chun

June 21, 2025

[1]:
```
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import seaborn as sns
```

[4]:
```
data=pd.read_csv(r"Customer Churn.csv")
```

[5]:
```
data.head()
```

[5]:

	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]
```

[6]:
```
data.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
```

1 replacing blank with 0 as tenure is 0 and dtypes hanged from object to float

[8]:
```
data["TotalCharges"]=data["TotalCharges"].replace(" ","0")
data["TotalCharges"]=data["TotalCharges"].astype("float")
```

[9]:
```
data.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
```

[11]:
```
data.isnull().sum()
```

[11]:
```
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
```

[12]:
```
data.describe()
```

[12]:
```
       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
```

[13]:
```
data.duplicated().sum()
```

[13]:
```
np.int64(0)
```

[16]:
```
data["customerID"].duplicated().sum()
```

[16]:
```
np.int64(0)
```

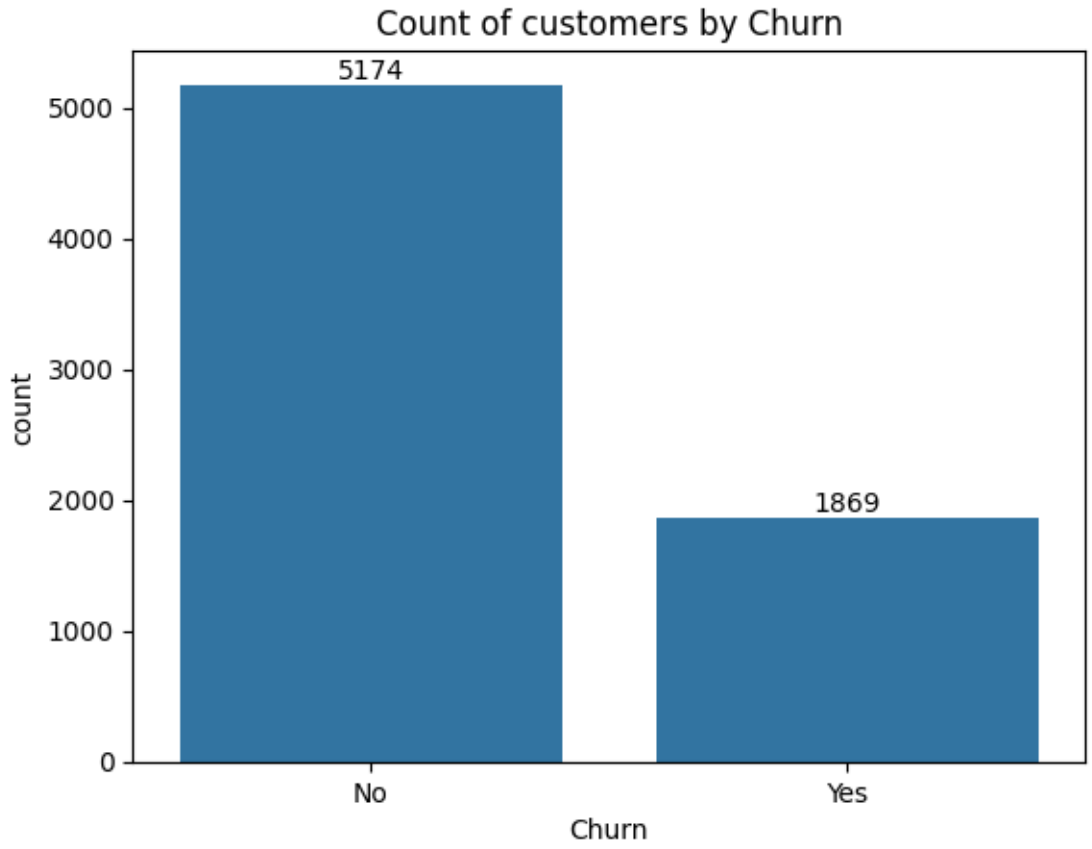
[17]:
```
def conv(value):
    if value ==1:
        return "yes"
    else:
        return "no"


data["SeniorCitizen"]=data["SeniorCitizen"].apply(conv)
```

[18]:
```
data.head()
```

[18]:
```
   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  … TechSupport  \
0  No phone service             DSL             No  …          No
1                No             DSL            Yes  …          No
2                No             DSL            Yes  …          No
3  No phone service             DSL            Yes  …         Yes
4                No     Fiber optic             No  …          No
```

```
  StreamingTV StreamingMovies        Contract PaperlessBilling  \
0          No              No  Month-to-month              Yes
1          No              No        One year               No
2          No              No  Month-to-month              Yes
3          No              No        One year               No
4          No              No  Month-to-month              Yes

               PaymentMethod MonthlyCharges TotalCharges  Churn  customer ID
0           Electronic check          29.85        29.85     No             0
1               Mailed check          56.95      1889.50     No             0
2               Mailed check          53.85       108.15    Yes             0
3  Bank transfer (automatic)          42.30      1840.75     No             0
4           Electronic check          70.70       151.65    Yes             0

[5 rows x 22 columns]
```

[30]:
```
ax=sns.countplot(x=data['Churn'])
ax.bar_label(ax.containers[0])
plt.title("Count of customers by Churn")
plt.show()
```

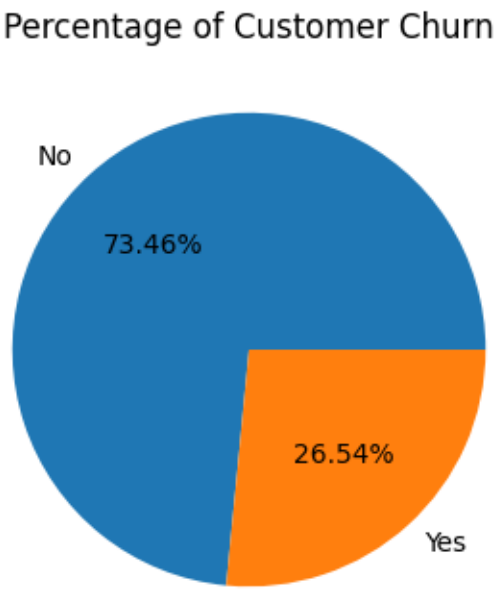


[25]:
```
gb=data.groupby("Churn").agg({"Churn":"count"})
gb
```

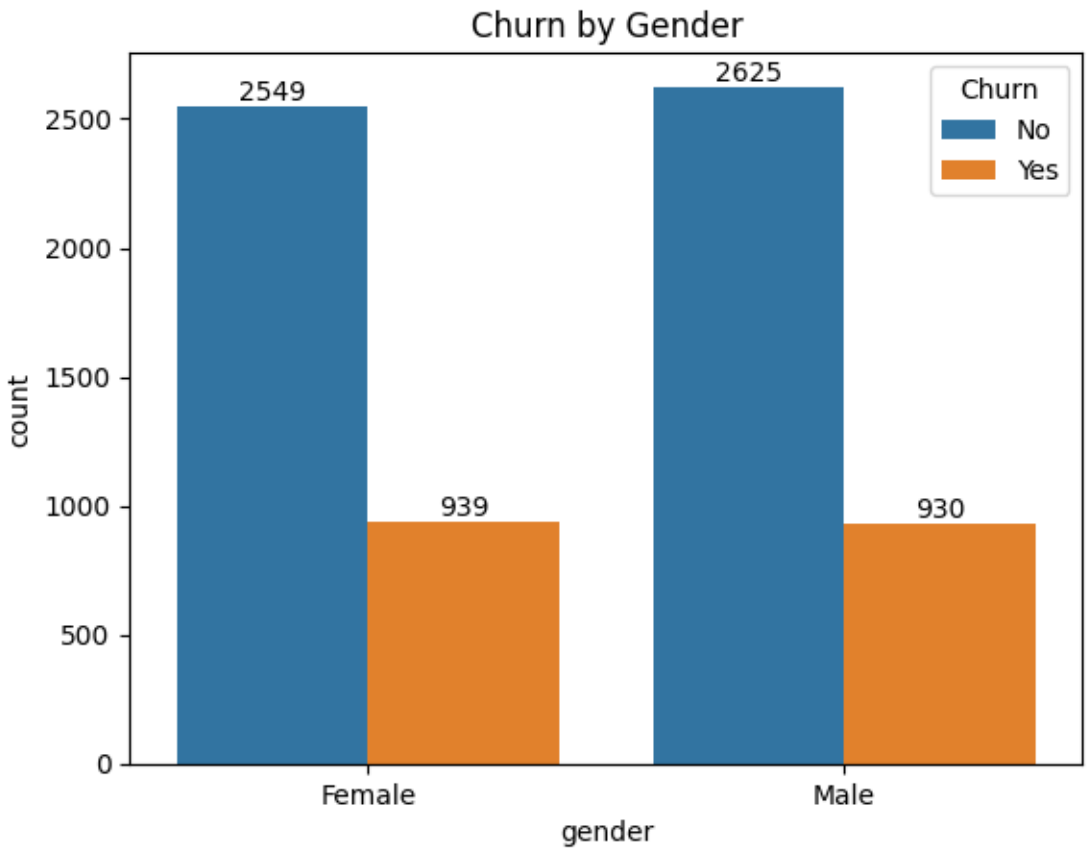
[25]:

Churn	Churn
No	5174
Yes	1869

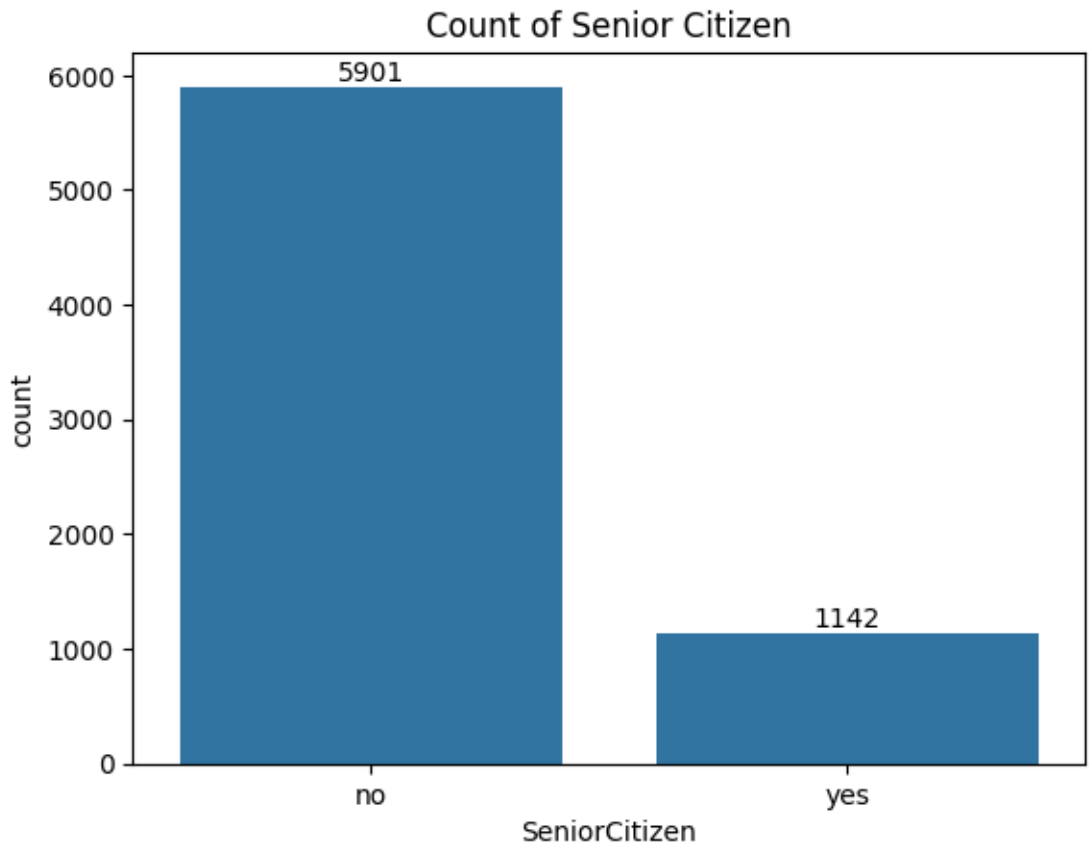
[32]:
```
plt.figure(figsize=(4,4))
plt.pie(gb["Churn"],labels=gb.index,autopct="%1.2f%%")
plt.title("Percentage of Customer Churn")
plt.show()
```



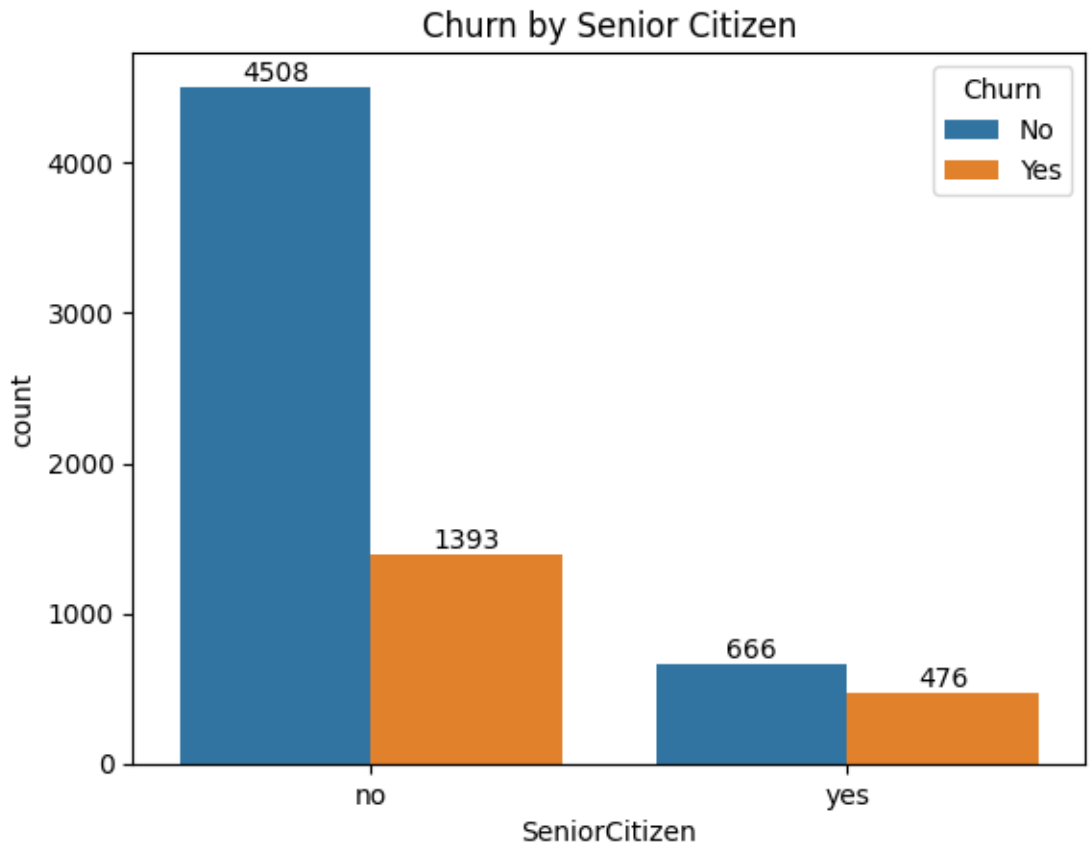
[42]:
```
ay=sns.countplot(x=data['gender'],data=data,hue='Churn')
ay.bar_label(ay.containers[0])
ay.bar_label(ay.containers[1])
plt.title("Churn by Gender")
plt.show()
```



[49]:
```
ab=sns.countplot(x=data['SeniorCitizen'],data=data)
ab.bar_label(ab.containers[0])
plt.title("Count of Senior Citizen")
plt.show()
```

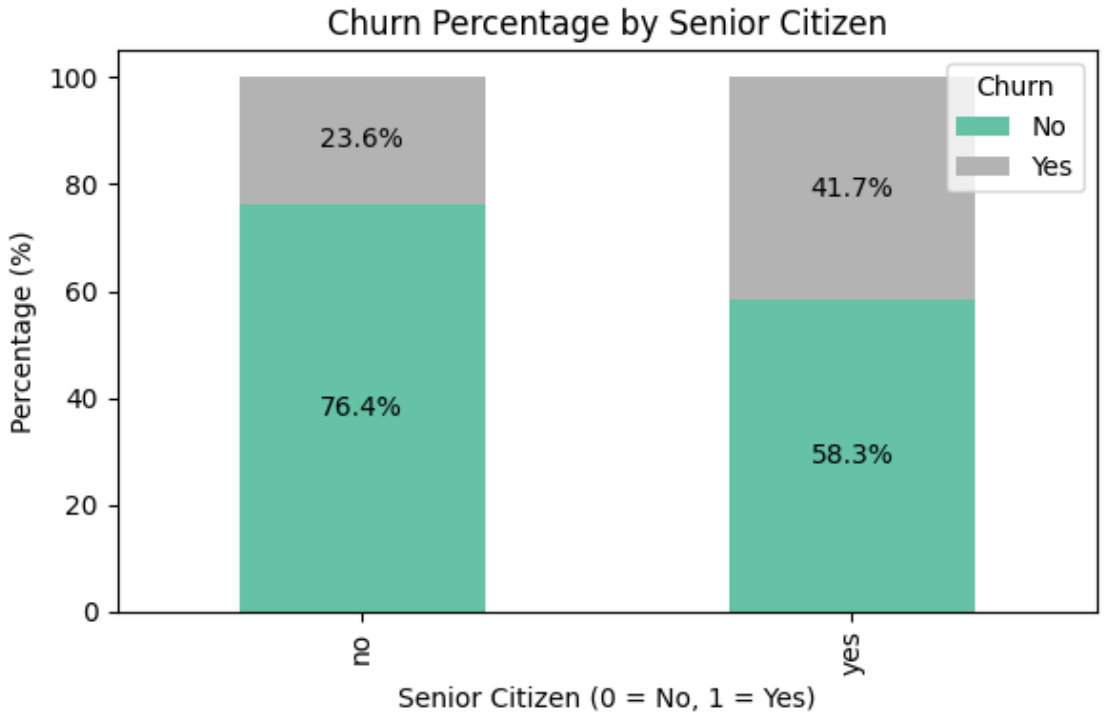


[43]:
```
az=sns.countplot(x=data['SeniorCitizen'],data=data,hue='Churn')
az.bar_label(az.containers[0])
az.bar_label(az.containers[1])
plt.title("Churn by Senior Citizen")
plt.show()
```

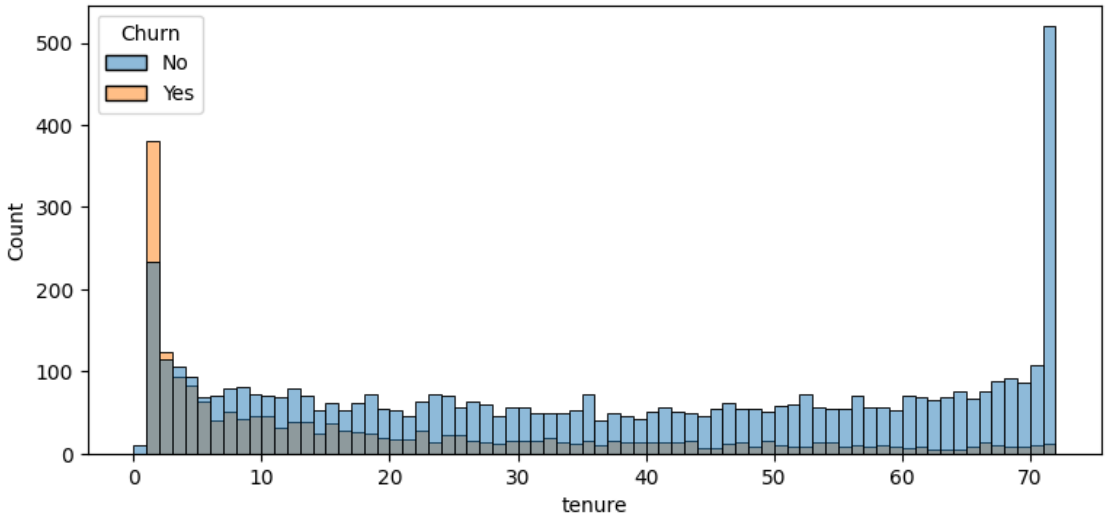


[44]:
```
ct = pd.crosstab(data['SeniorCitizen'], data['Churn'])

# Step 2: Convert to percentages
ct_percent = ct.div(ct.sum(axis=1), axis=0) * 100

# Step 3: Plot
ax = ct_percent.plot(kind='bar', stacked=True, colormap='Set2', figsize=(6,4))

# Step 4: Add percentage labels
for i, row in enumerate(ct_percent.values):
    bottom = 0
    for j, val in enumerate(row):
        if val > 0:
            ax.text(i, bottom + val / 2, f'{val:.1f}%', ha='center',␣
 ↪va='center', fontsize=10)
            bottom += val

# Formatting
plt.title('Churn Percentage by Senior Citizen')
plt.xlabel('Senior Citizen (0 = No, 1 = Yes)')
```

```
plt.ylabel('Percentage (%)')
plt.legend(title='Churn', loc='upper right')
plt.tight_layout()
plt.show()
```

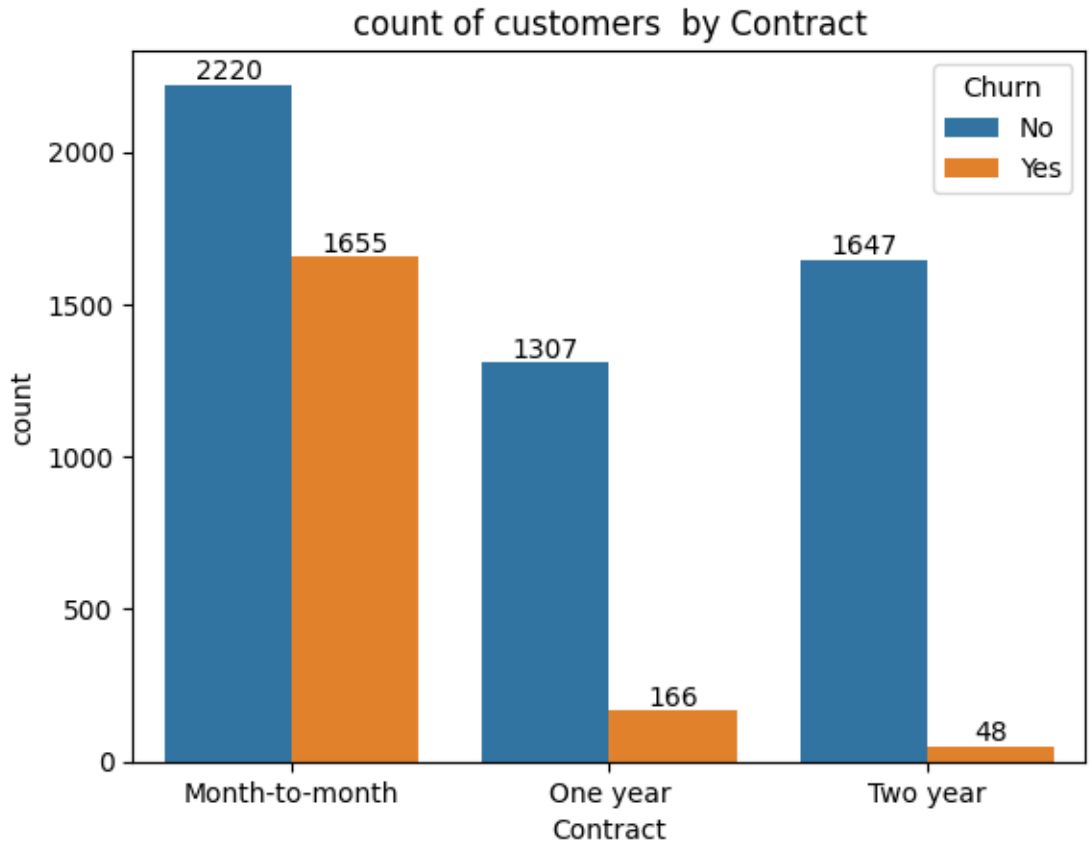


[57]:
```
plt.figure(figsize=(9,4))
sns.histplot(x='tenure',data=data,bins=72,hue='Churn')
plt.show()
```



2 people who have used have your services for long time has stay and people who used your services for 1 or 2 month haved churned

[62]:
```
ay=sns.countplot(x=data['Contract'],data=data,hue='Churn')
ay.bar_label(ay.containers[0])
ay.bar_label(ay.containers[1])
plt.title("count of customers  by Contract")
plt.show()
```

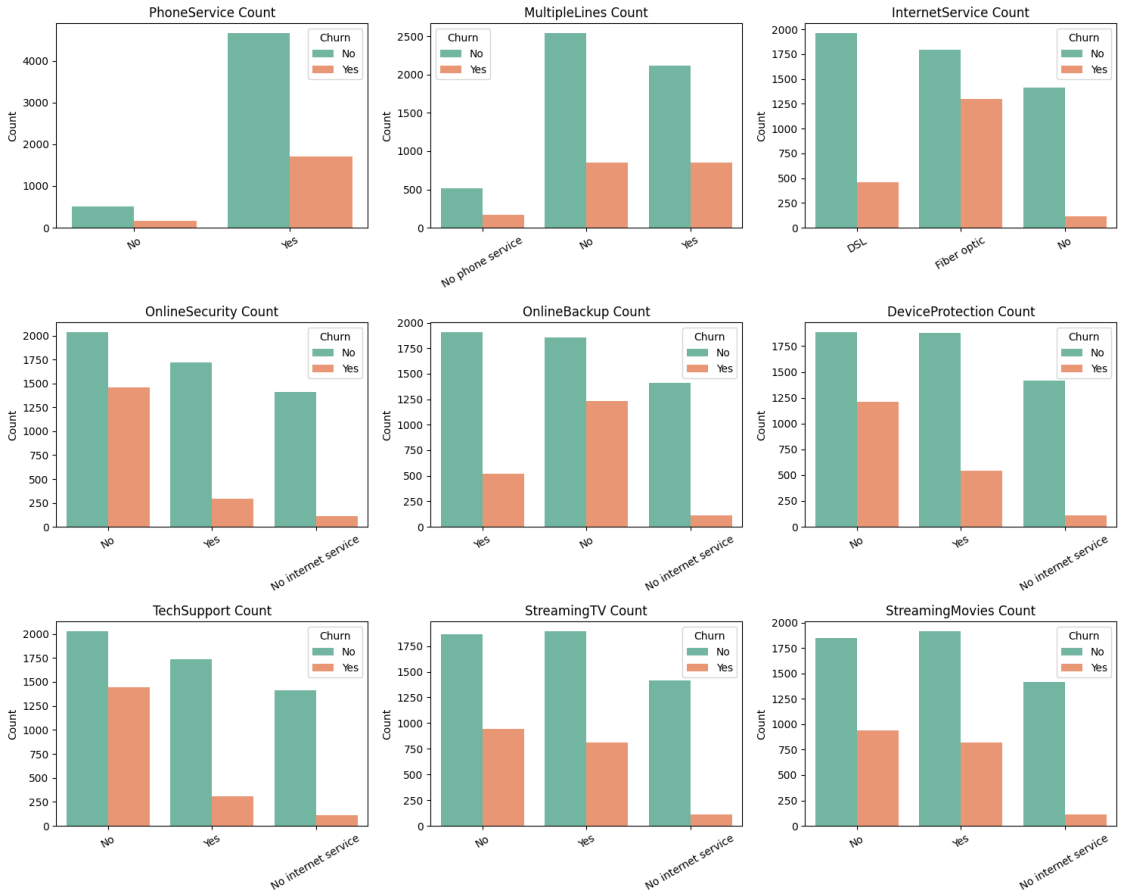


3 people who have 2 month contract are likely to churn then from those who have 1 or 2 yer of contract

[63]:
```
data.columns.values
```

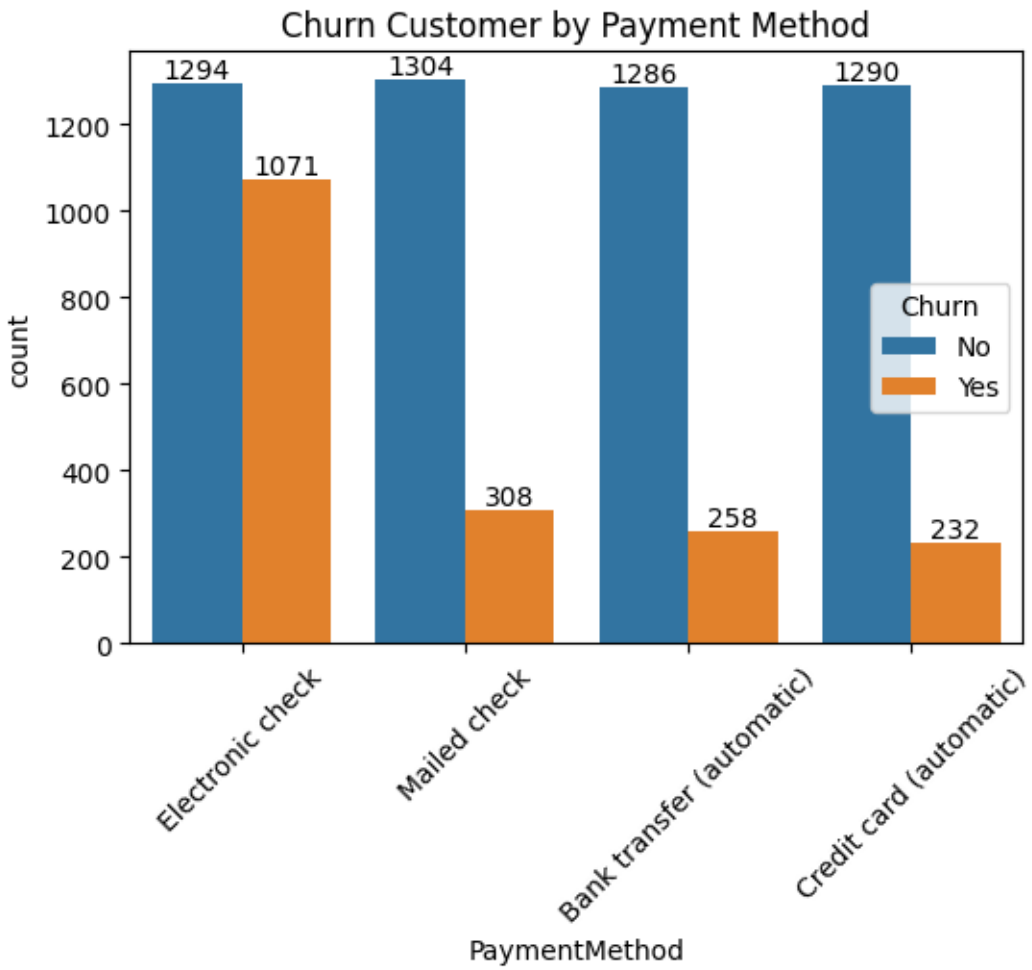
[63]:
```
array(['customerID', 'gender', 'SeniorCitizen', 'Partner', 'Dependents',
       'tenure', 'PhoneService', 'MultipleLines', 'InternetService',
       'OnlineSecurity', 'OnlineBackup', 'DeviceProtection',
       'TechSupport', 'StreamingTV', 'StreamingMovies', 'Contract',
       'PaperlessBilling', 'PaymentMethod', 'MonthlyCharges',
       'TotalCharges', 'Churn', 'customer ID'], dtype=object)
```

[66]:
```
cols = [
    'PhoneService', 'MultipleLines', 'InternetService',
    'OnlineSecurity', 'OnlineBackup', 'DeviceProtection',
    'TechSupport', 'StreamingTV', 'StreamingMovies'
]

# Create subplots (3 rows x 3 columns)
fig, axes = plt.subplots(nrows=3, ncols=3, figsize=(15, 12))
axes = axes.flatten()  # Flatten to 1D list for easy iteration

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

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



#Customers who do not have services like OnlineSecurity, TechSupport, and DeviceProtection are more likely to churn. Churn is higher among fiber optic users compared to DSL or no internet service. People without streaming services (TV or Movies) and OnlineBackup also tend to churn more. In general, lack of additional services is linked to higher churn rates, suggesting these features help retain customers.

[70]:
```
plt.figure(figsize=(6,4))
ax=sns.countplot(x="PaymentMethod",data=data,hue="Churn")
ax.bar_label(ax.containers[0])
ax.bar_label(ax.containers[1])
plt.xticks(rotation=45)
plt.title("Churn Customer by Payment Method")
plt.show()
```



#Customer is Likely to Churn when he is using electronic check as a payment method

[ ]: