

Customer Churn Report

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Problem Statement

A leading cell phone company aims to identify key factors contributing to customer churn to reduce advertising costs by \$3,500 per churn.

Exploratory Data Analysis (EDA)

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Dataset Overview

- 667 Observations
- 20 Variables
- Independent Variables
 - the total number of minutes, charges, and calls for each day, eve, night, and international. As well as, information about the customer's location (State), area code, how many customer service calls made, the number of voicemails, and if they have an international or voicemail plan (Y/N).
- Dependent Variable:
 - Customer Churn (Y/N).
- Missing Values:
 - None
- Basic Feature Engineering:
 - Cluster states by time-zone regions to test significance on a smaller scale.
 - More after EDA.

Descriptive Statistics

Numerical Features:

- Account Length
- Number of Voicemail Messages
- Total Day Minutes
- Total Day Charge
- Total Day Calls
- Total Eve Minutes
- Total Eve Charge
- Total Eve Calls
- Total Night Minutes
- Total Night Charge
- Total Night Calls
- Total Intl Minutes
- Total Intl Charge
- Total Intl Calls
- Customer Service Calls

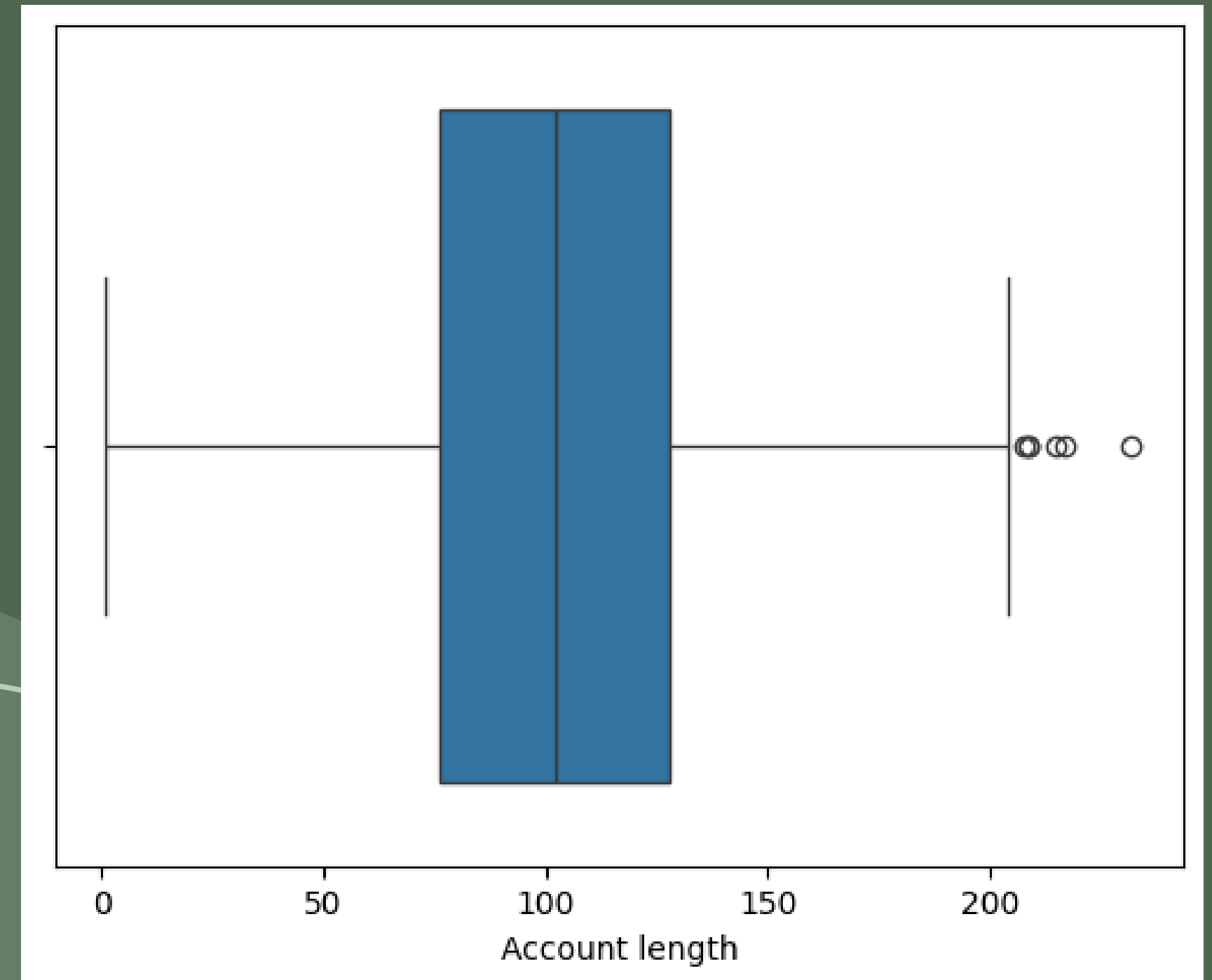
Descriptive Statistics

Account Length: The number of days the customer has been with the company.

Average: 102 days

Median: 102 days

Range: 1 - 232



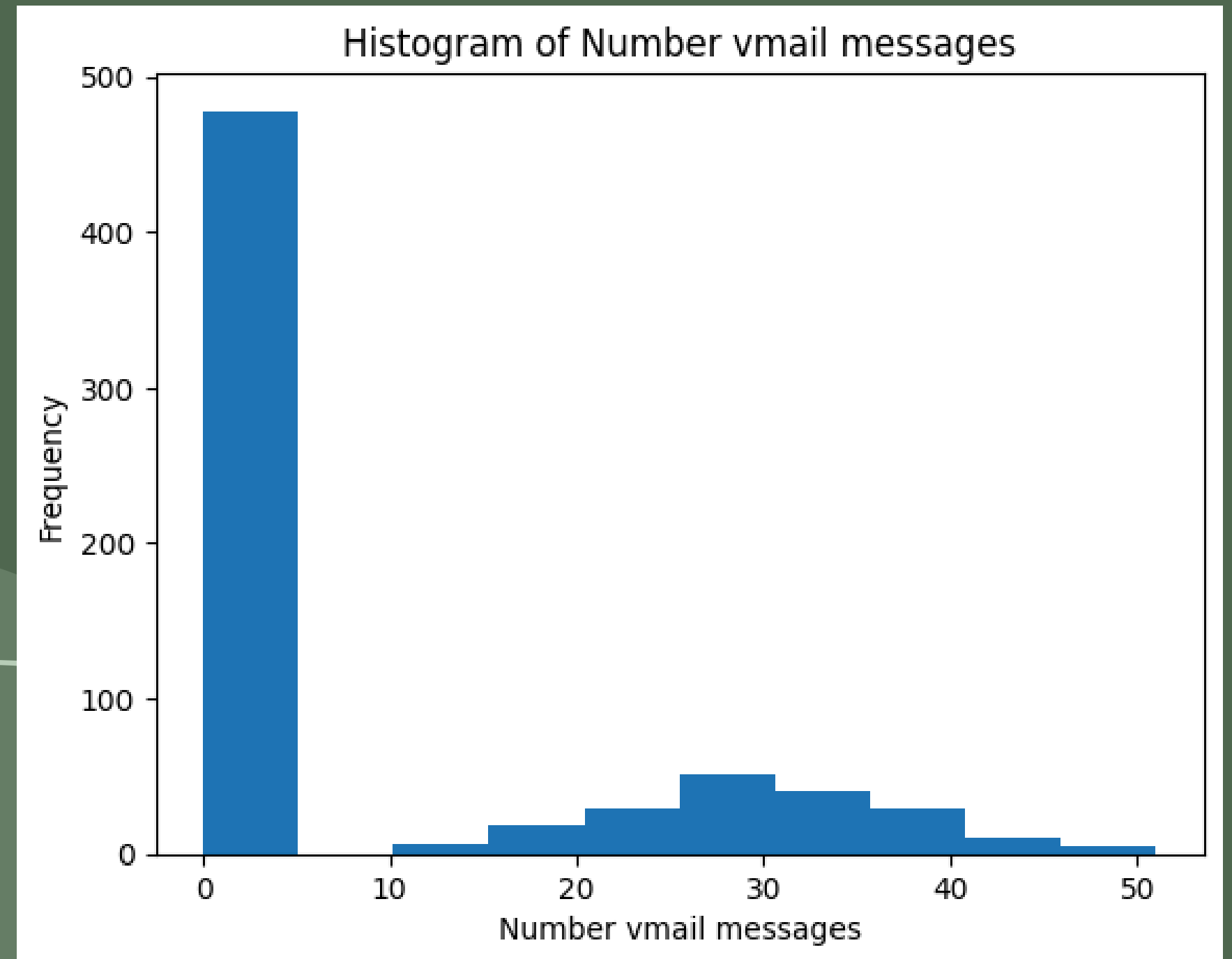
Descriptive Statistics

Number of Voicemail Messages:

Average: About 8 messages

Median: 0

Range: 0 – 51



Descriptive Statistics

Total Day Minutes:

Average: about 181 minutes

Median: 178 minutes

Range: 25 - 334

Total Day Charges:

Average: About \$31

Median: \$30.31

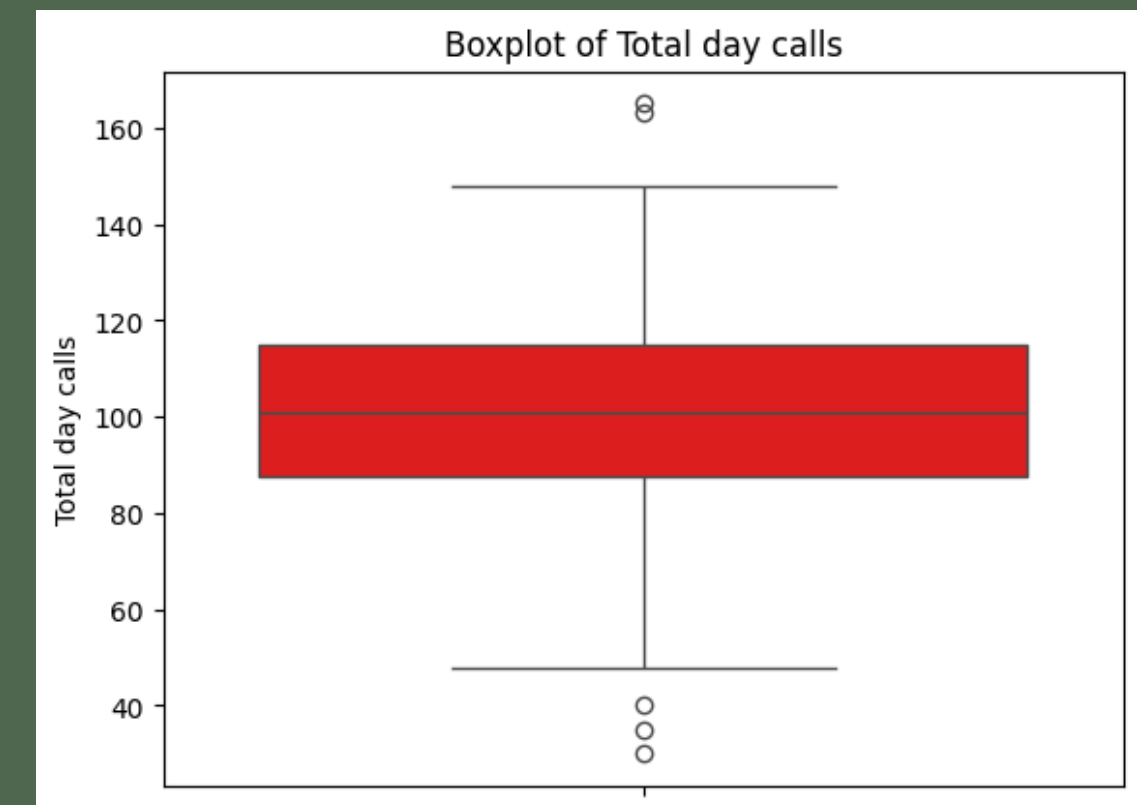
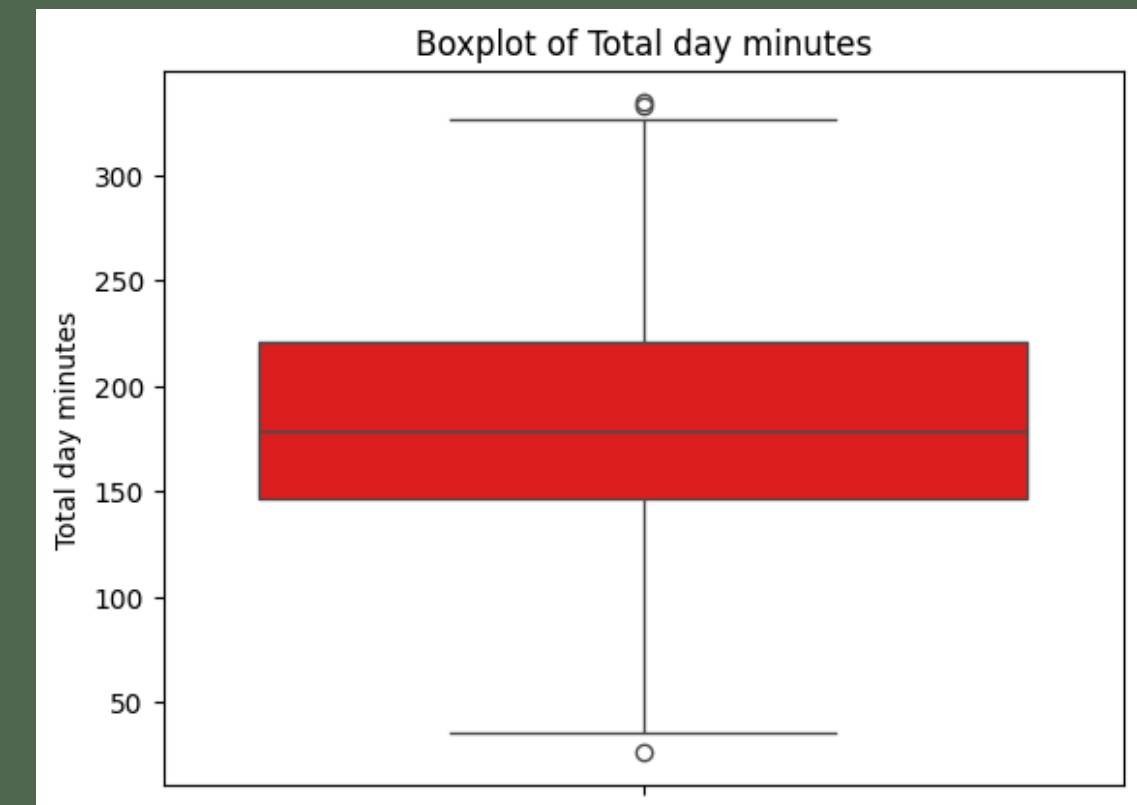
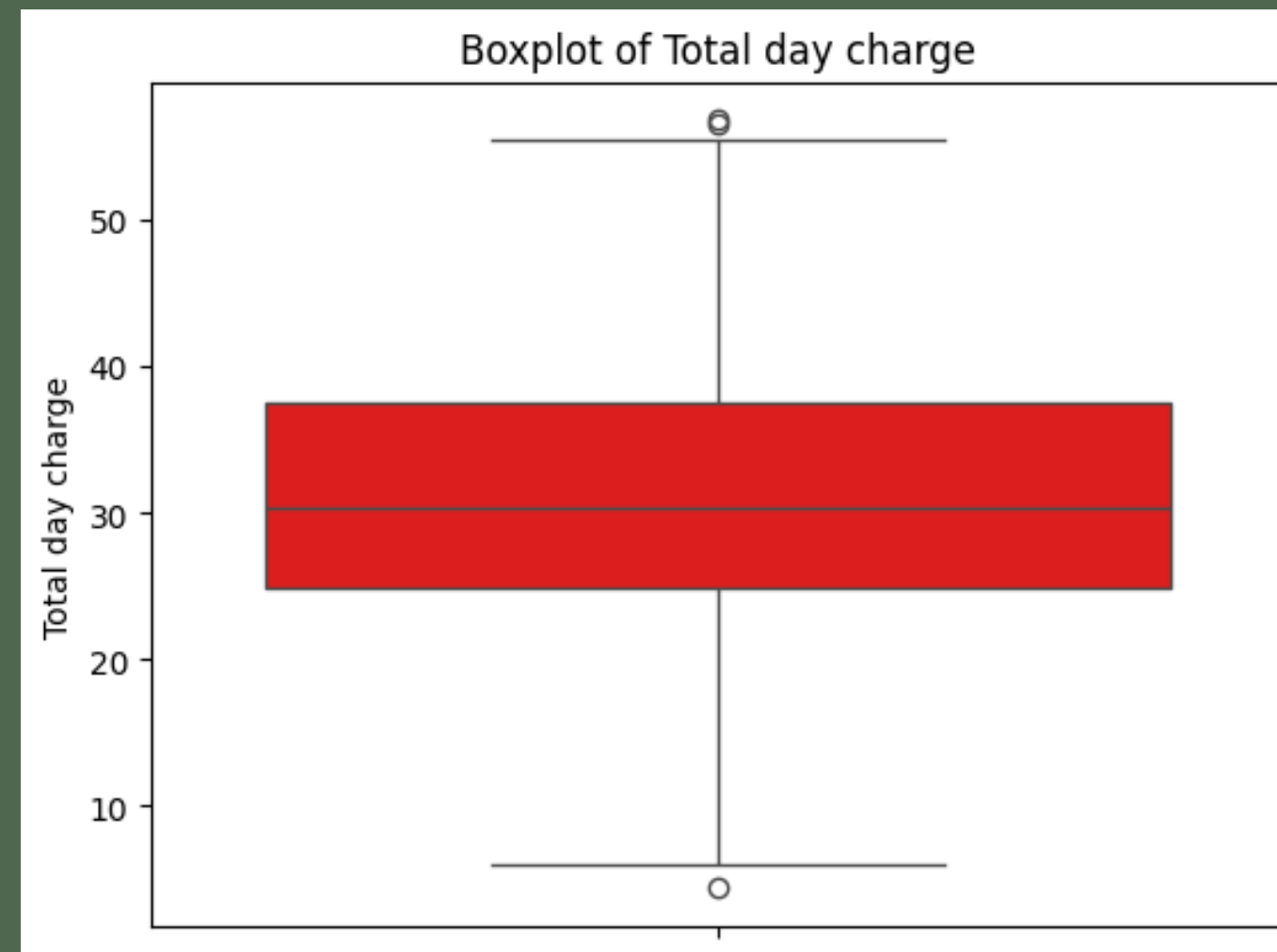
Range: 4.40 - 56.83

Total Day Calls:

Average: about 101 calls

Median: 101 calls

Range: 30 - 165



Descriptive Statistics

Total Eve Minutes:

Average: about 203 minutes

Median: 204 minutes

Range: 48 - 361

Total Eve Charges:

Average: About \$17

Median: \$17.31

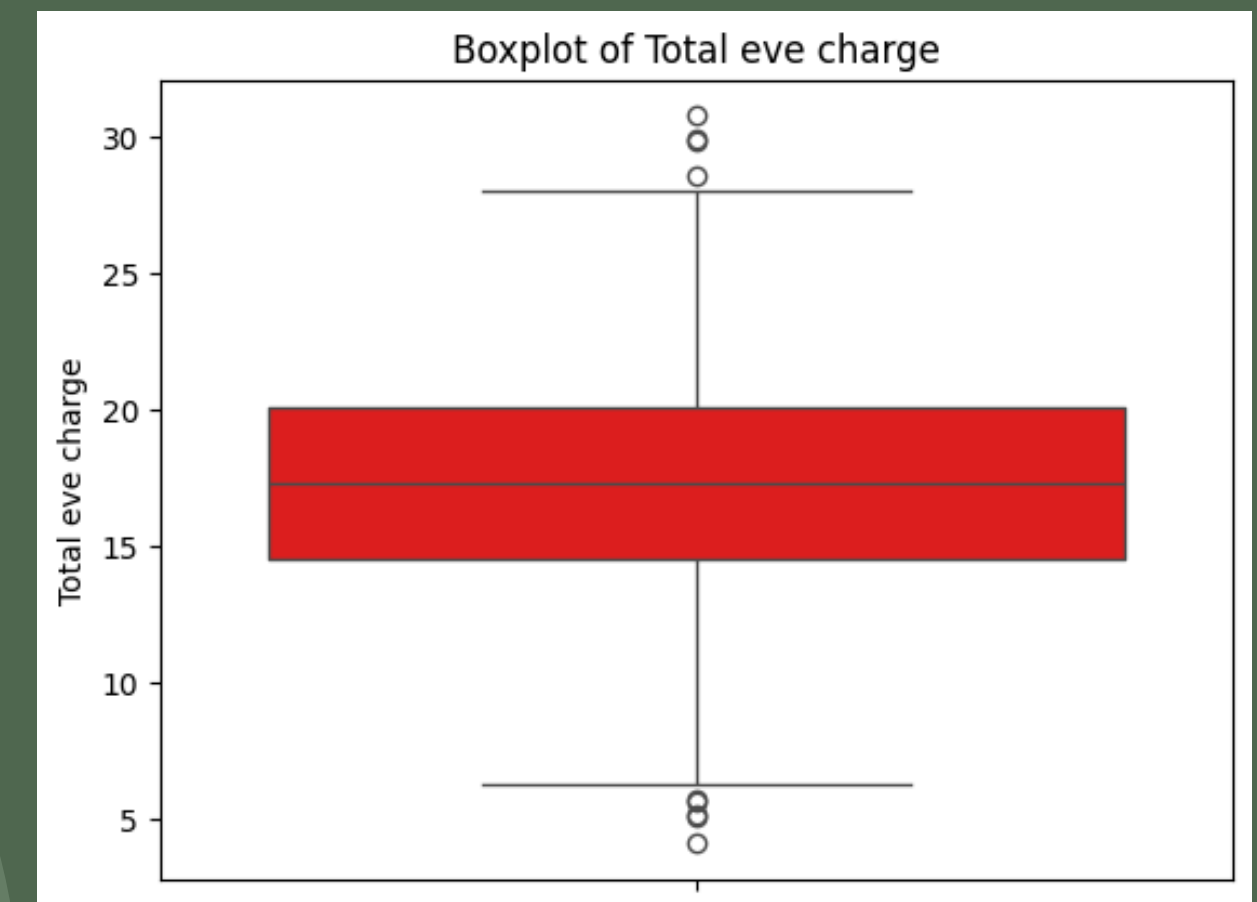
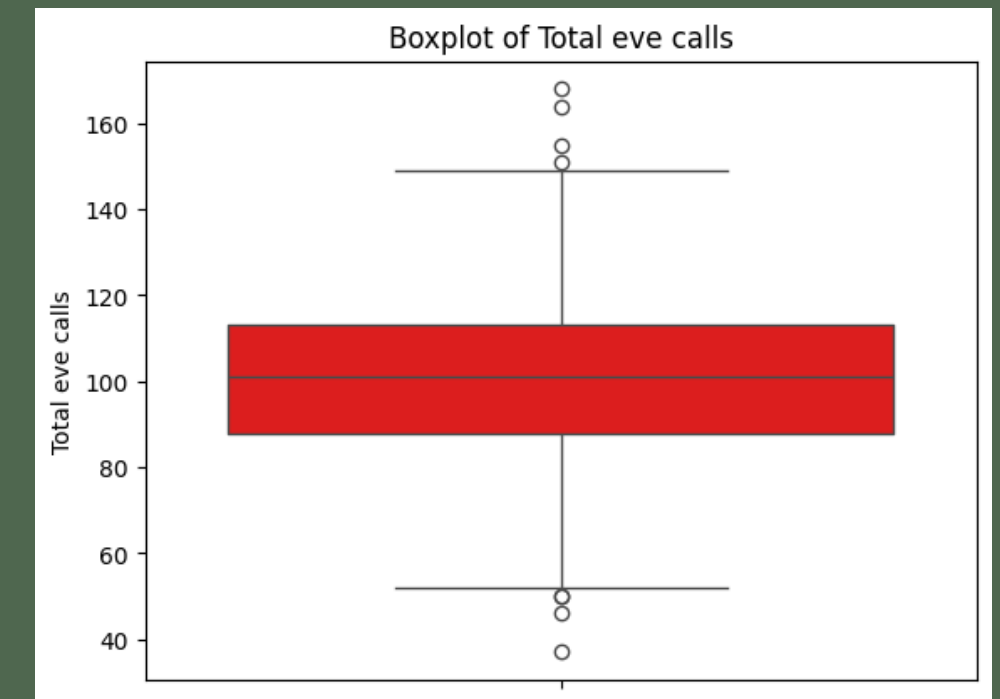
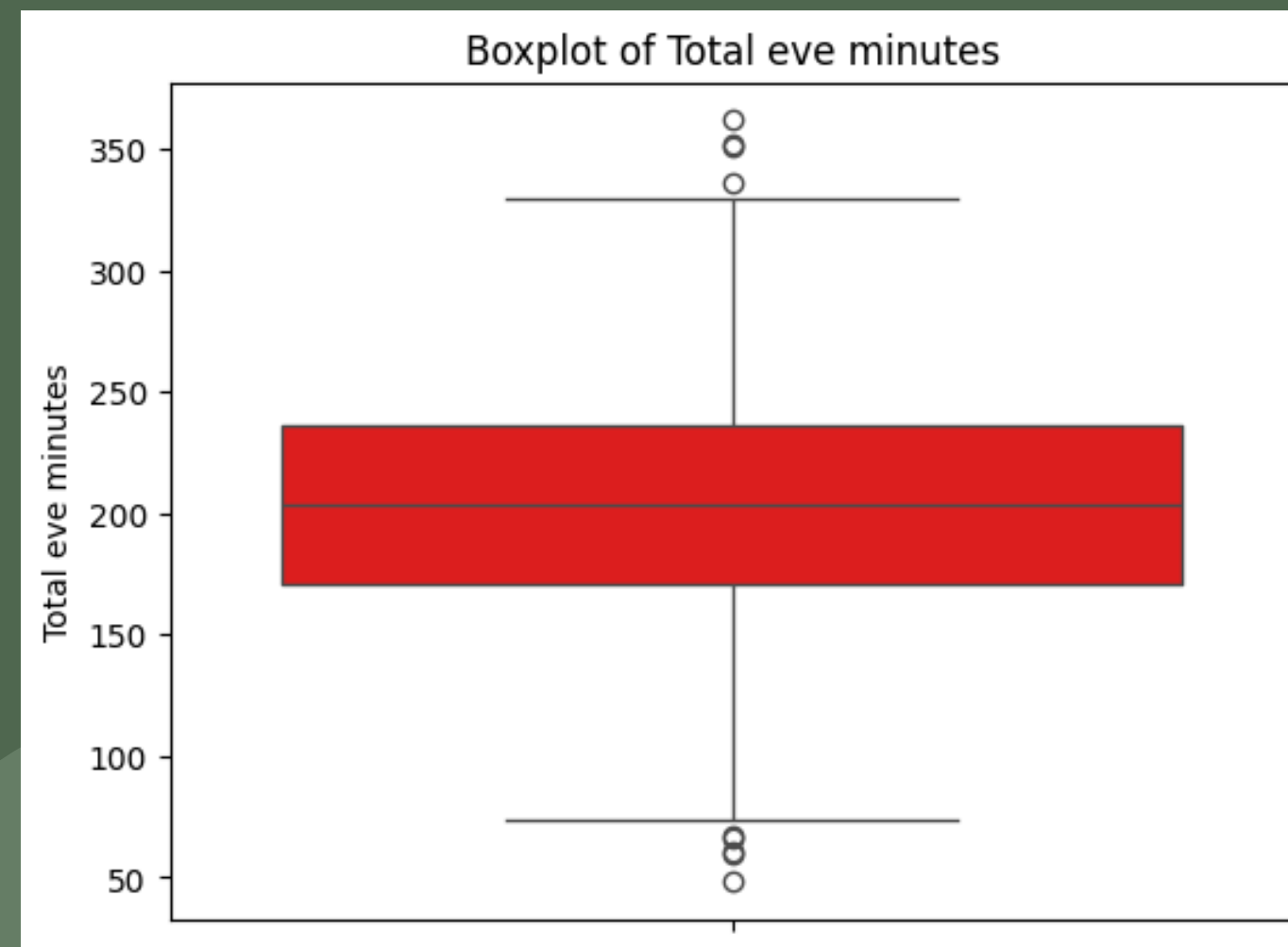
Range: 4.23 - 30.75

Total Eve Calls:

Average: about 100 calls

Median: 101 calls

Range: 19 - 168



Descriptive Statistics

Total Night Minutes:

Average: about 200 minutes

Median: 201 minutes

Range: 23 - 368

Total Night Charges:

Average: About \$8

Median: \$9.07

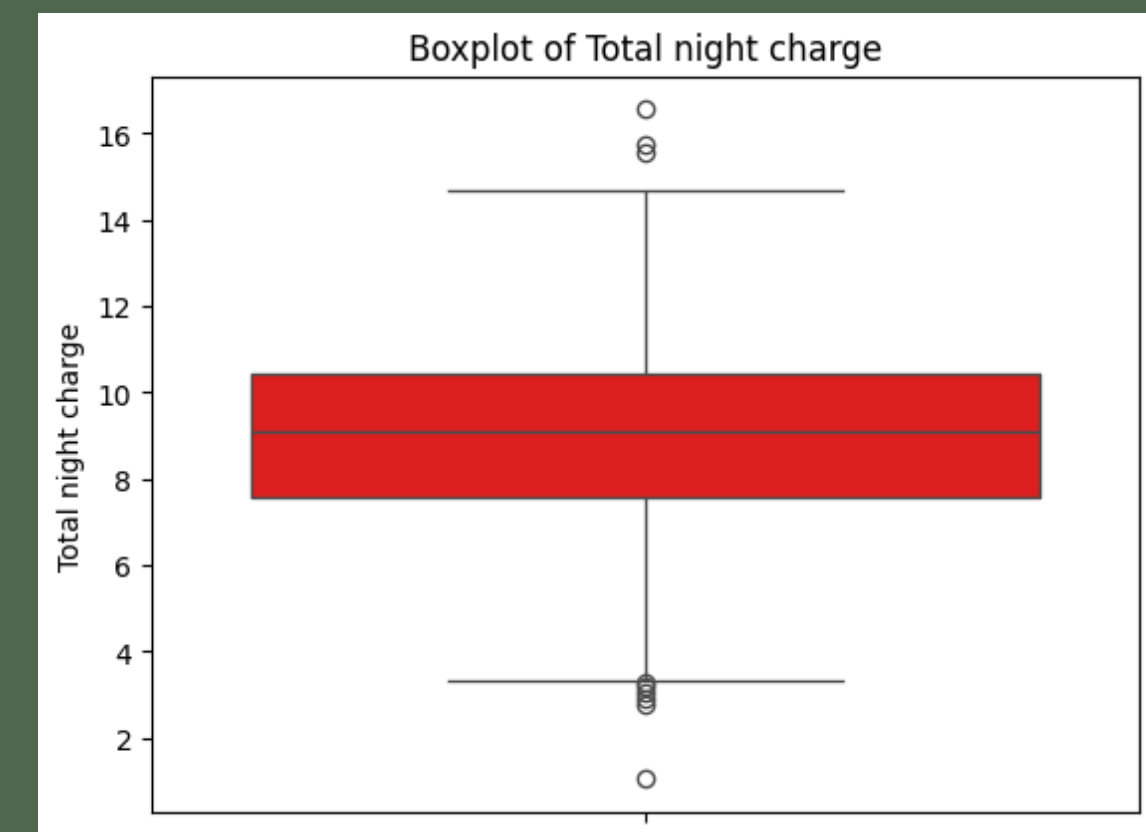
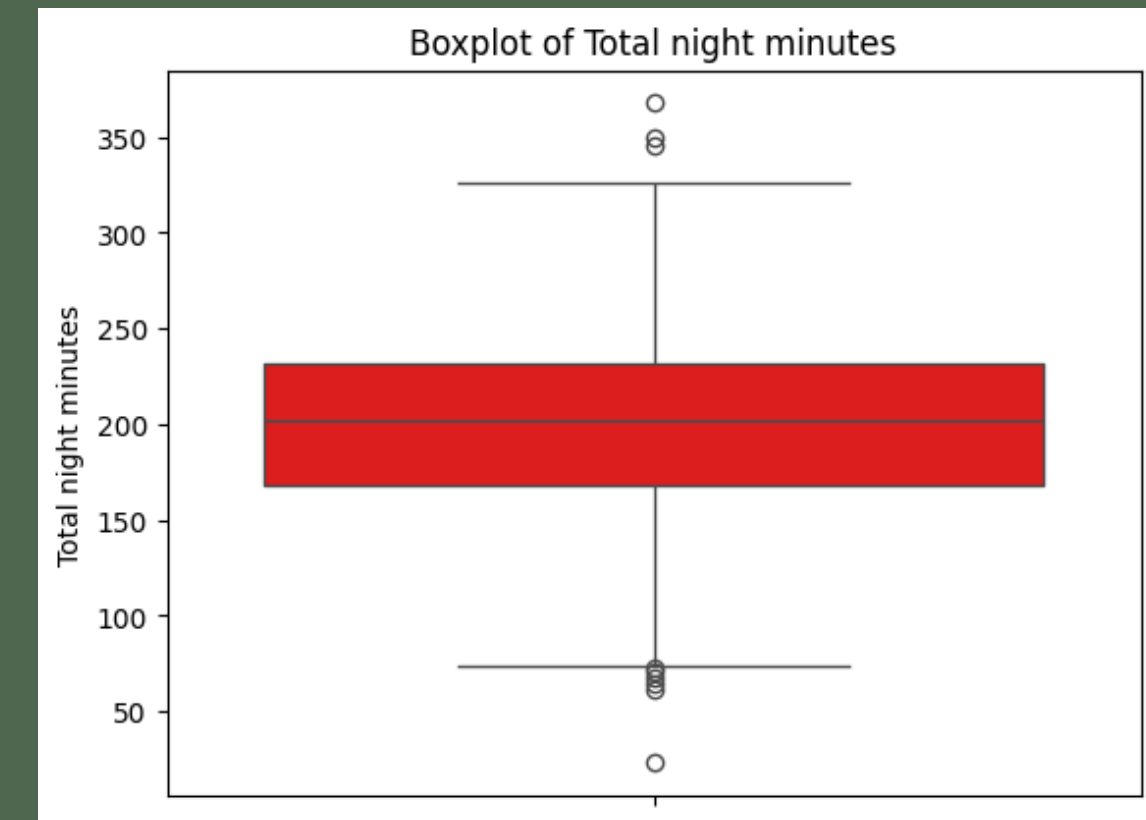
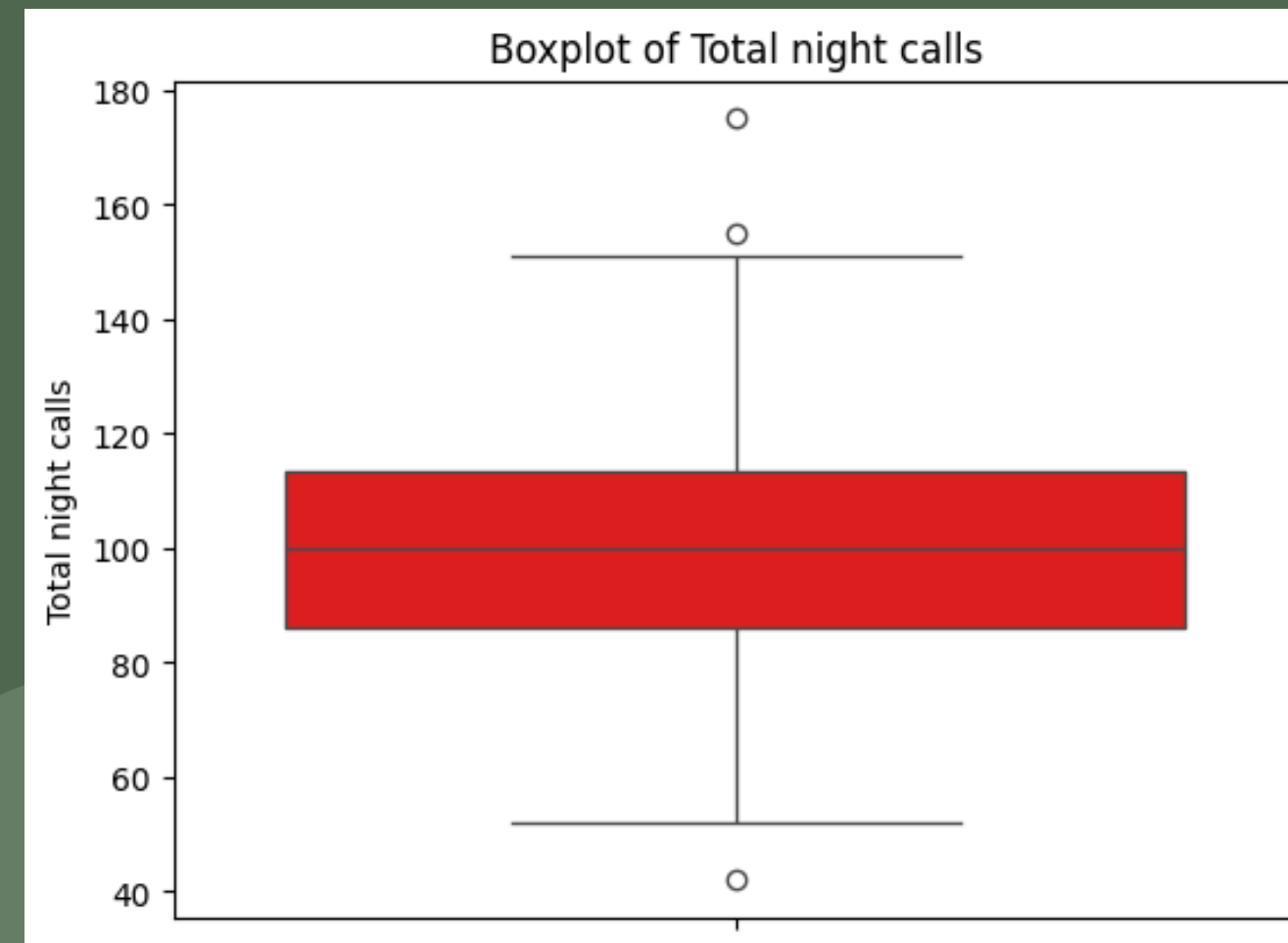
Range: 1.04 - 16.55

Total Night Calls:

Average: about 100 calls

Median: 100 calls

Range: 20- 175



Descriptive Statistics

Total International Minutes:

Average: about 10 minutes

Median: 12 minutes

Range: 0 - 18

Total International Charges:

Average: About \$3

Median: \$2.84

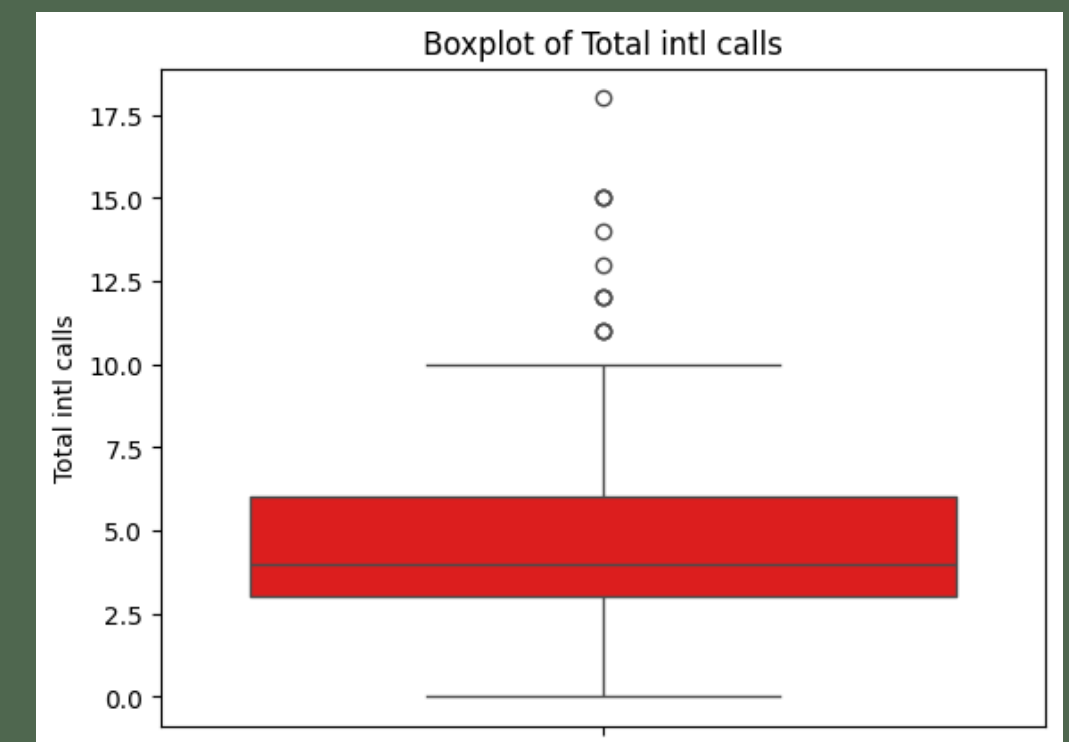
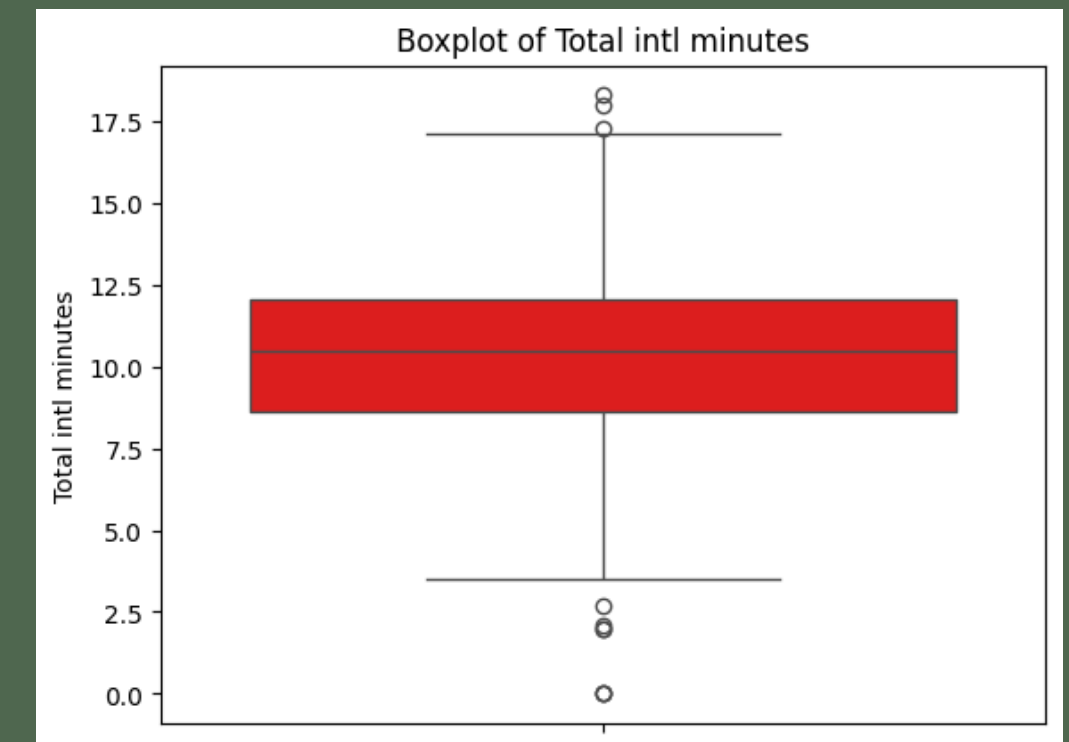
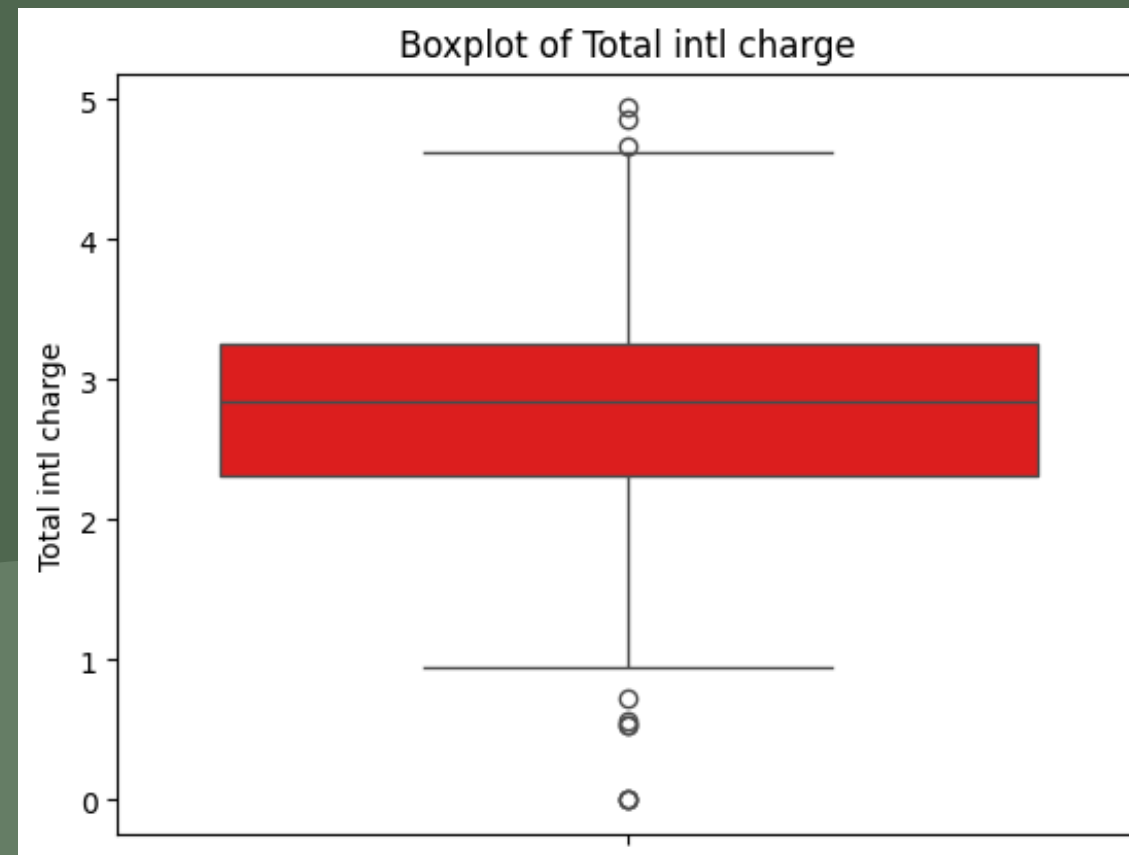
Range: 0 - 4.94

Total International Calls:

Average: about 5 calls

Median: 4 calls

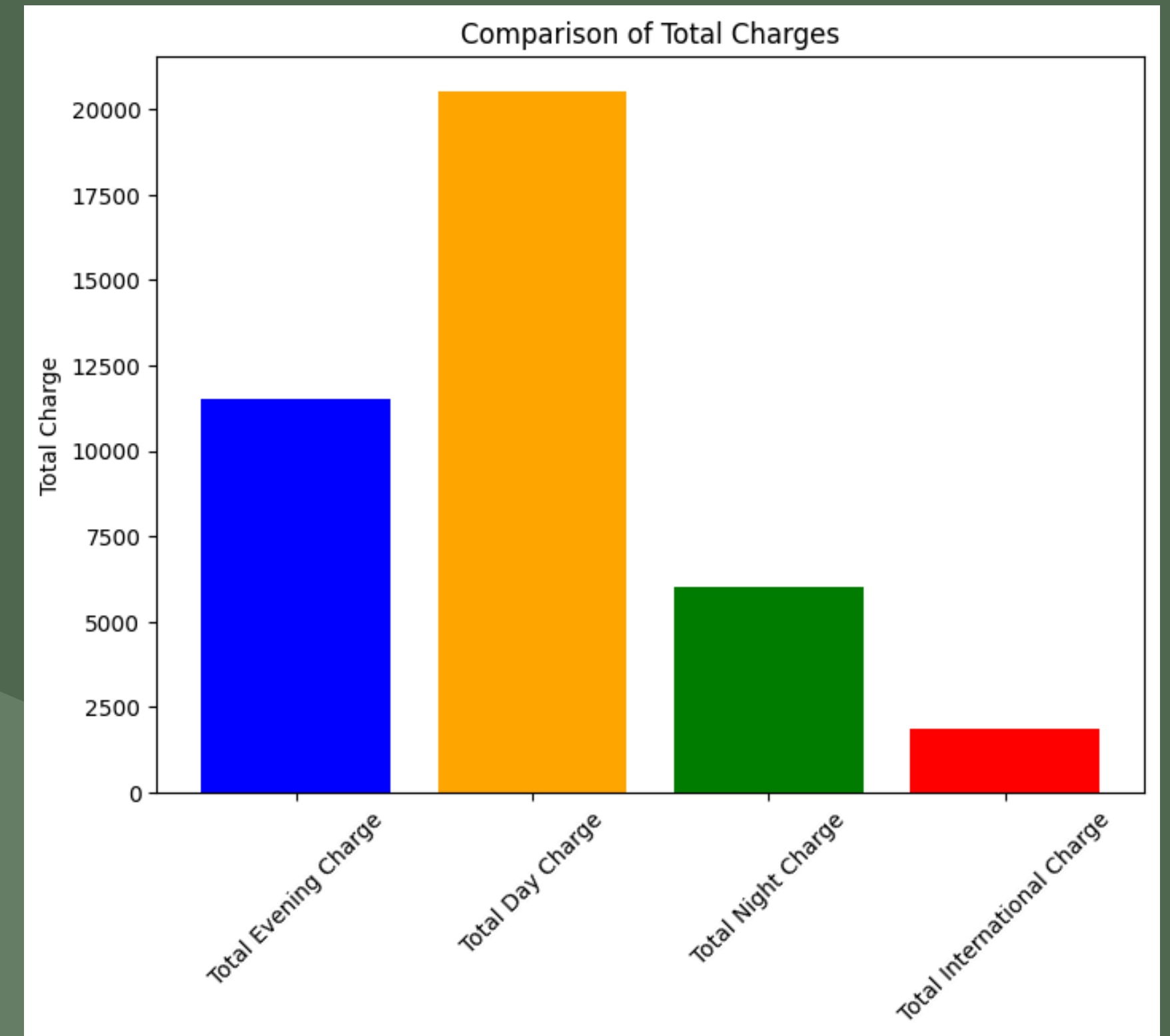
Range: 0- 18



Descriptive Statistics

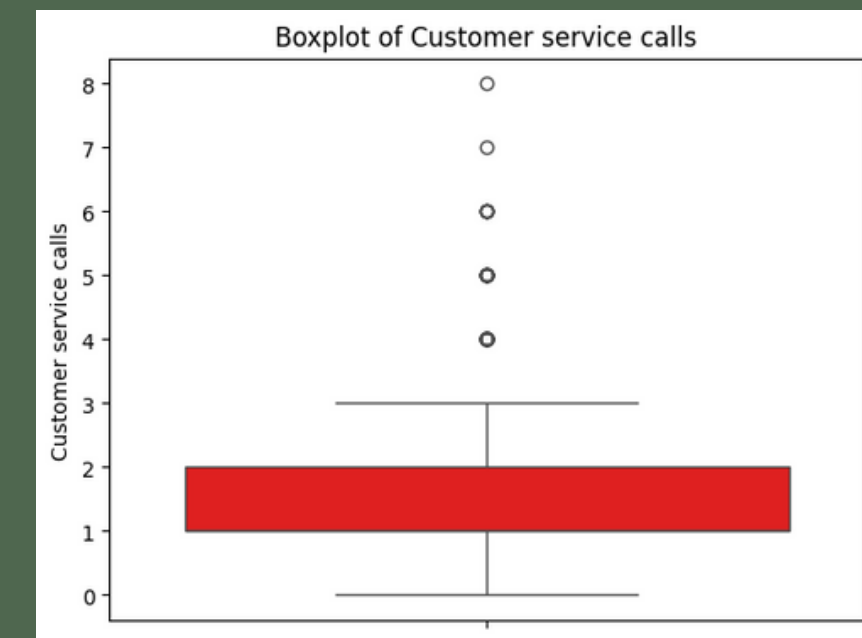
Comparison of Total Charges:

- Total day charge is significantly more than all other times of day.
- International is charged the least, which might indicate less customers with international plans. Because of this, more research into the charges, specifically how many customers have an international plan, could help determine the significance between the differences.



Descriptive Statistics

Boxplot shows outliers within customer service calls. As the calls go up, outlier circles get lighter, meaning there are less customers calling 7 or 8 times.



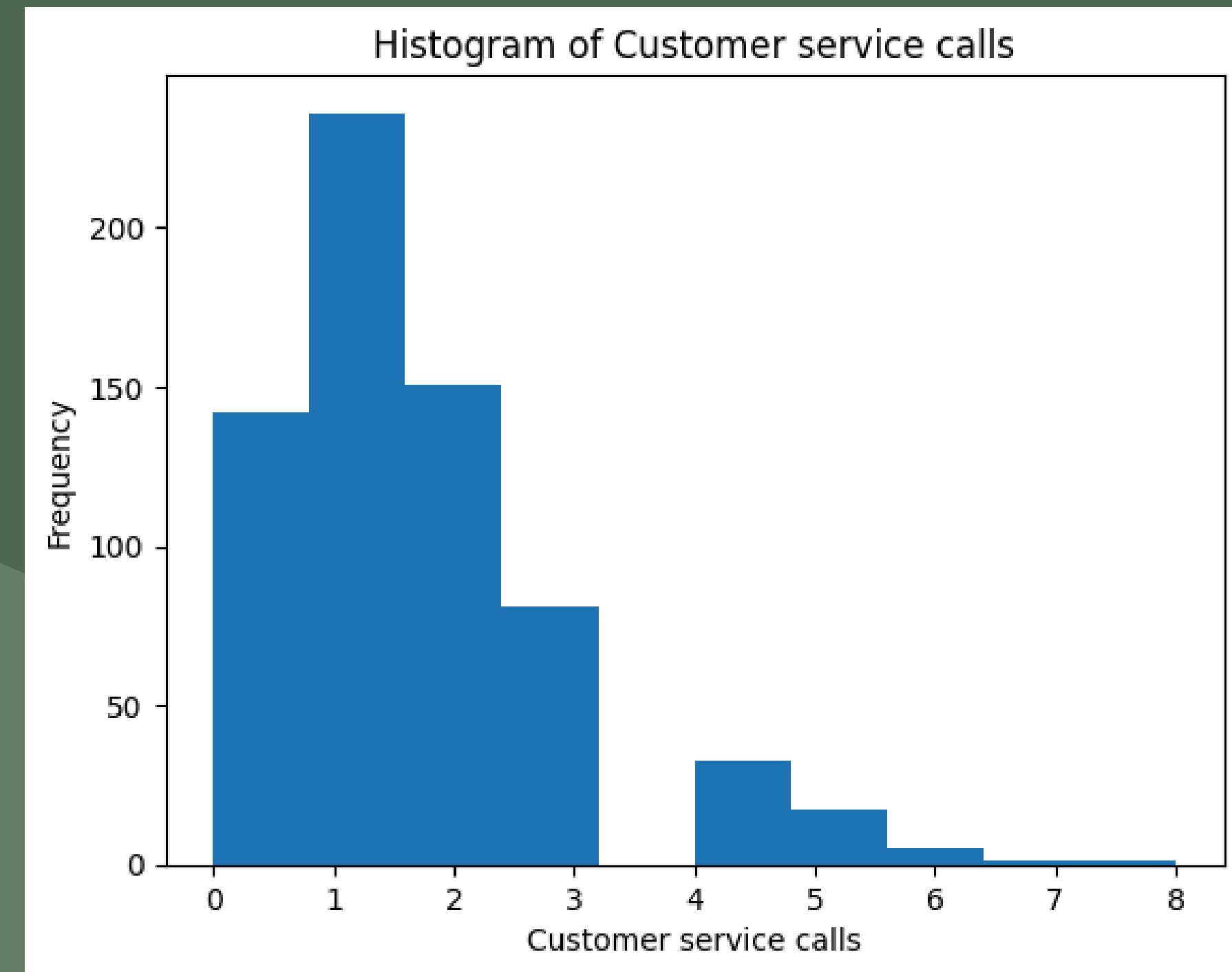
Customer Service Calls:

Average: about 1 call

Median: 1 call

Range: 0 - 8

A customer that is calling for support will likely call 1-2 times. Very rarely customers call customer service 7 or 8 times, indicating that one call is frequently enough service for customers.



Categorical Features

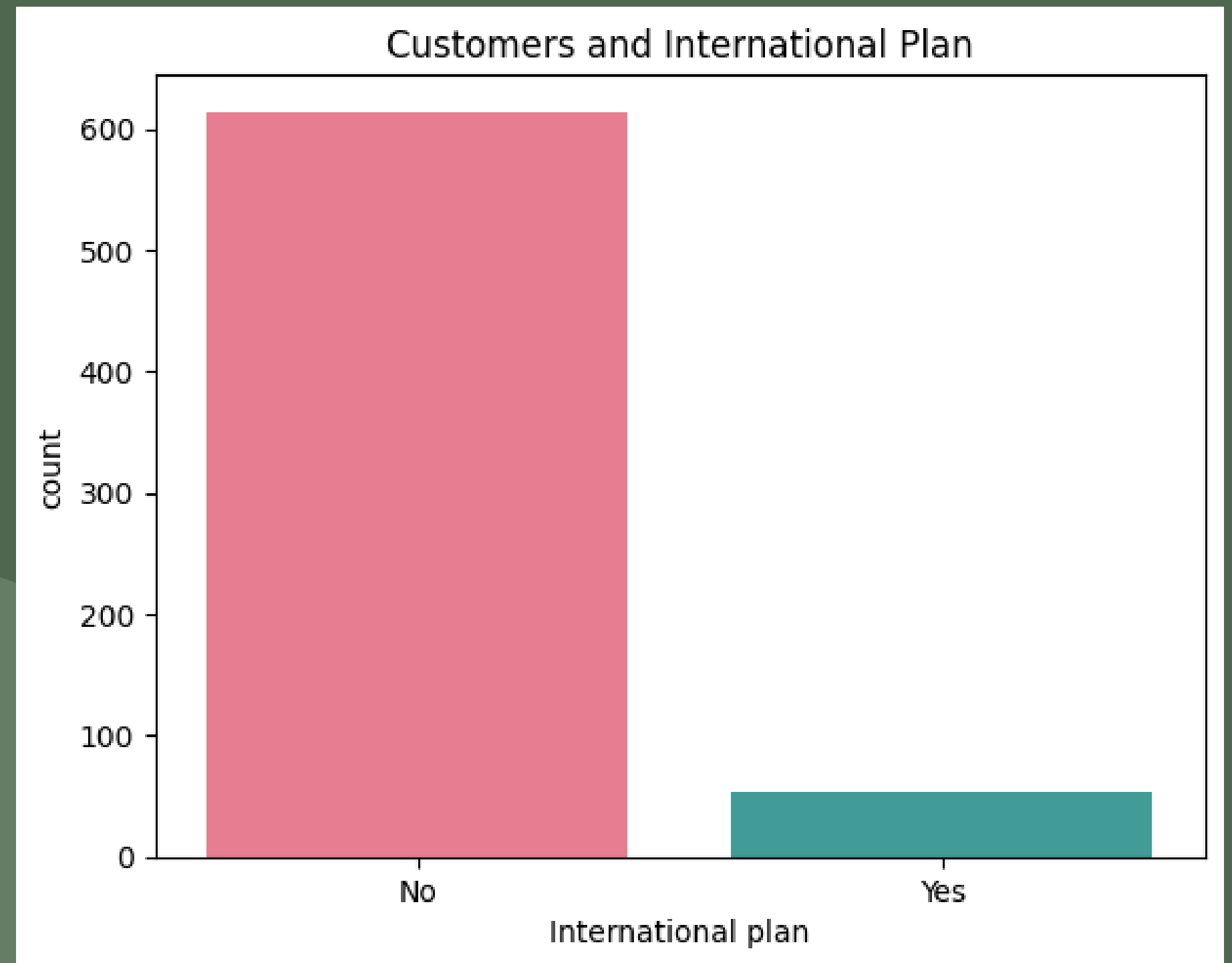
- International plan
- Voicemail plan
- Region
- Area Code
- Churn (Target variable)

Categorical Features

International Plan:

- Yes 53 customers
- No 614 customers

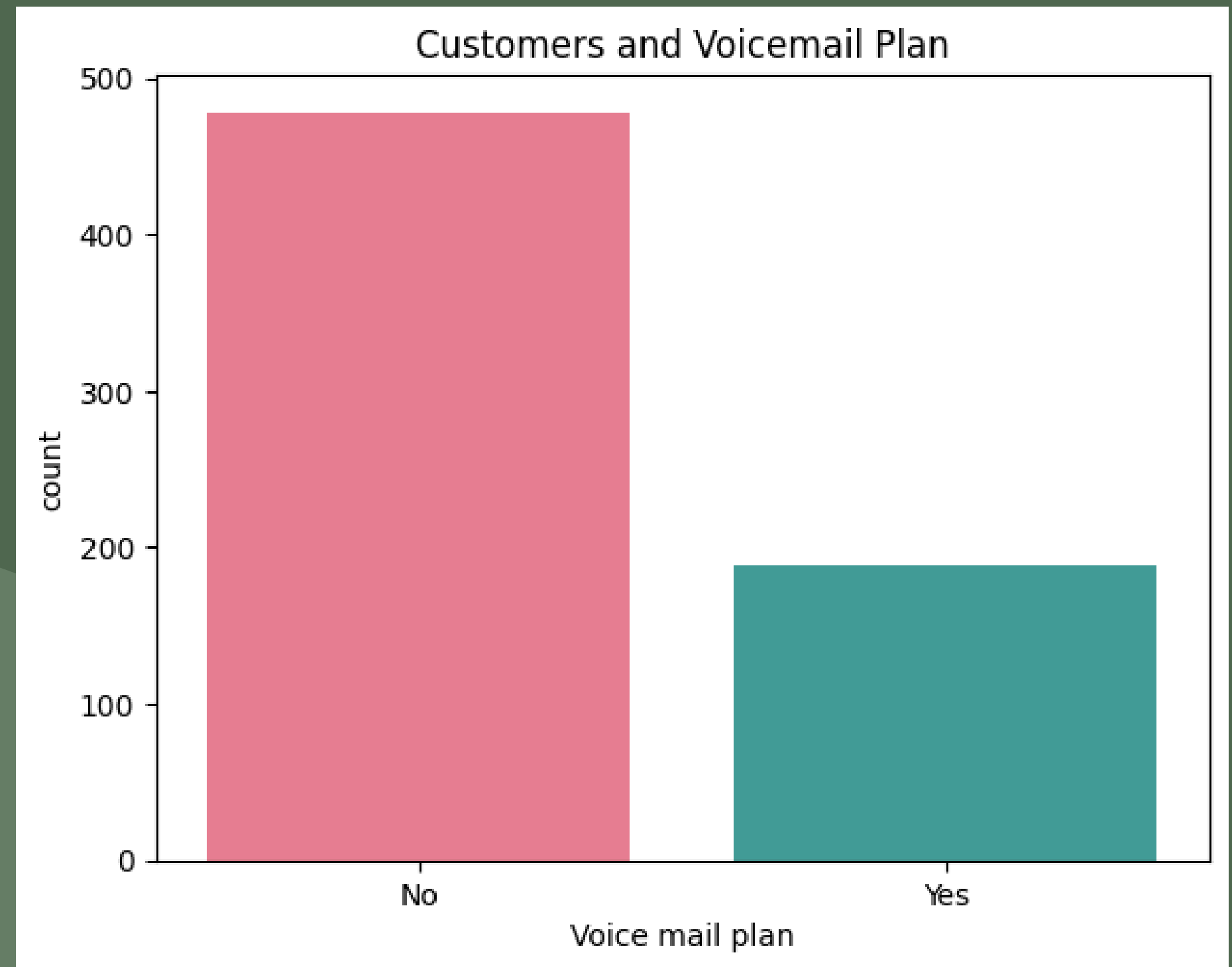
Fewer customers have international plans which can change the impact of the international charges compared to other charges.



Categorical Features

Voicemail Plan:

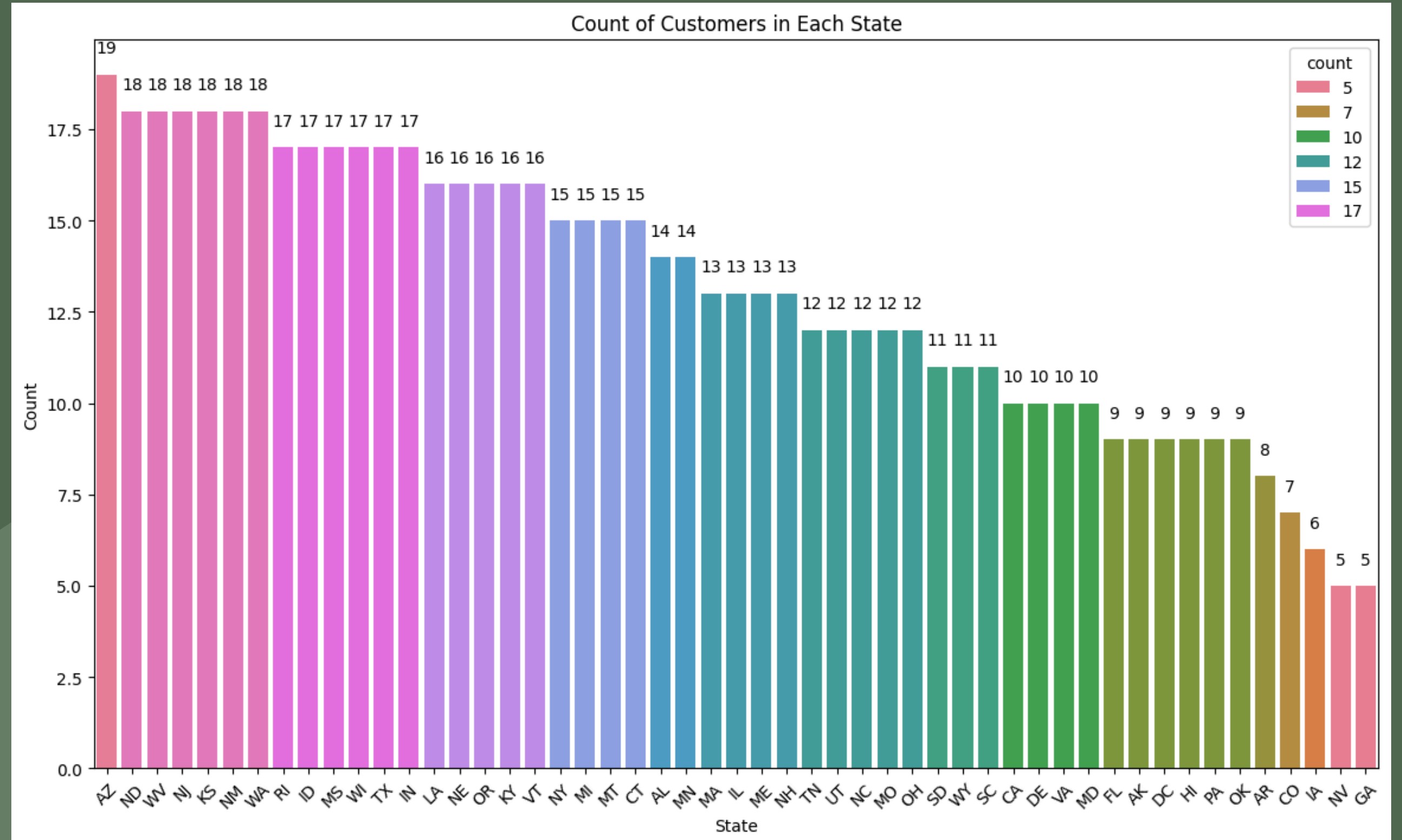
- Yes 478 customers
- No 189 customers



Categorical Features

State:

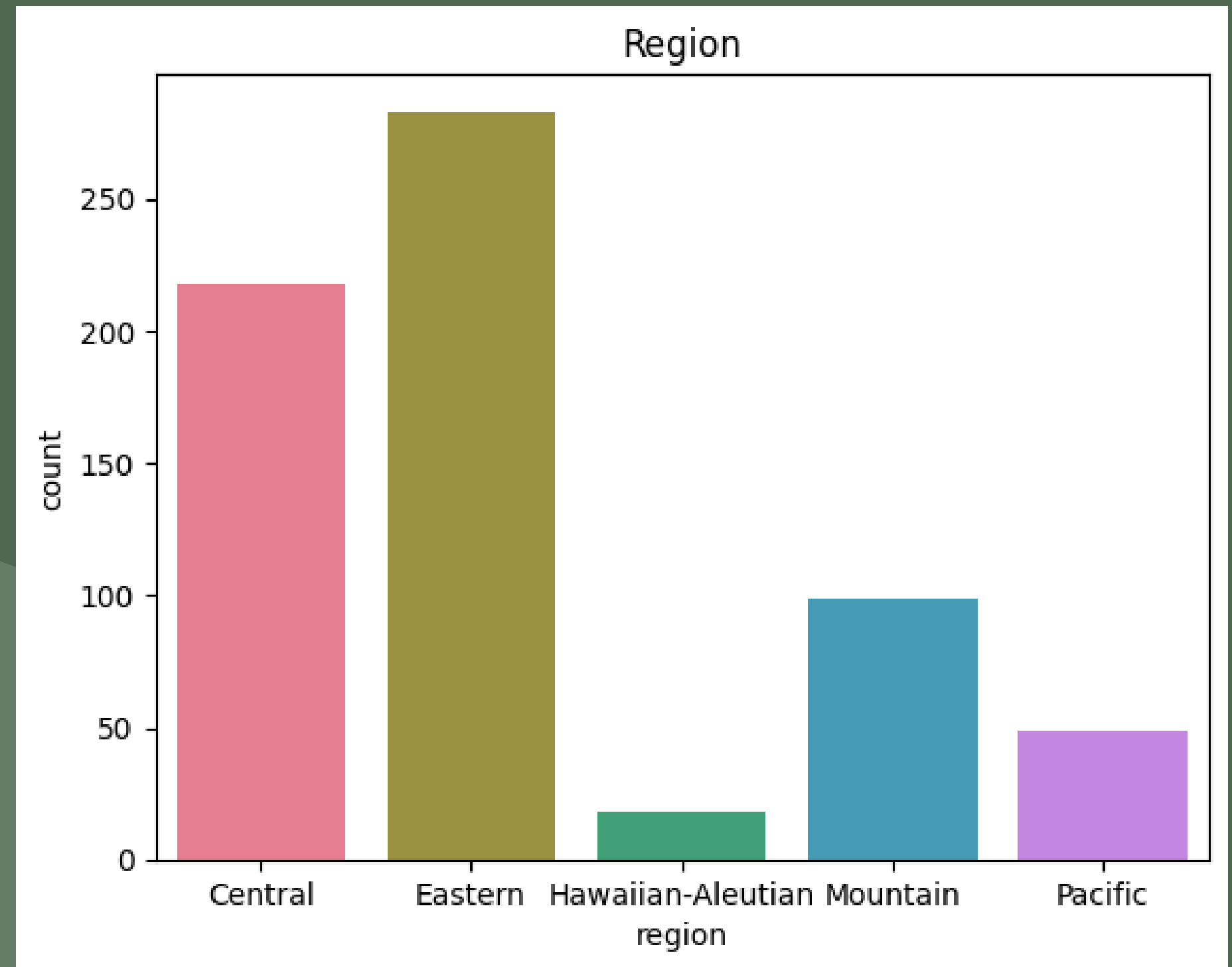
- AZ has the most customers
- NV and GA have the least customers of every state



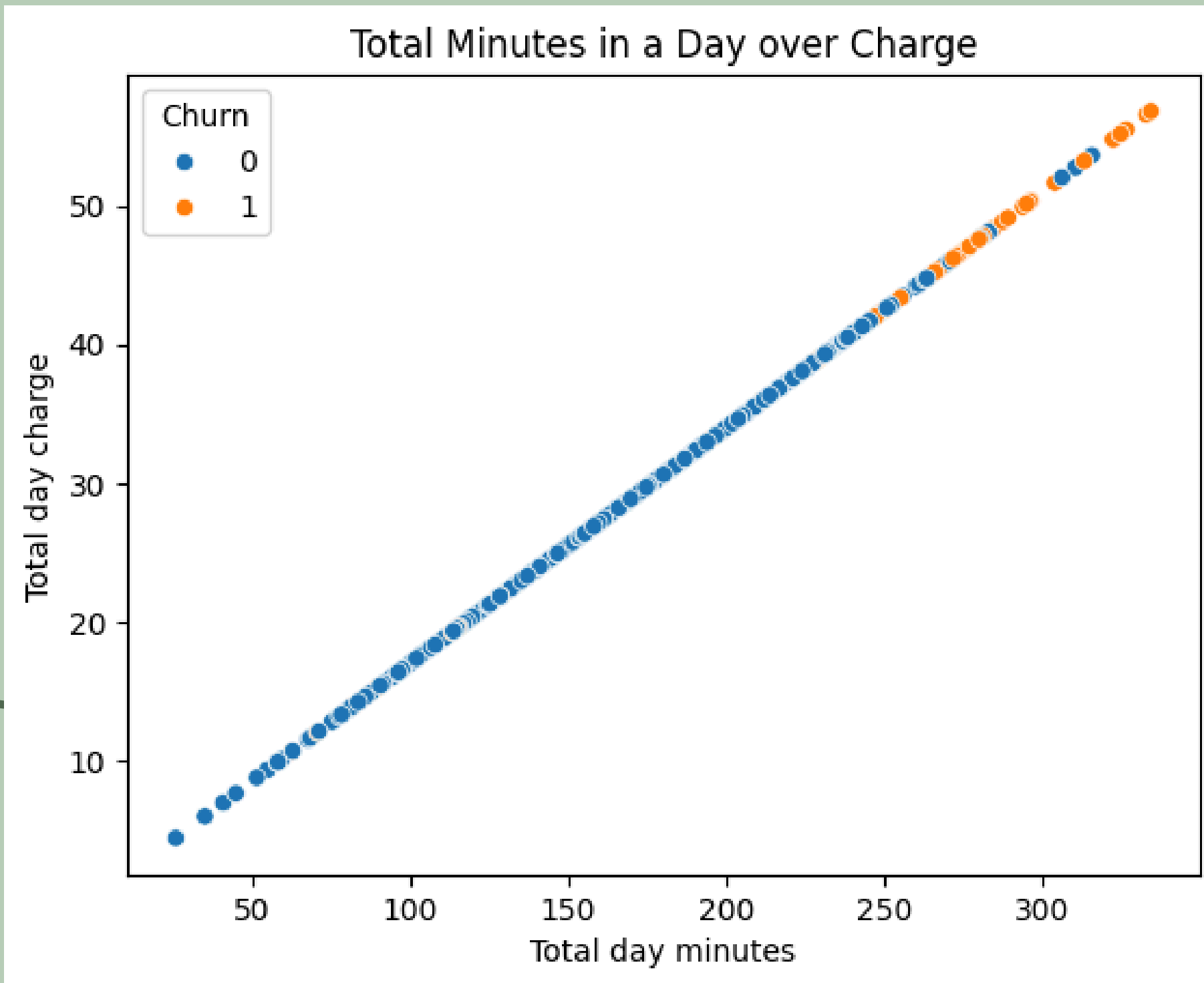
Categorical Features

Region:

- Eastern 283 customers
- Central 218 customers
- Mountain 99 customers
- Pacific 49 customers
- Hawaiian-Aleutian 18 customers

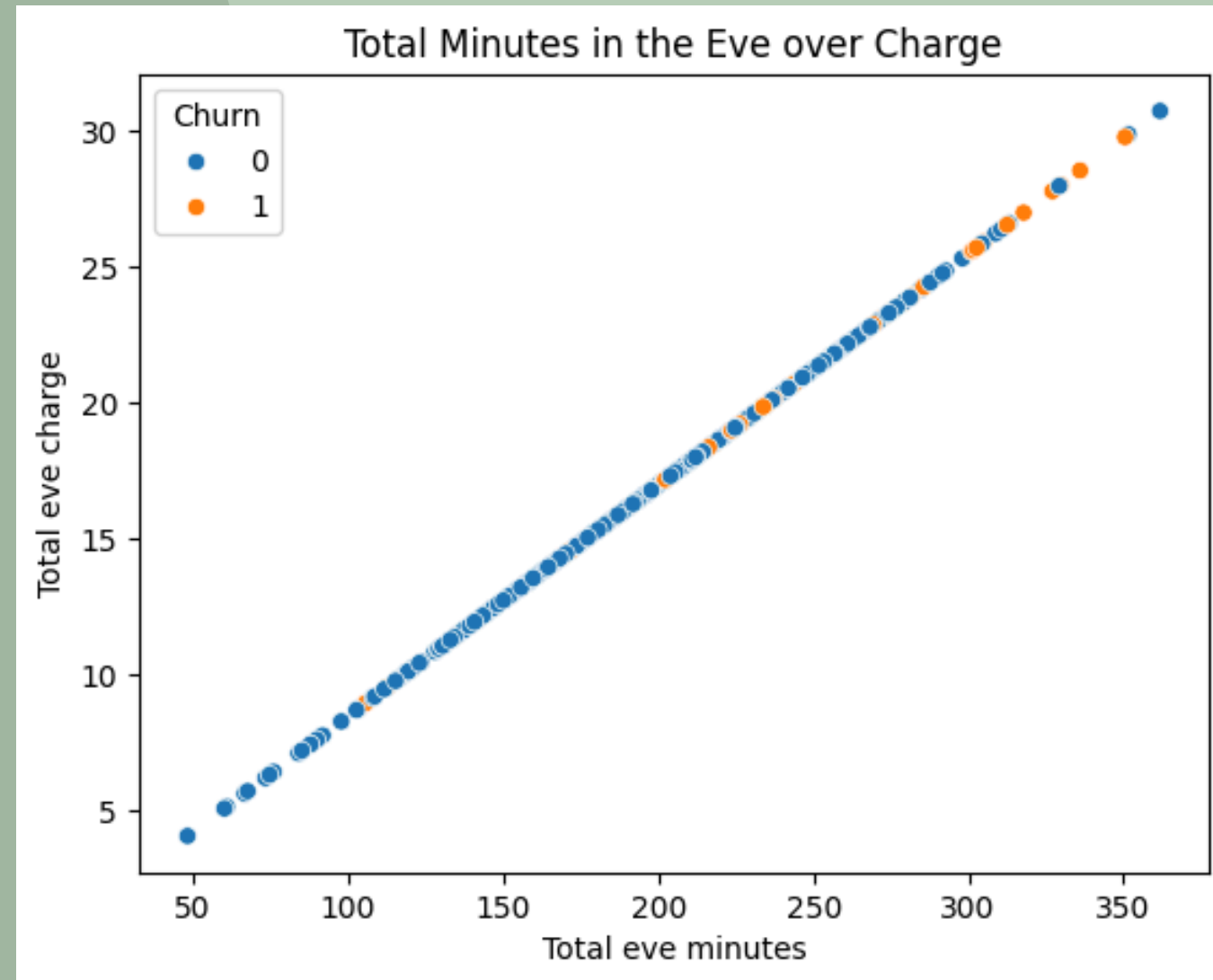


Bivariate Analysis



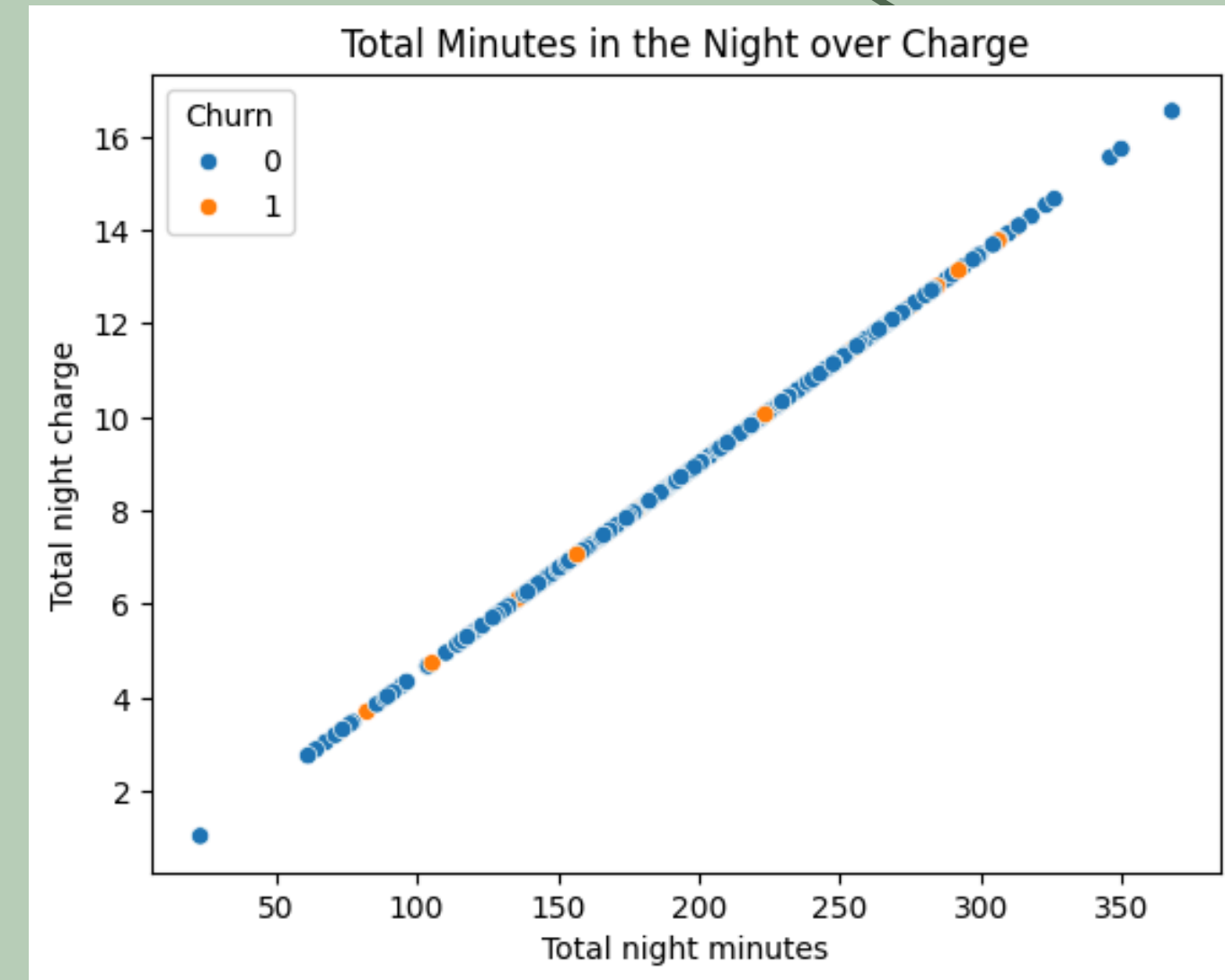
- Customers with more minutes and charges during the day are more likely to churn.
- In other words, customers with more minutes during the day leads to more day charges. In the plot when both of these happen, the customer churn rate goes up.

Bivariate Analysis:



Eve Minutes & Charge

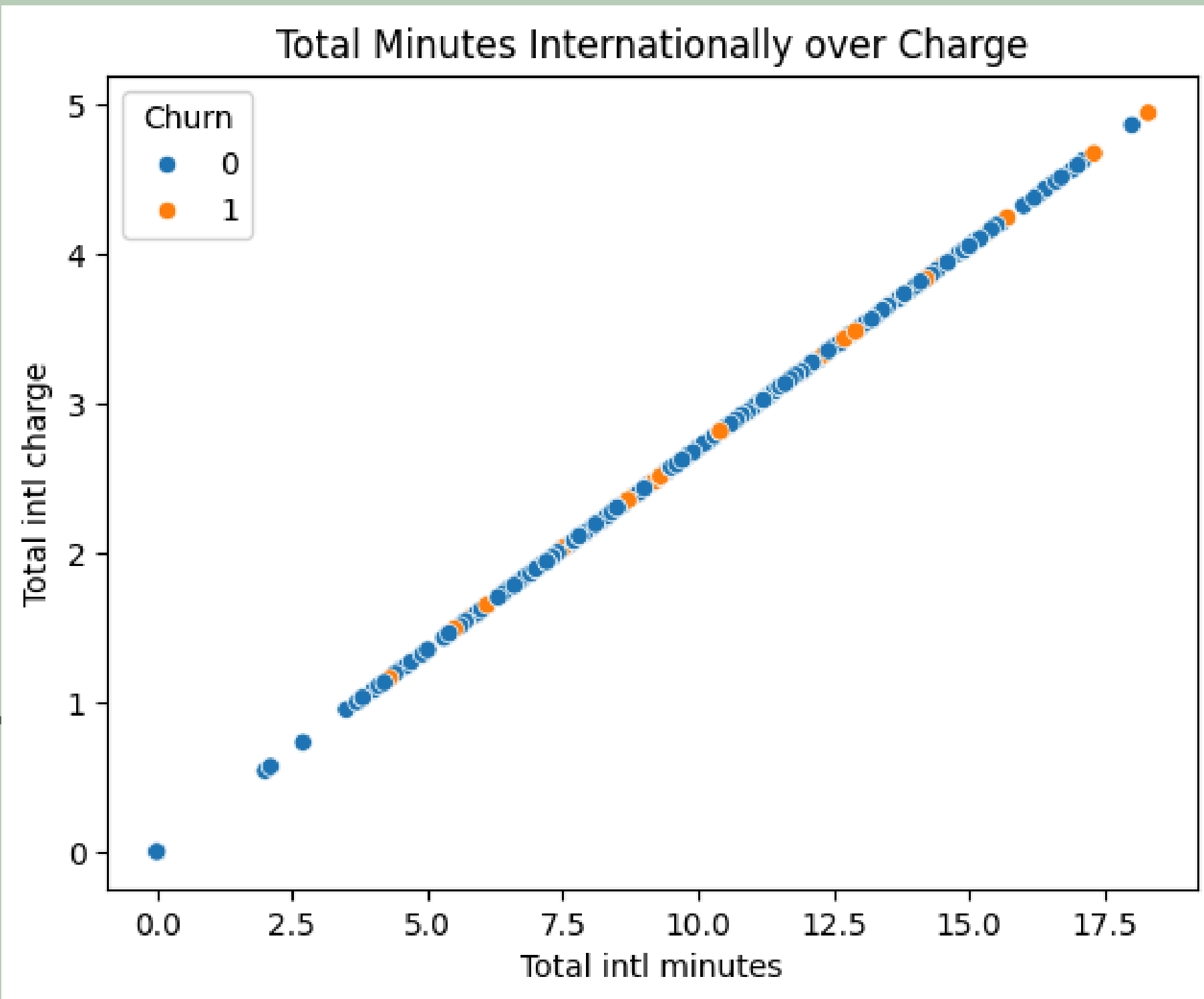
Customer churn is more likely when minutes are up and charges are up, but there are some visual outliers to inspect further to determine significance.



Night Minutes & Charge

Night minutes by charge does not seem to influence churn. These variables would need further investigation to determine their significance.

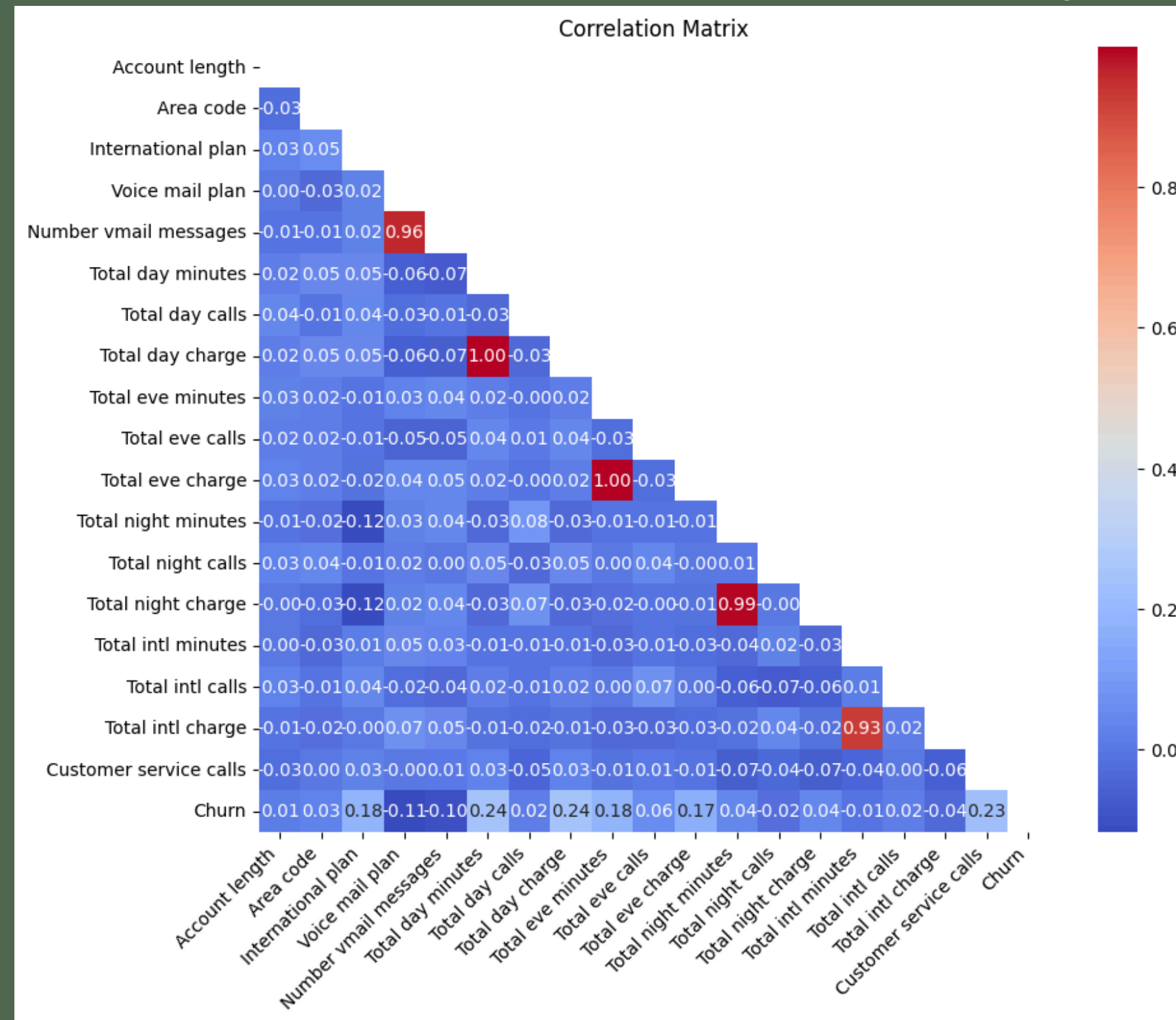
Bivariate Analysis



- Higher international charges and minutes will not accurately predict customer churn based on this plot.
- Further investigation on how many customers with international minutes and charges actually churn will help the cell phone company.
- The plot looks like there are more customers that stay rather than leave.

Correlation Analysis:

- Positively Correlated:
Total day minutes & Total day charges, Voicemail plan & Number of Voicemails, Total eve charge & Total eve minutes, Total night charge & Total night minutes, Total international charge & Total international minutes.



- Negatively Correlated: Churn & Voicemail plan, Number of voicemail messages & Churn

Feature Engineering

Feature engineering is necessary on these variables because it enhances the robustness of our analysis. It also allows us to interpret the results without any misunderstanding on the factors that influence customer churn.

Feature Engineering

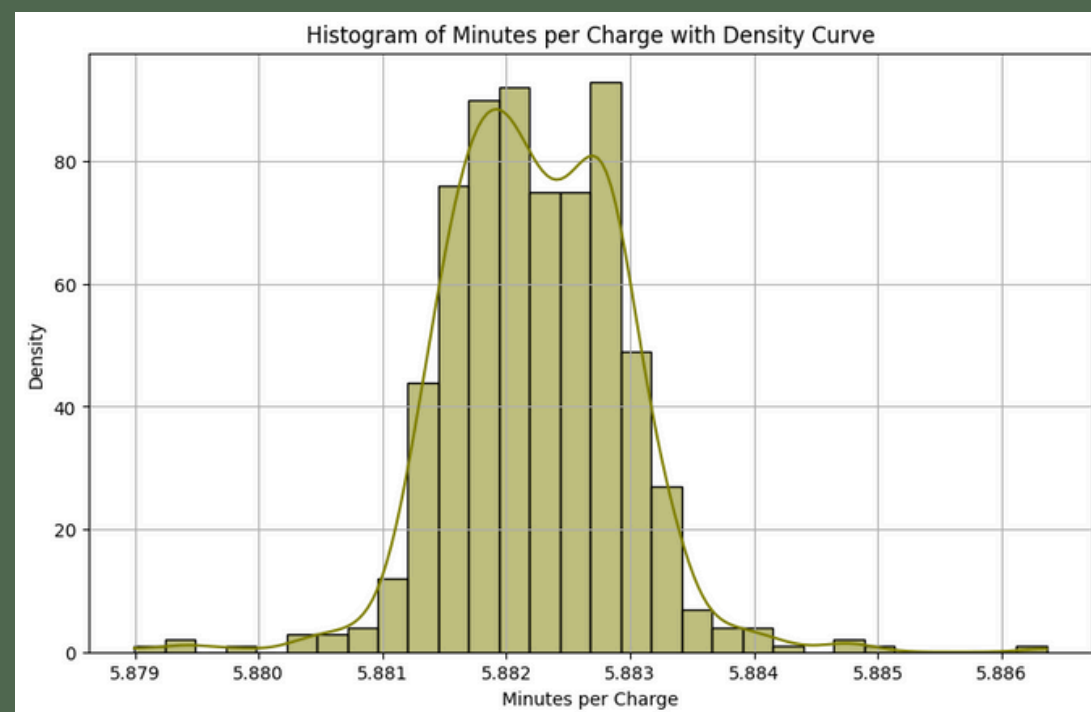
Total Day Minutes & Total Day Charge

Day Minutes per Charge

Average: About 6 minutes per charge

Median: About 6 minutes per charge

Range: 0 - 6



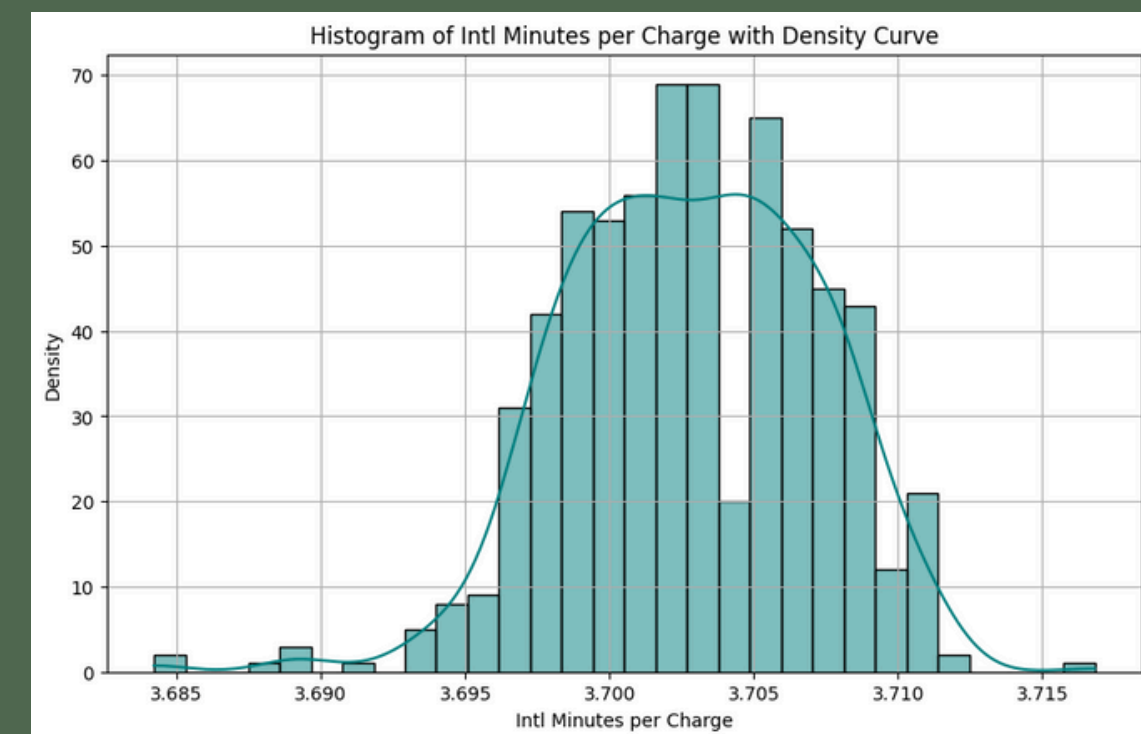
Total Intl Minutes & Total Intl Charge

Intl Minutes per Charge

Average: About 4 minutes per charge

Median: About 4 minutes per charge

Range: 0 - 4



Feature Engineering

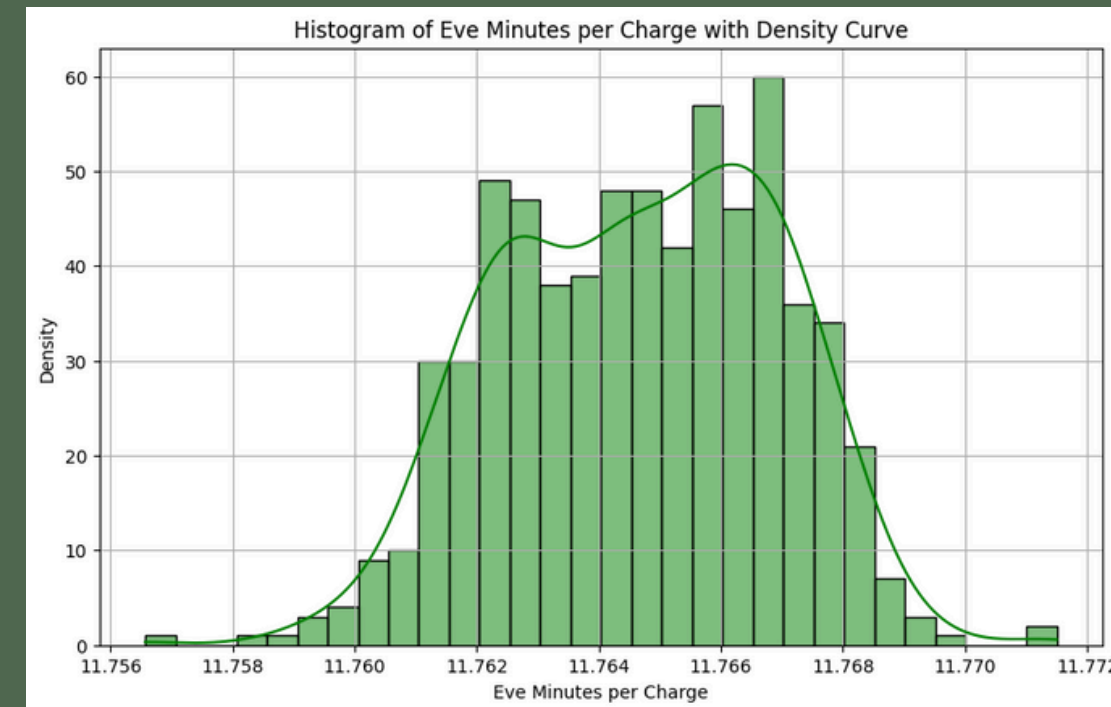
Total Eve Minutes & Total Eve Charge

Eve Minutes per Charge

Average: About 12 minutes per charge

Median: About 12 minutes per charge

Range: 0 - 12



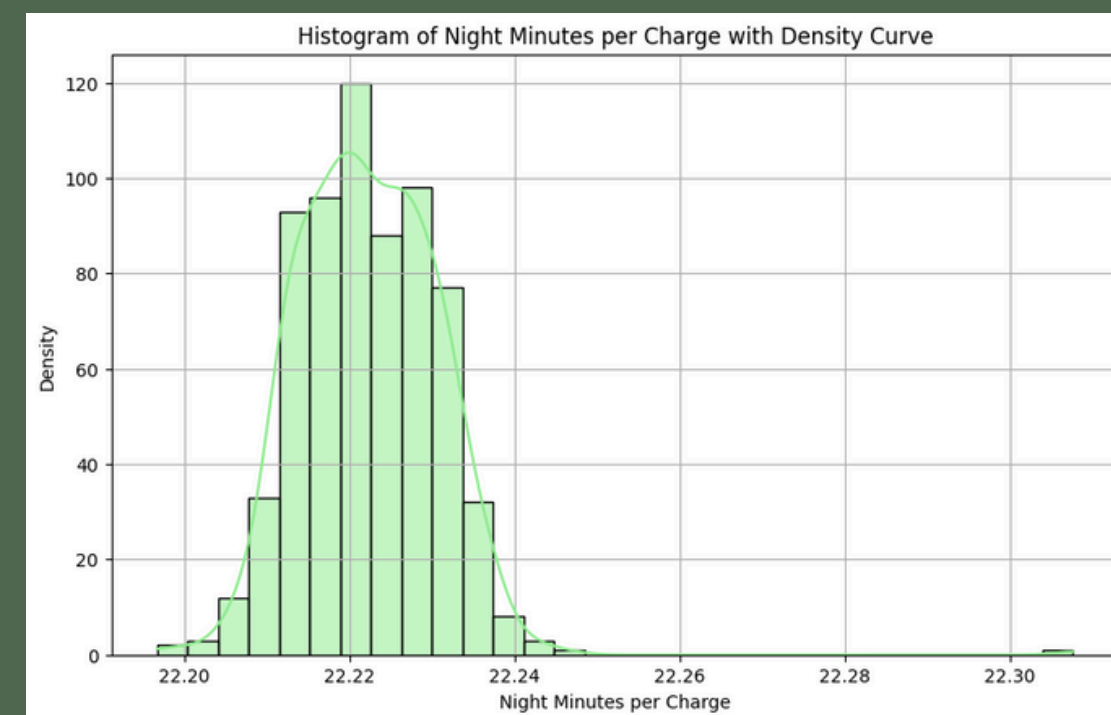
Total Night Minutes & Total Night Charge

Night Minutes per Charge

Average: About 22 minutes per charge

Median: About 22 minutes per charge

Range: 0 - 22



Significance Testing

In analyzing the features that influence customer churn for a major cell phone company,

- H0: There is no significant impact on customer churn based on these features.
- H1: There is a significant impact on customer churn based on these features.

Features: Account Length, Area Code, International Plan, Voicemail Plan, Number of Voicemail Messages, Total day minutes, Total day calls, Total day charge, Total eve minutes, Total eve calls, Total eve charge, Total night minutes, Total night calls, Total night charge, Total international minutes, Total international calls, Total international charge, Customer service calls, Region (categorical)

Significance Testing

Significance level = 0.05

- Accepting that there is a 5% chance of incorrectly rejecting the null hypothesis when it is actually true.

Continuous Features (Numerical):

- Significant
 - Number of Voicemail messages, Customer service calls, Eastern region, Hawaiian-Aleutian region, Mountain region, Pacific region

Categorical Features

- Voicemail Plan & International Plan

Recommendations

Customer Service

Implement proactive customer support initiatives to address issues before they escalate, such as timely billing reminders, troubleshooting assistance, and personalized assistance with international usage.

Day & Eve Charges

Transparent pricing to ensure communication is clear for charges to avoid any confusion or dissatisfaction among customers.

International Plan / Voicemail Plan

Offer customized plans for international plans or voicemail plans to enhance customer satisfaction. Additionally, providing targeted retention offers on international or voicemail usage can encourage customers to remain loyal.

Modeling

- Final Model: Random Forest Classifier
 - Specificity: Approximately 80.2% of non-churning customers are correctly identified.
 - Sensitivity: Around 89.7% of churning customers are accurately identified.
 - Precision: Positive predictions are accurate about 82.7% of the time.

In summary, our Random Forest model effectively predicts customer churn with strong performance. It achieves approximately 80.2% specificity, identifying non-churning customers, and about 89.7% sensitivity, recognizing churning customers. Additionally, its precision score of around 82.7% reflects its reliability in making accurate positive predictions. These findings underscore the model's robustness and effectiveness, offering valuable insights for targeted retention strategies.

Conclusion

In conclusion, understanding and addressing key factors such as customer service, plan charges, and service offerings are vital for minimizing churn in the telecommunications industry. By tailoring plans, providing excellent customer support, and offering retention incentives, companies can effectively reduce churn rates and enhance customer satisfaction. Notably, with the company spending an estimated \$3500 on advertising per lost customer, reducing churn not only retains revenue but also optimizes marketing expenditures, significantly impacting profitability. Leveraging insights from models like Random Forest, which achieves approximately 80.2% specificity, 89.7% sensitivity, and a precision score of around 82.7%, can further refine retention strategies, positioning companies for long-term success in a competitive market.



Thank you!