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

df=pd.read_csv(r"D:\Data Set\grameenphone_customer_churn.csv")
df.head(5)
```

```
  customer_id  age  gender   region  sim_type          package  \
0     GP00001   56    Male  Barisal   Prepaid  Priyo Unlimited
1     GP00002   69  Female   Khulna   Prepaid           Djuice
2     GP00003   46  Female    Dhaka  Postpaid       Nishchinto
3     GP00004   32    Male  Rangpur   Prepaid           MyPlan
4     GP00005   60    Male  Barisal  Postpaid           Djuice

   monthly_recharge  call_minutes  data_usage_gb  tenure_months churn
0             467.0         213.0           0.28             13    No
1             256.0         120.0           3.08             39    No
2             178.0         424.0           6.01             15    No
3             422.0         297.0           2.87             38    No
4             258.0          89.0           3.44             30    No
```

```
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 5000 entries, 0 to 4999
Data columns (total 11 columns):
 #   Column            Non-Null Count  Dtype
---  ------            --------------  -----
 0   customer_id       5000 non-null   object
 1   age               5000 non-null   int64
 2   gender            5000 non-null   object
 3   region            5000 non-null   object
 4   sim_type          5000 non-null   object
 5   package           5000 non-null   object
 6   monthly_recharge  5000 non-null   float64
 7   call_minutes      5000 non-null   float64
 8   data_usage_gb     5000 non-null   float64
 9   tenure_months     5000 non-null   int64
 10  churn             5000 non-null   object
dtypes: float64(3), int64(2), object(6)
memory usage: 429.8+ KB
```

```
df.isnull().sum()
df.duplicated().sum()
```

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

```
df.describe()
```

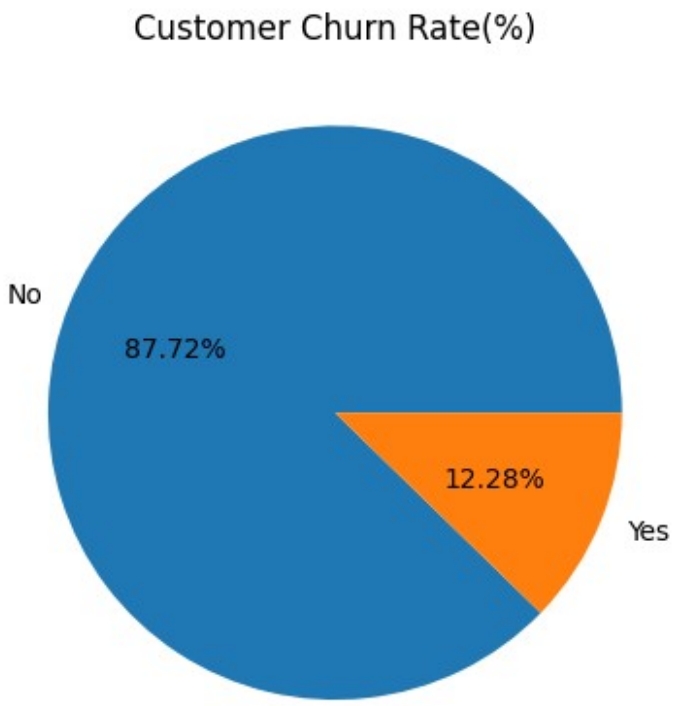
```
                age  monthly_recharge  call_minutes  data_usage_gb  \
count  5000.000000       5000.000000   5000.000000    5000.000000   
mean     43.584600        307.381600    251.219000       3.063358   
std      14.919094        144.475338    100.473561       1.873711   
min      18.000000         50.000000      0.000000       0.000000   
25%      31.000000        201.000000    183.000000       1.620000   
50%      43.000000        307.000000    249.000000       3.010000   
75%      56.000000        408.000000    319.000000       4.340000   
max      69.000000        867.000000    631.000000      10.010000   
```

```
       tenure_months
count     5000.00000
mean        29.87880
std         16.99117
min          1.00000
25%         15.00000
50%         30.00000
75%         44.00000
max         59.00000
```

```
df['churn'].value_counts()
```

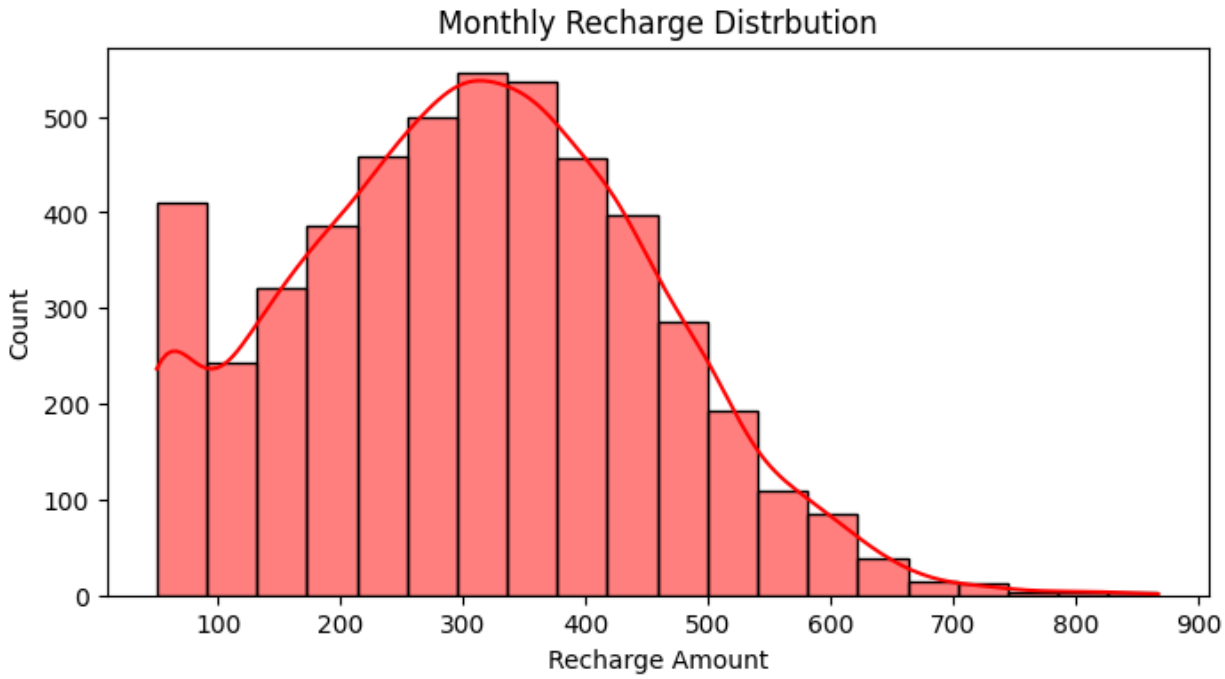
```
churn
No     4386
Yes     614
Name: count, dtype: int64
```

```
gb=df.groupby('churn').agg({'churn':'count'})
plt.pie(gb['churn'], labels=gb.index, autopct='%1.2f%%')
plt.title('Customer Churn Rate(%)')
plt.show()
```

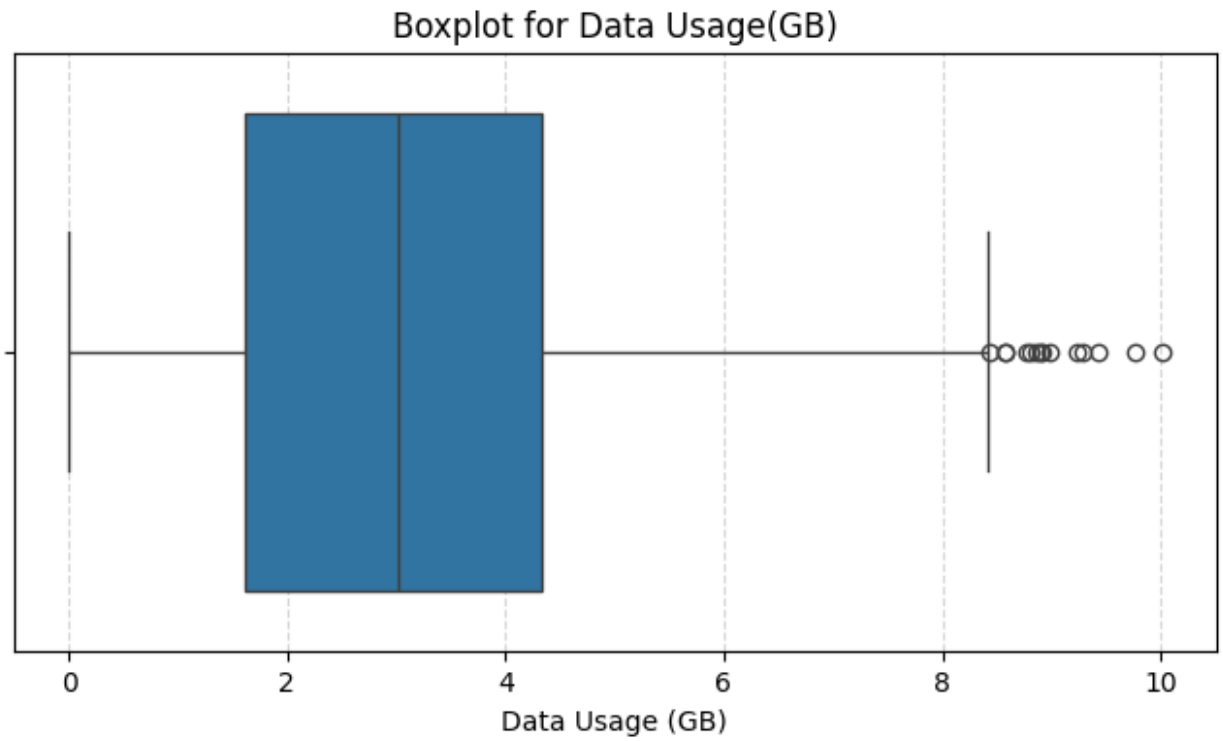


monthly_recharge → distribution plot

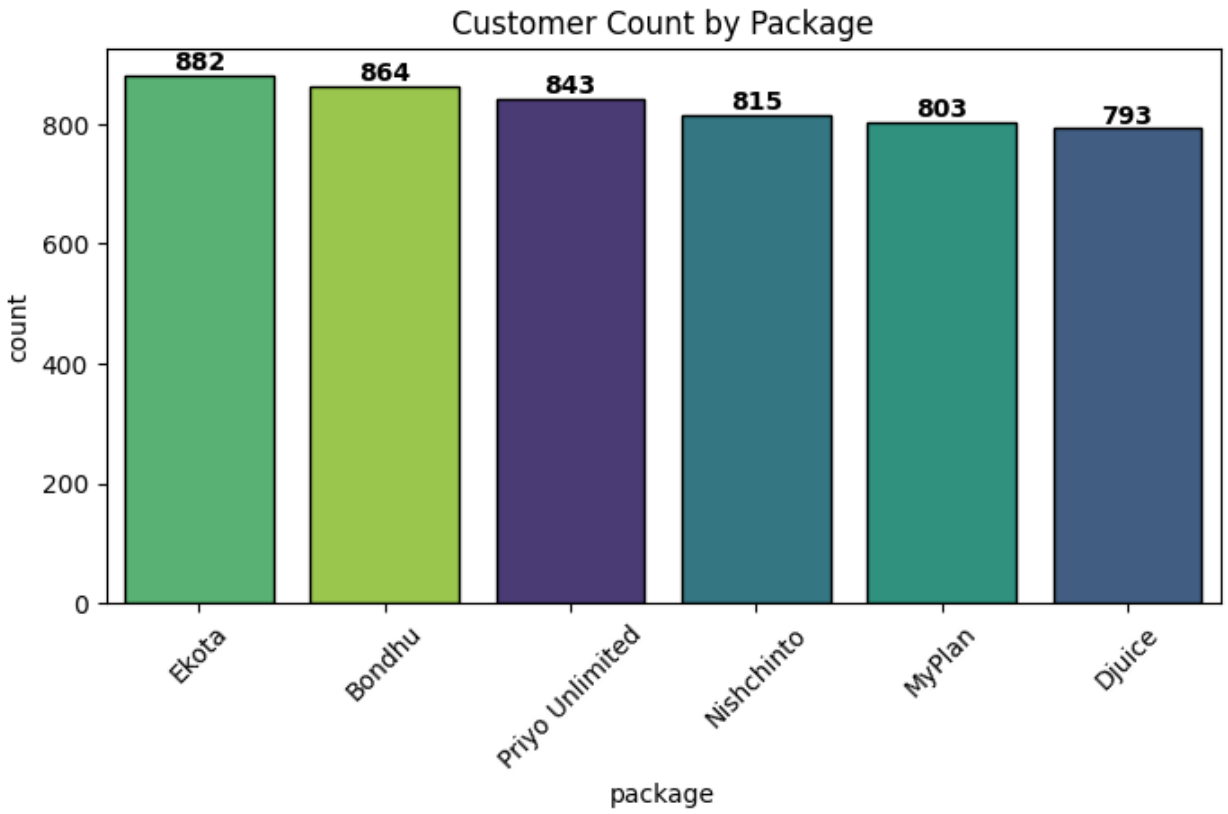
```
plt.figure(figsize=(8,4))
sns.histplot(df['monthly_recharge'], kde=True, color='red',
edgecolor='black', bins=20)
plt.title('Monthly Recharge Distrbution')
plt.xlabel('Recharge Amount')
plt.ylabel('Count')
plt.show()
```



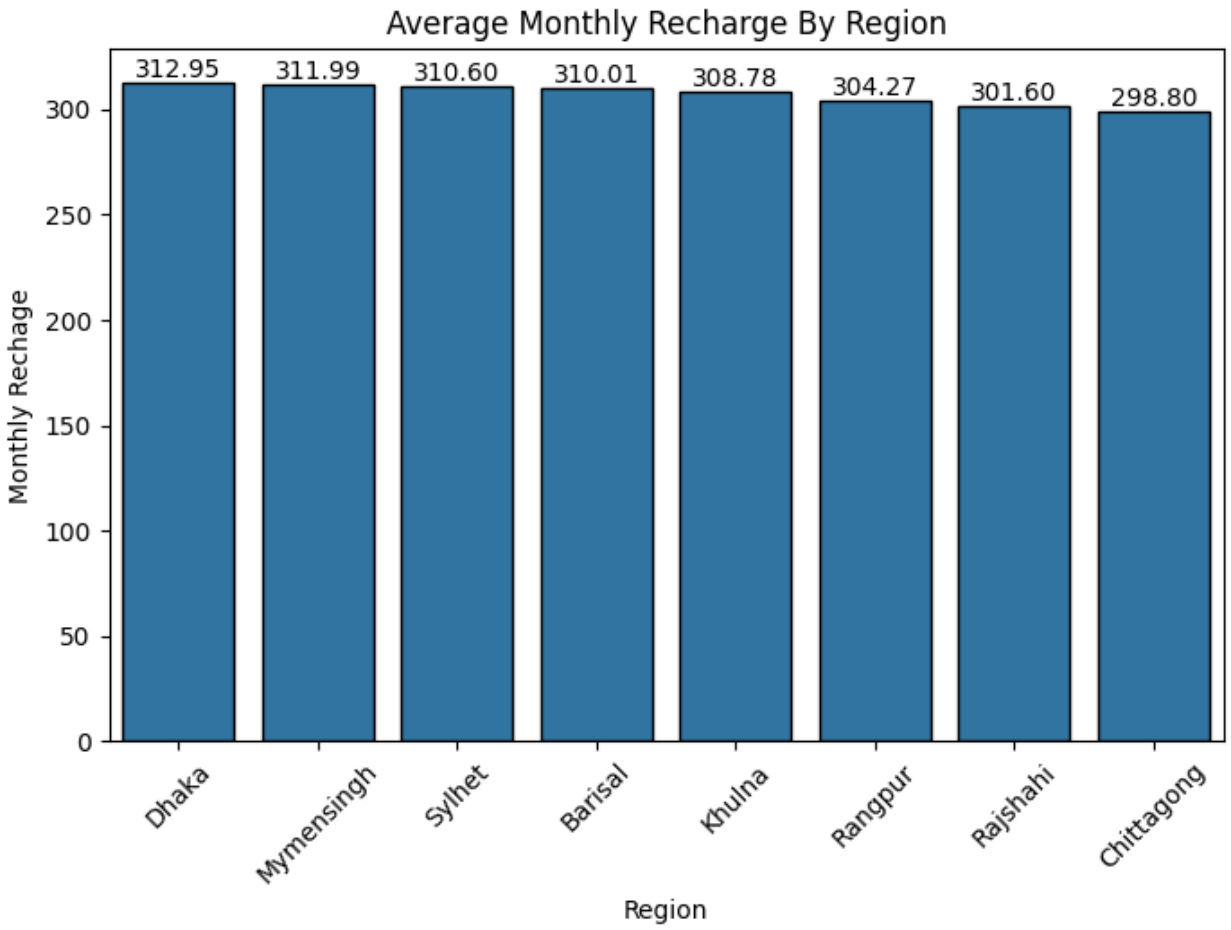

```
plt.figure(figsize=(8,4))
sns.boxplot(x=df['data_usage_gb'])
plt.grid(axis='x', linestyle='--', alpha=0.5)
plt.title('Boxplot for Data Usage(GB)')
plt.xlabel('Data Usage (GB)')
plt.show()
```



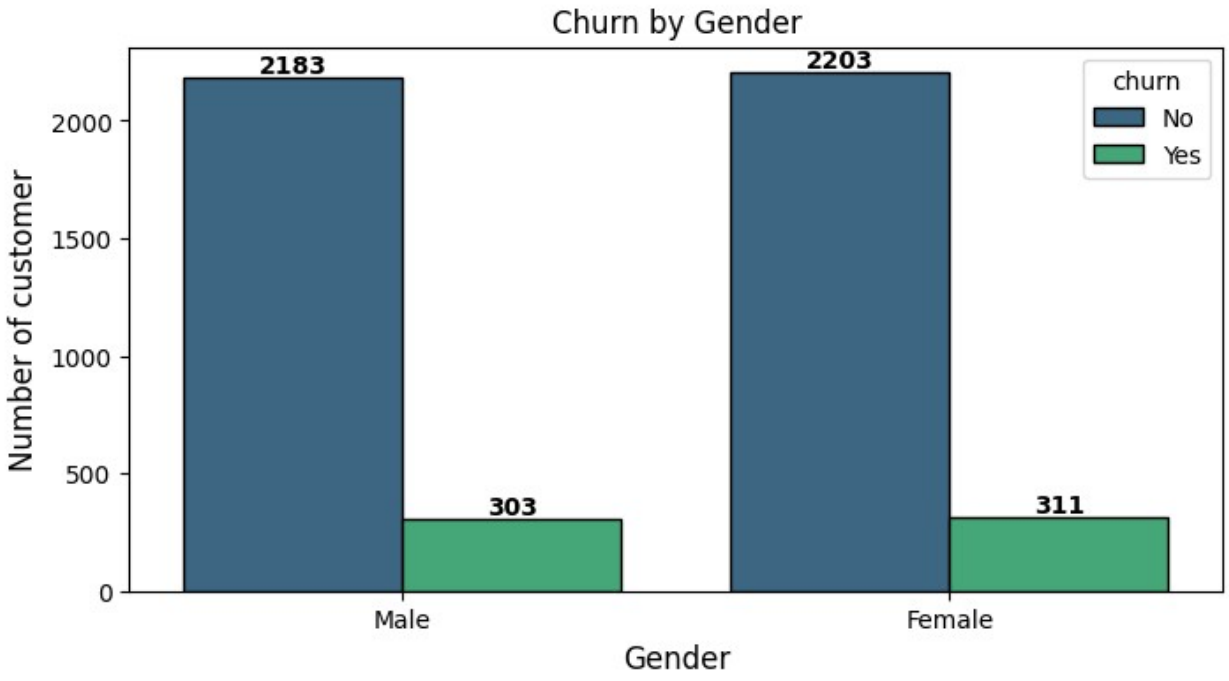

```
order= df['package'].value_counts().sort_values(ascending=False).index
plt.figure(figsize=(8,4))
ax = sns.countplot( data=df, x='package', hue='package',
palette='viridis',order=order, legend=False, edgecolor='black')
# ax.bar_label(ax.containers[0], fontsize=10, color='black',
weight='bold')
for container in ax.containers:
    ax.bar_label(container, weight='bold')
plt.title('Customer Count by Package')
plt.xticks(rotation=45)
plt.show()
```



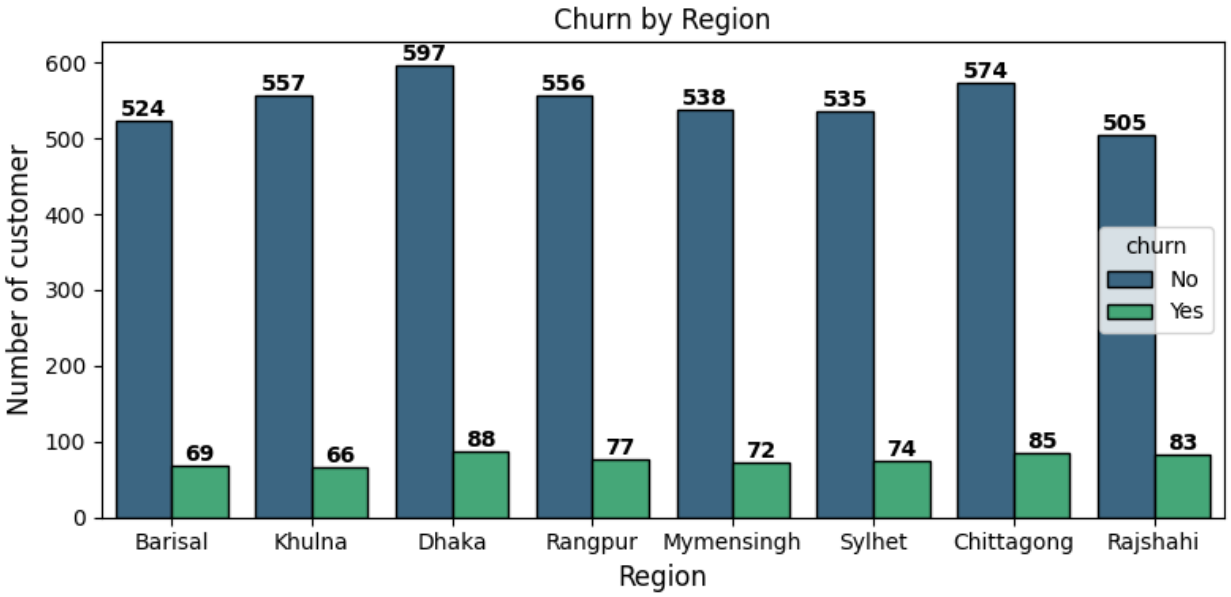

```
plt.figure(figsize=(8,5))
r_r=df.groupby('region')['monthly_recharge'].mean().reset_index()
r_r=r_r.sort_values(by='monthly_recharge', ascending=False)
order=r_r['region']
ax=sns.barplot(x='region', y='monthly_recharge', data=r_r,
order=order, edgecolor='black')
for container in ax.containers:
    ax.bar_label(container, fmt='%.2f')
plt.title('Average Monthly Recharge By Region')
plt.xlabel('Region')
plt.ylabel('Monthly Rechage')
plt.xticks(rotation=45)
plt.show()
```



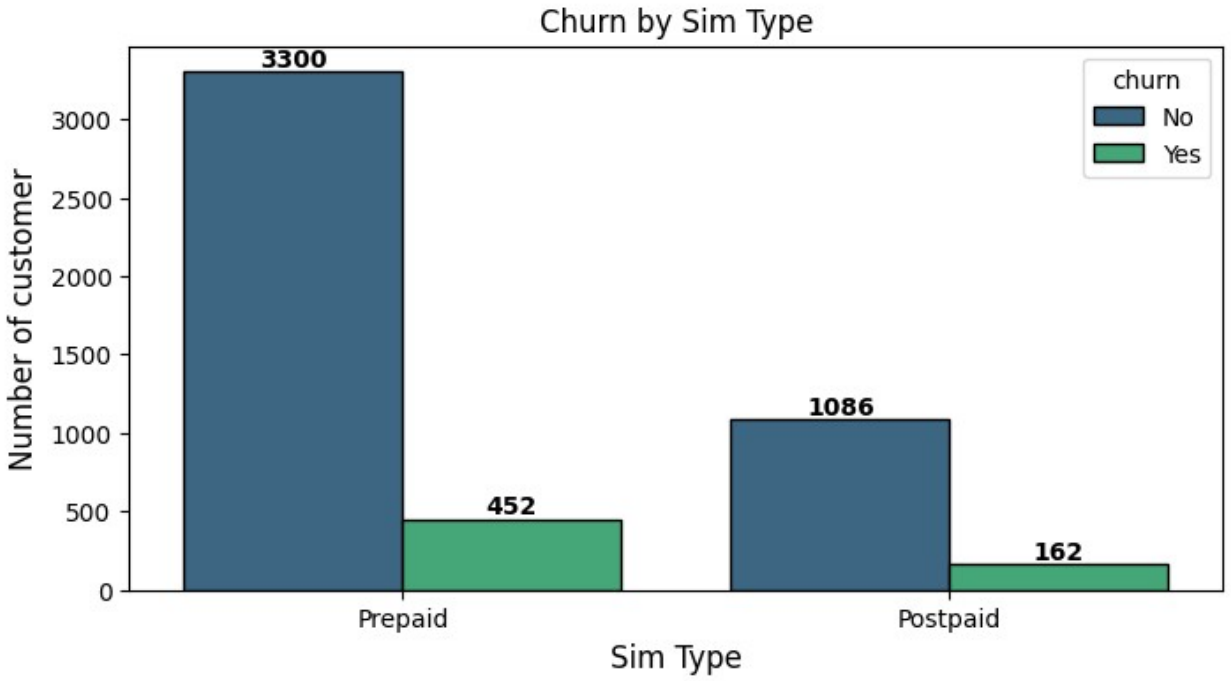

```
plt.figure(figsize=(8,4))
ax=sns.countplot(x='gender', data=df, hue='churn', palette='viridis',
edgecolor='black')
for container in ax.containers:
    ax.bar_label(container, weight='bold')
plt.title('Churn by Gender')
plt.xlabel('Gender', fontsize=12)
plt.ylabel('Number of customer', fontsize=12)
plt.show()
```



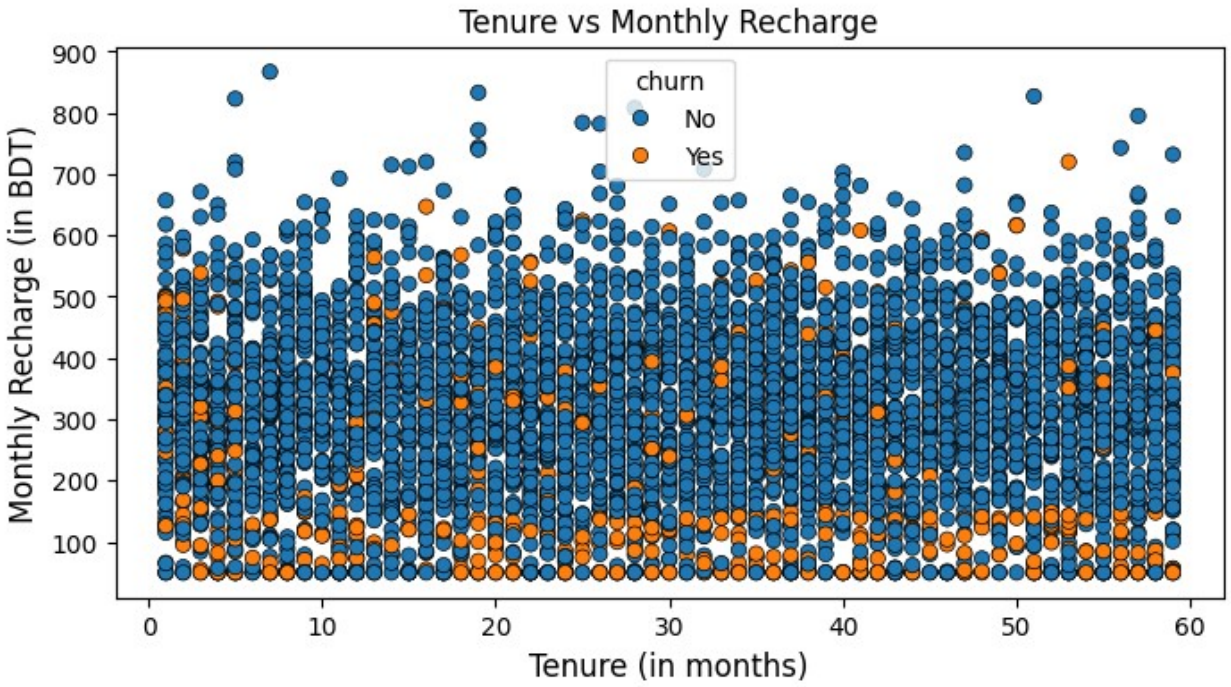

```
plt.figure(figsize=(8,4))
ax=sns.countplot(x='region', data=df, hue='churn', palette='viridis',
edgecolor='black')
for container in ax.containers:
    ax.bar_label(container, weight='bold')
plt.title('Churn by Region')
plt.xlabel('Region', fontsize=12)
plt.ylabel('Number of customer', fontsize=12)
plt.tight_layout()
plt.show()
```




```
plt.figure(figsize=(8,4))
ax=sns.countplot(x='sim_type', data=df, hue='churn',
palette='viridis', edgecolor='black')
for container in ax.containers:
    ax.bar_label(container, weight='bold')
plt.title('Churn by Sim Type')
plt.xlabel('Sim Type', fontsize=12)
plt.ylabel('Number of customer', fontsize=12)
plt.show()
```



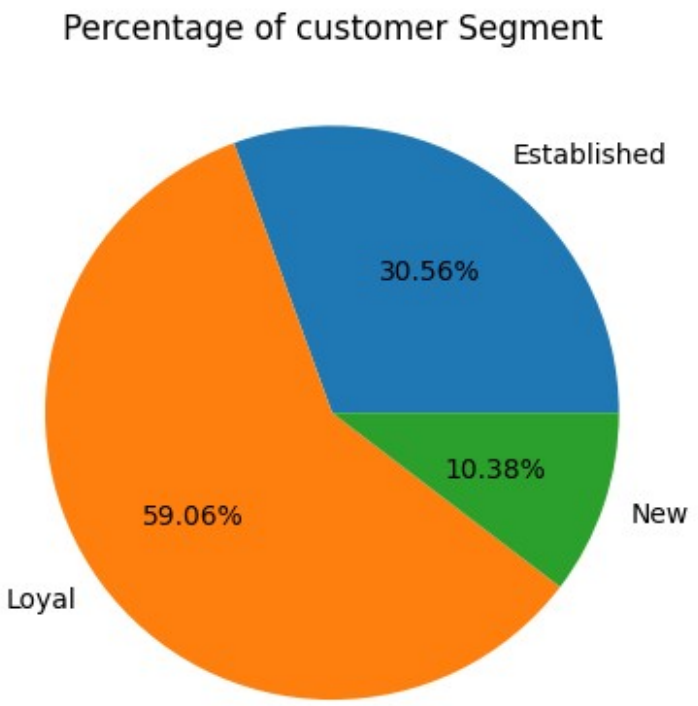
```
plt.figure(figsize=(8,4))
sns.scatterplot(x='tenure_months', y='monthly_recharge', data=df,
hue='churn', edgecolor='black')
# for container in ax.containers:
#     ax.bar_label(container, weight='bold')
plt.title('Tenure vs Monthly Recharge')
plt.xlabel('Tenure (in months)', fontsize=12)
plt.ylabel('Monthly Recharge (in BDT)', fontsize=12)
plt.show()
```



Segment tenure_months → New, Established, Loyal

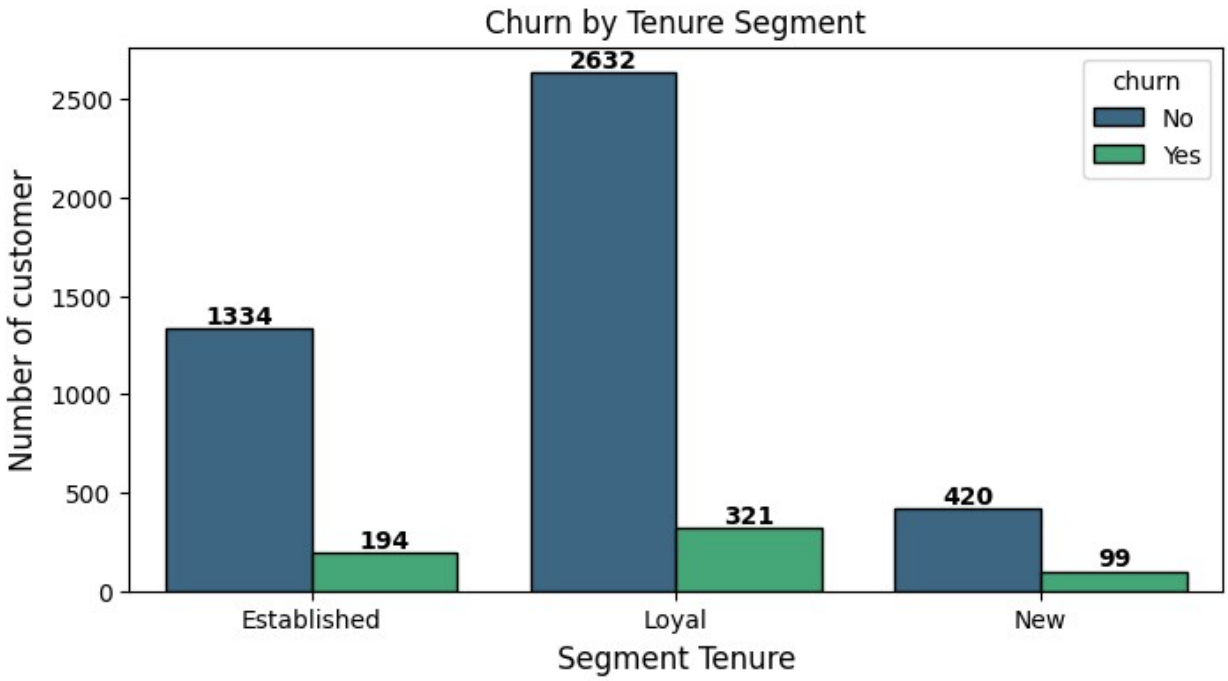
```
def segment_tenure(months):
    if months <=6:
        return 'New'
    elif months<=24:
        return 'Established'
    else:
        return 'Loyal'
df['tenure_segment']=df['tenure_months'].apply(segment_tenure)

gb=df.groupby('tenure_segment').agg({'tenure_segment':'count'})
plt.pie(gb['tenure_segment'], labels=gb.index, autopct='%1.2f%%')
plt.title('Percentage of customer Segment')
plt.show()
```

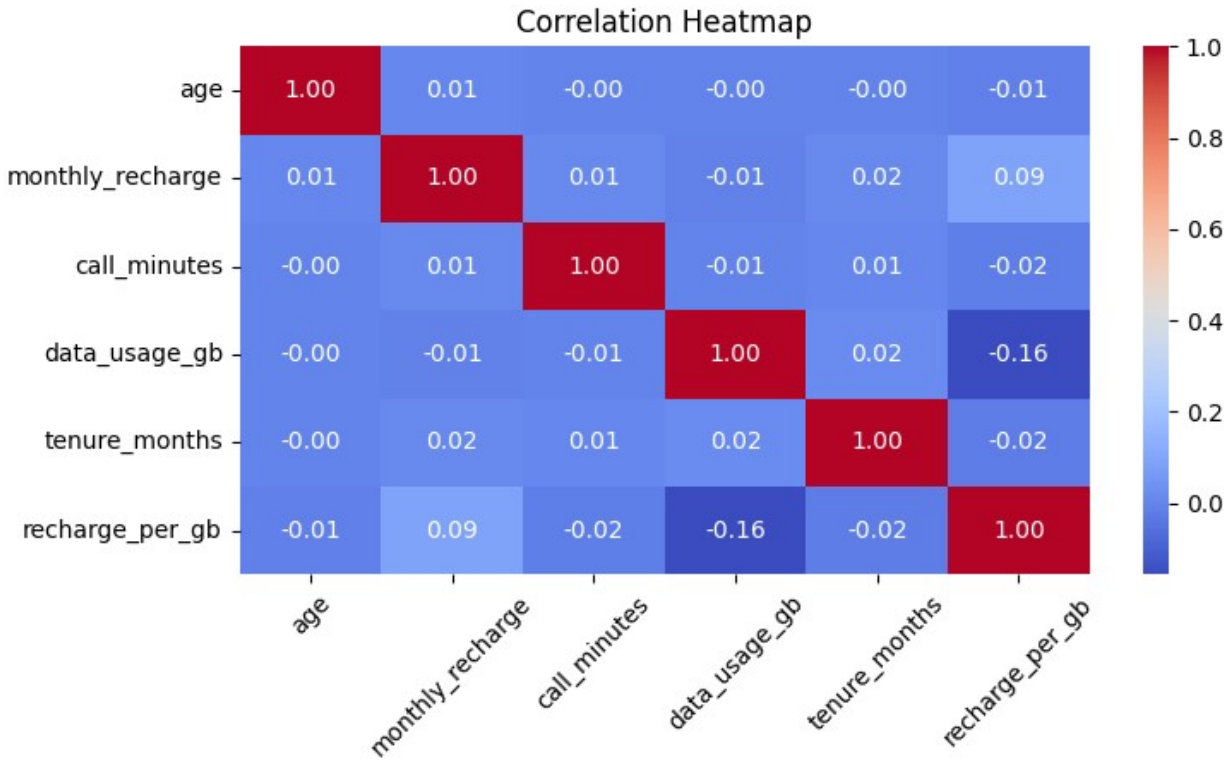


Churn by segment_tenure

```
plt.figure(figsize=(8,4))
ax=sns.countplot(x='tenure_segment', data=df, hue='churn',
palette='viridis', edgecolor='black')
for container in ax.containers:
    ax.bar_label(container, weight='bold')
plt.title('Churn by Tenure Segment')
plt.xlabel('Segment Tenure', fontsize=12)
plt.ylabel('Number of customer', fontsize=12)
plt.show()
```




```
numeric_df=df.select_dtypes(include='number').round(2)
corr=numeric_df.corr()
plt.figure(figsize=(8,4))
sns.heatmap(corr, annot=True, cmap='coolwarm', fmt='.2f' )
plt.title('Correlation Heatmap')
plt.xticks(rotation=45)
plt.show()
```


Correlation Heatmap
age
monthly_recharge
call_minutes
data_usage_gb
tenure_months
recharge_per_gb
1.00 0.01 -0.00 -0.00 -0.00 -0.01
0.01 1.00 0.01 -0.01 0.02 0.09
-0.00 0.01 1.00 -0.01 0.01 -0.02
-0.00 -0.01 -0.01 1.00 0.02 -0.16
-0.00 0.02 0.01 0.02 1.00 -0.02
-0.01 0.09 -0.02 -0.16 -0.02 1.00
1.0
0.8
0.6
0.4
0.2
0.0