviceProtection',
    'TechSupport', 'StreamingTV', 'StreamingMovies'
]

fig, axes = plt.subplots(nrows=3, ncols=3, figsize=(18, 12))
axes = axes.flatten()

for i, col in enumerate(plot_cols):
    sns.countplot(data=df, x=col, hue='Churn', ax=axes[i],
palette='Set2')
    axes[i].set_title(f'{col} vs Churn', fontsize=12)
    axes[i].tick_params(axis='x', rotation=30)
    axes[i].set_xlabel('')
    axes[i].set_ylabel('Count')

for j in range(len(plot_cols), len(axes)):
    fig.delaxes(axes[j])

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




```
# Columns to plot
cols = [
    'PhoneService', 'MultipleLines', 'InternetService',
```

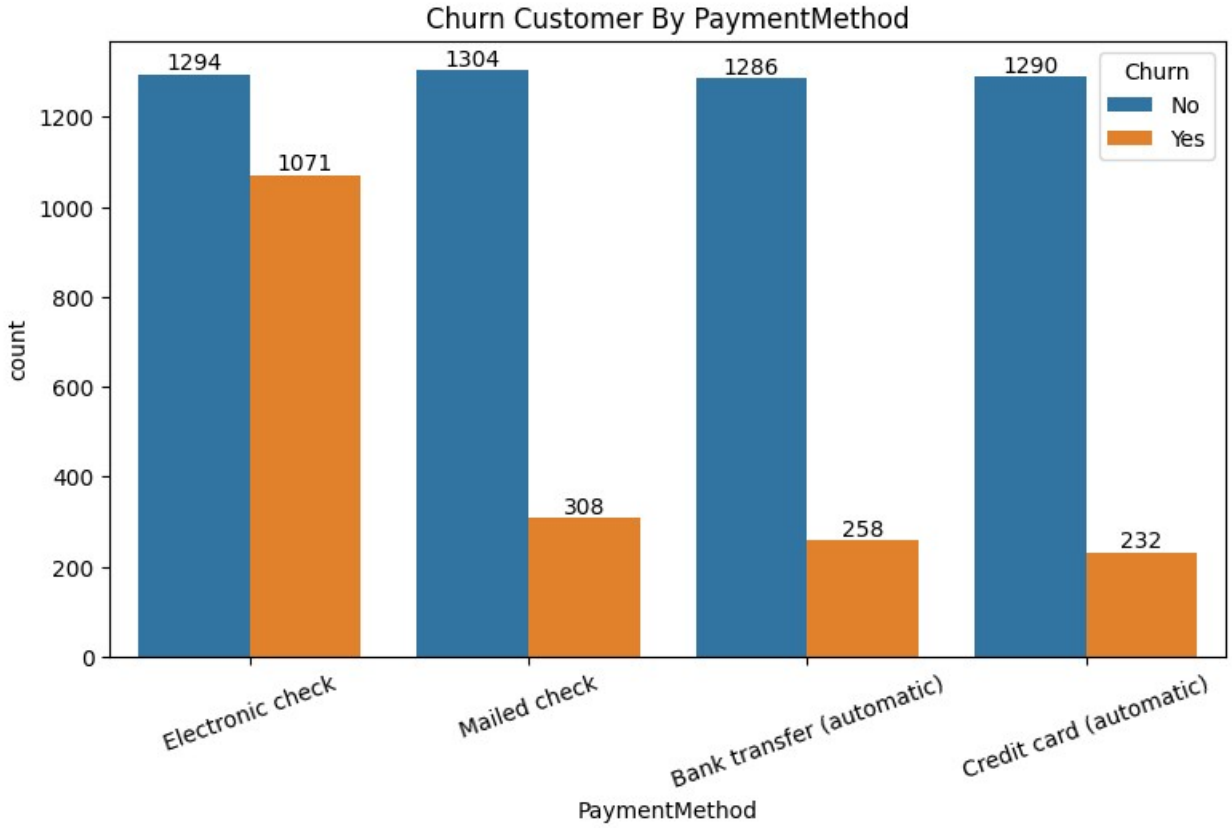
```
    'OnlineSecurity', 'OnlineBackup', 'DeviceProtection',
    'TechSupport', 'StreamingTV', 'StreamingMovies'
]

# Setup the subplots
plt.figure(figsize=(18, 12))

for i, col in enumerate(cols):
    plt.subplot(3, 3, i+1)  # 3 rows, 3 columns
    sns.countplot(x=col, hue='Churn', data=df)
    plt.title(f'{col} vs Churn')
    plt.xticks(rotation=20)
    plt.tight_layout()

plt.show()
```



#Customers without internet-related services (OnlineSecurity, TechSupport, DeviceProtection, etc.) tend to churn more. Additionally, those with “No” in services like PhoneService or MultipleLines also show higher churn rates, indicating service availability significantly affects retention.

```
plt.figure(figsize = (9,5))

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

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

plt.title("Churn Customer By PaymentMethod", color = "Black")
plt.xticks(rotation = 20)
plt.show()
```




```
#customer is likely to churn when he is  using electronic as a payment
```