LENDING CLUB CASE STUDY

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BUSINESS OBJECTIVE

- This company is the largest online loan marketplace, facilitating personal loans, business loans, and financing of medical procedures. Borrowers can easily access lower interest rate loans through a fast online interface.

- Like most other lending companies, lending loans to 'risky' applicants is the largest source of financial loss (called credit loss). Credit loss is the amount of money lost by the lender when the borrower refuses to pay or runs away with the money owed. In other words, borrowers who default cause the largest amount of loss to the lenders. In this case, the customers labelled as 'charged-off' are the 'defaulters'.

- If one is able to identify these risky loan applicants, then such loans can be reduced thereby cutting down the amount of credit loss. Identification of such applicants using EDA is the aim of this case study.

- In other words, the company wants to understand the driving factors (or driver variables) behind loan default, i.e. the variables which are strong indicators of default. The company can utilise this knowledge for its portfolio and risk assessment.

PROBLEM STATEMENT

- The aim is to identify patterns which indicate if a person is likely to default, which may be used for taking actions such as denying the loan, reducing the amount of loan, lending (to risky applicants) at a higher interest rate, etc.

ANALYSIS APPROACH

- Import Necessary Libraries

- Load the data

- Data Understanding

  - Remove unwanted columns

  - Missing Value check and treatment

  - Data type conversions and clean up

  - Outlier treatment

  - Derived Variables

- Univariate Analysis (One Variable at a time)

  - Quantitative Variables

  - Unordered Categorical Variables

  - Ordered Categorical Variables

- Segmented Univariate Analysis

- Bivariate Analysis (Two Variable at a time)

- Multivariate Analysis (More than two Variables at a time)

- Recommendations

UNIVARIATE ANALYSIS

QUANTITATIVE VARIABLES
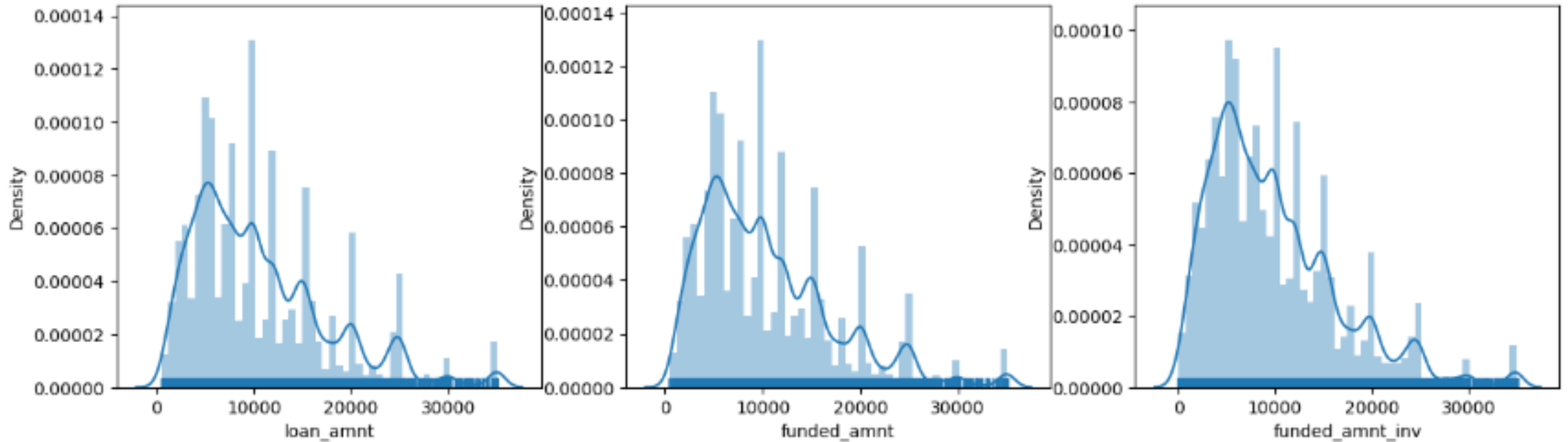
DISTRIBUTION OF LOAN AMOUNT, FUNDED AMOUNT AND FUNDED AMOUNT BY INVESTOR USING DISTRIBUTION PLOT.

Observation:

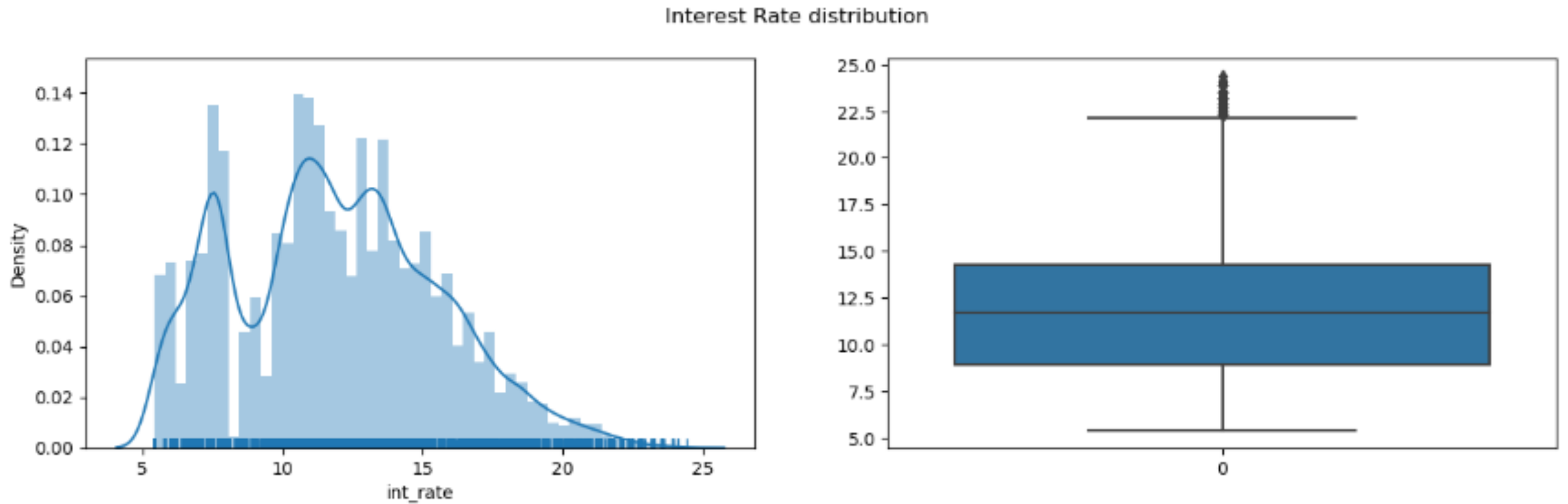- Amount distribution looks very similar for all, we will use **loan_amnt** for our further analysis

Loan Amount distribution
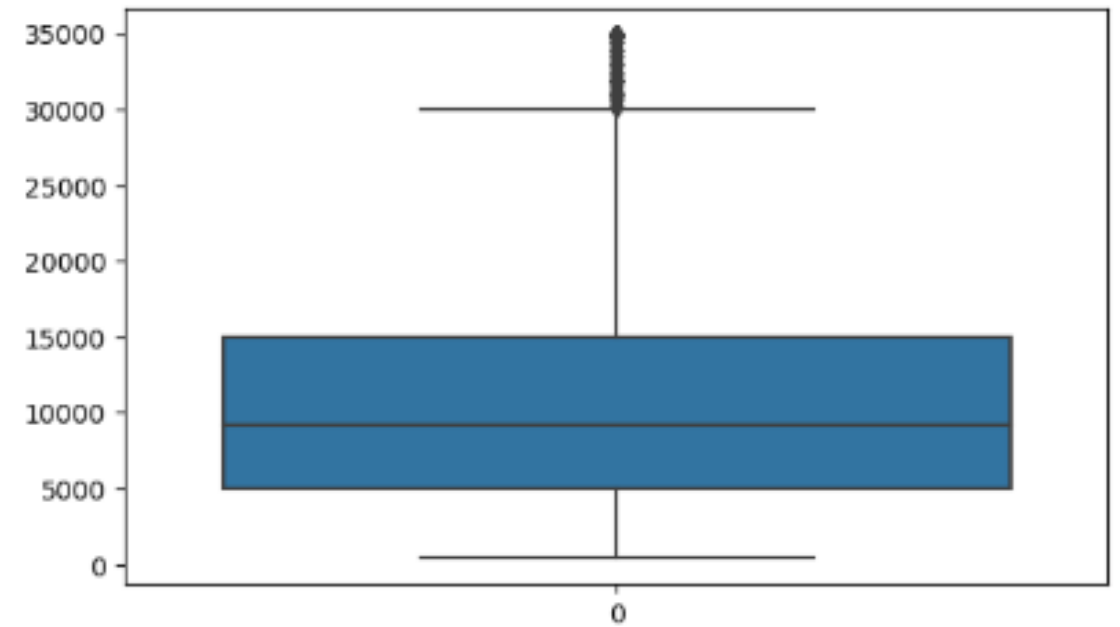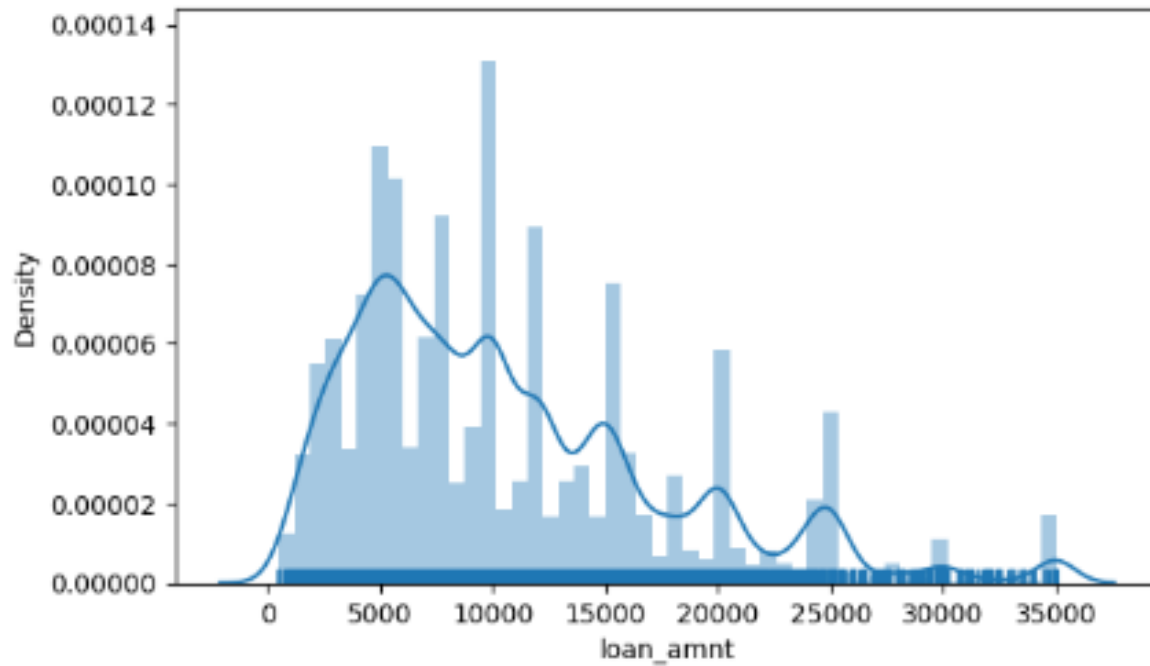
ANALYZING LOAN AMOUNT

Observation:

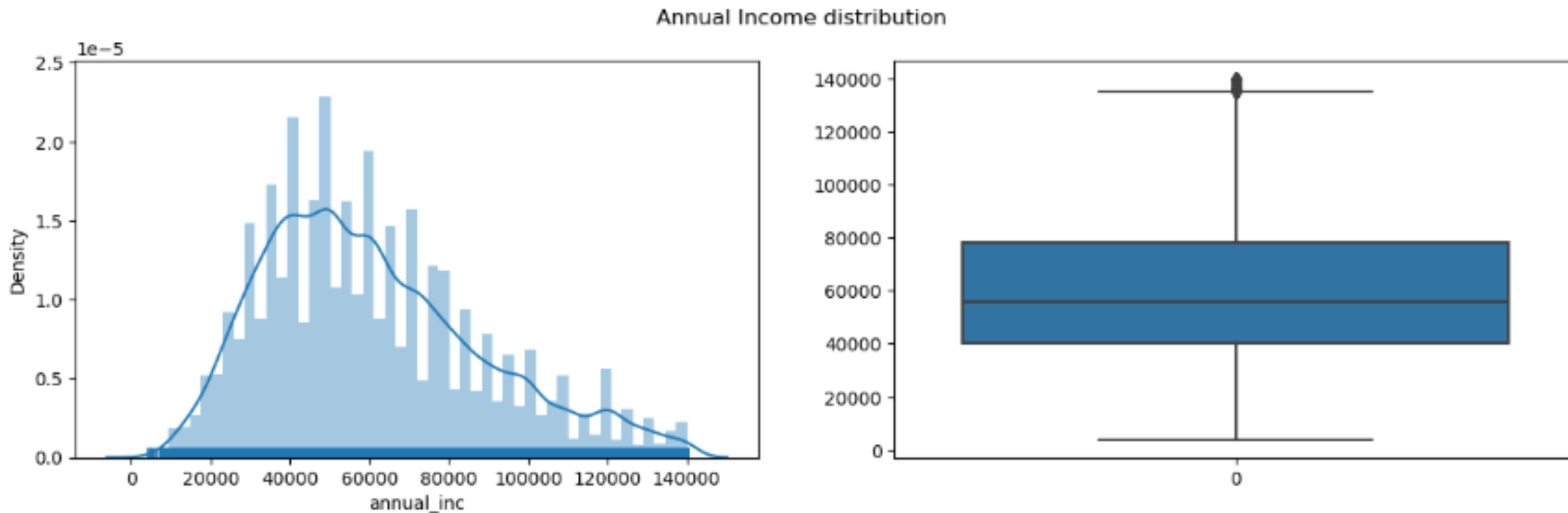- Most of the people have taken their loan between 5000 and 15000

Interest Rate distribution

ANALYZING INTEREST RATE

Observation:

- Most of the interest rate lies between 9% to 14.5%

Annual Income distribution

ANALYZING ANNUAL INCOME

Observation:

- Most of the borrowers annual income are in the range of 40k to 80k

Issue month Distribution
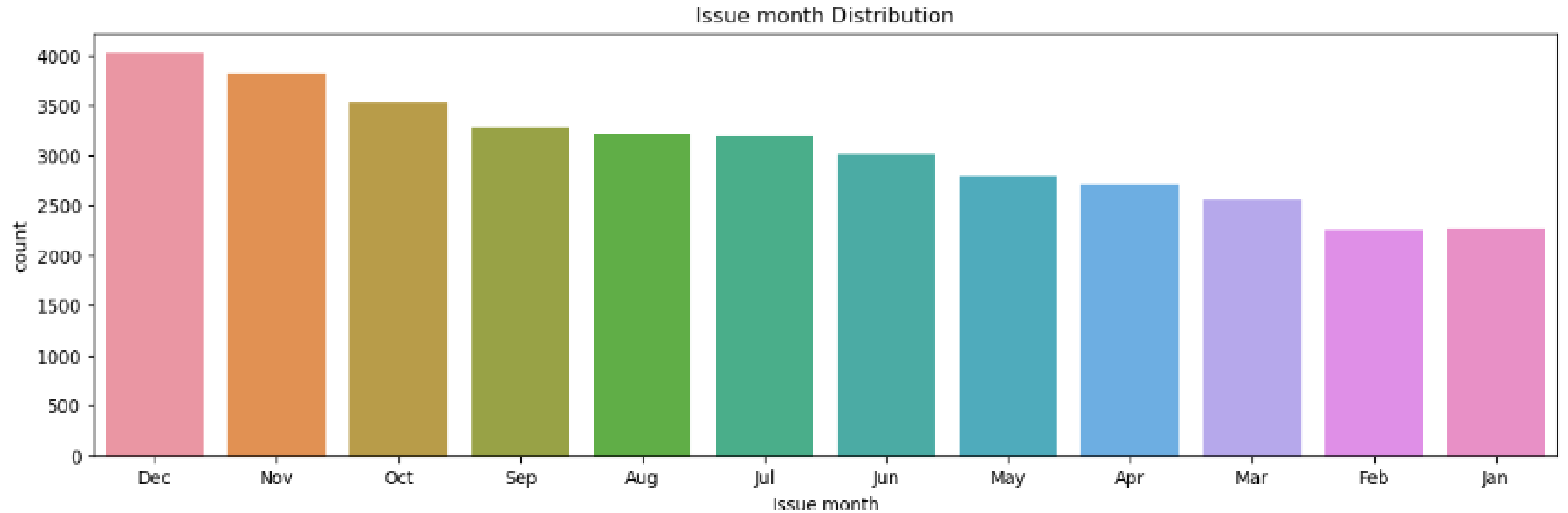
ANALYZING ISSUE MONTH DATA

Observation:

- Issue of loan increases every month from Jan to Dec

Issue year Distribution
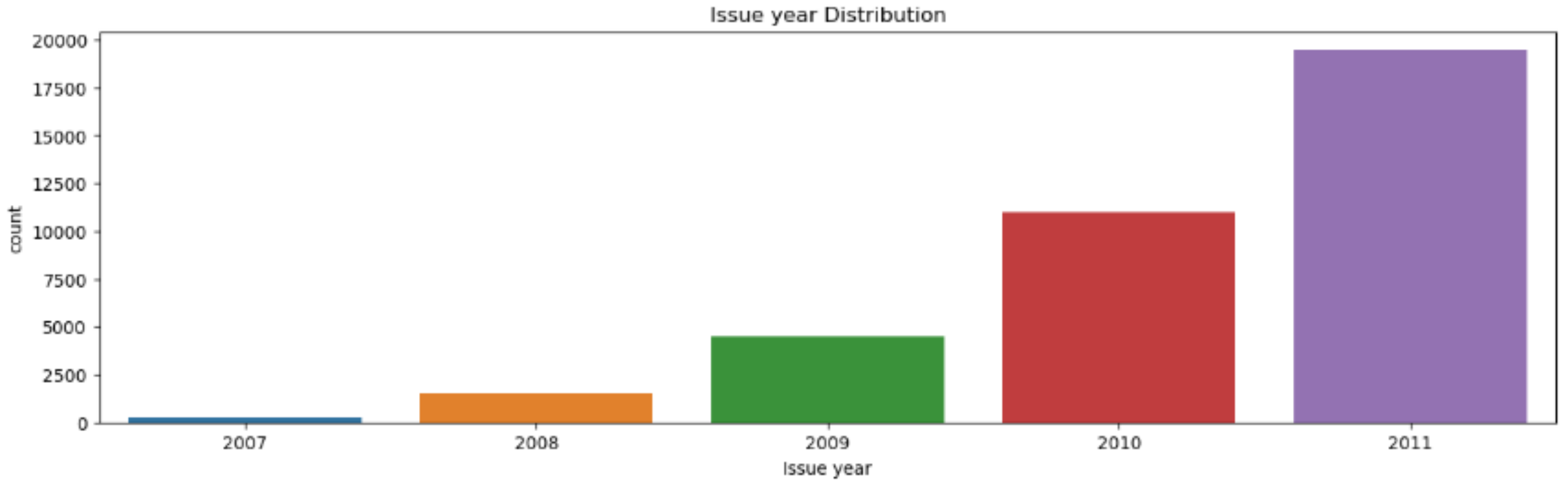
ANALYZING ISSUE YEAR DATA

Observation:

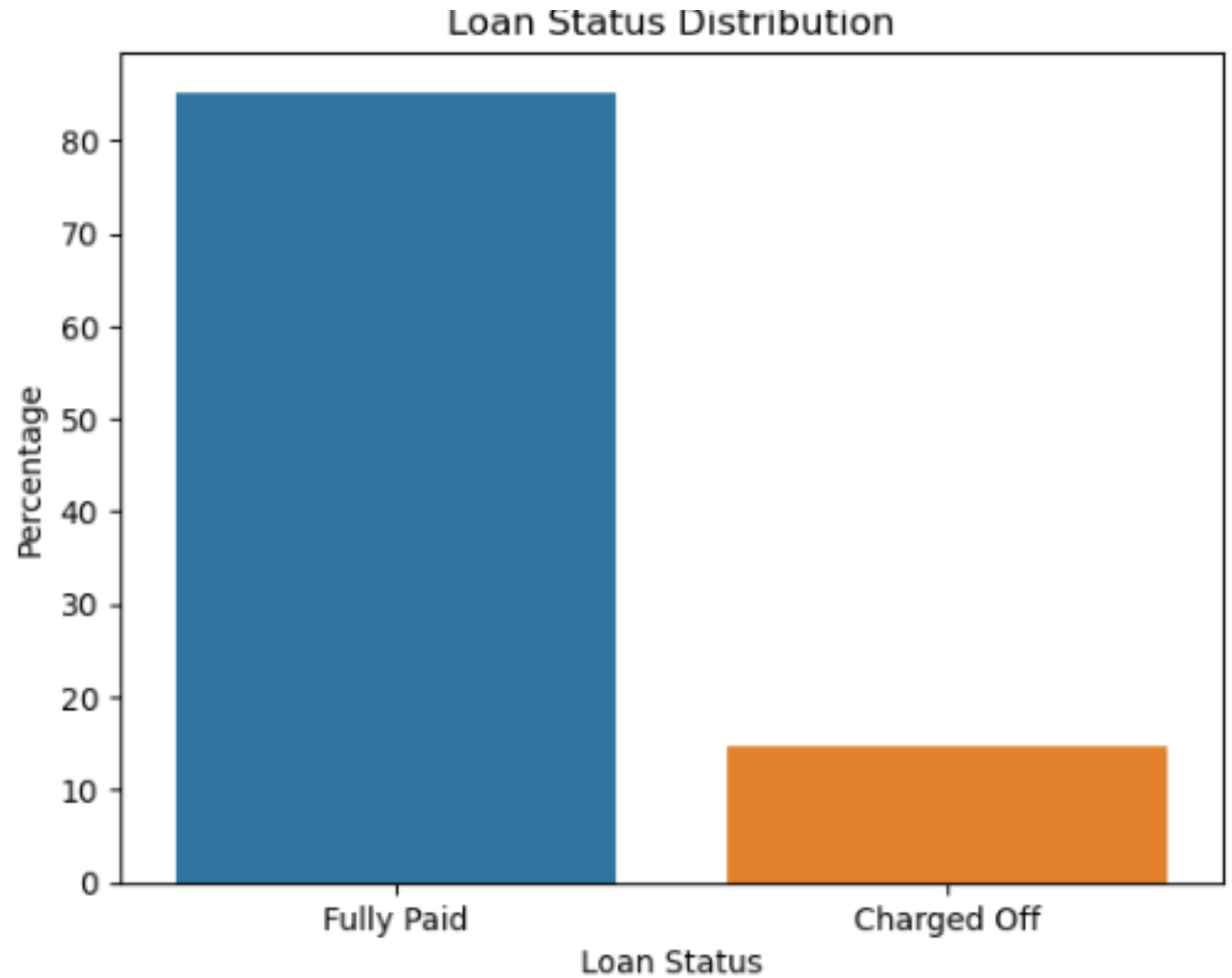* Every year the number of loans are almost doubled

UNIVARIATE ANALYSIS
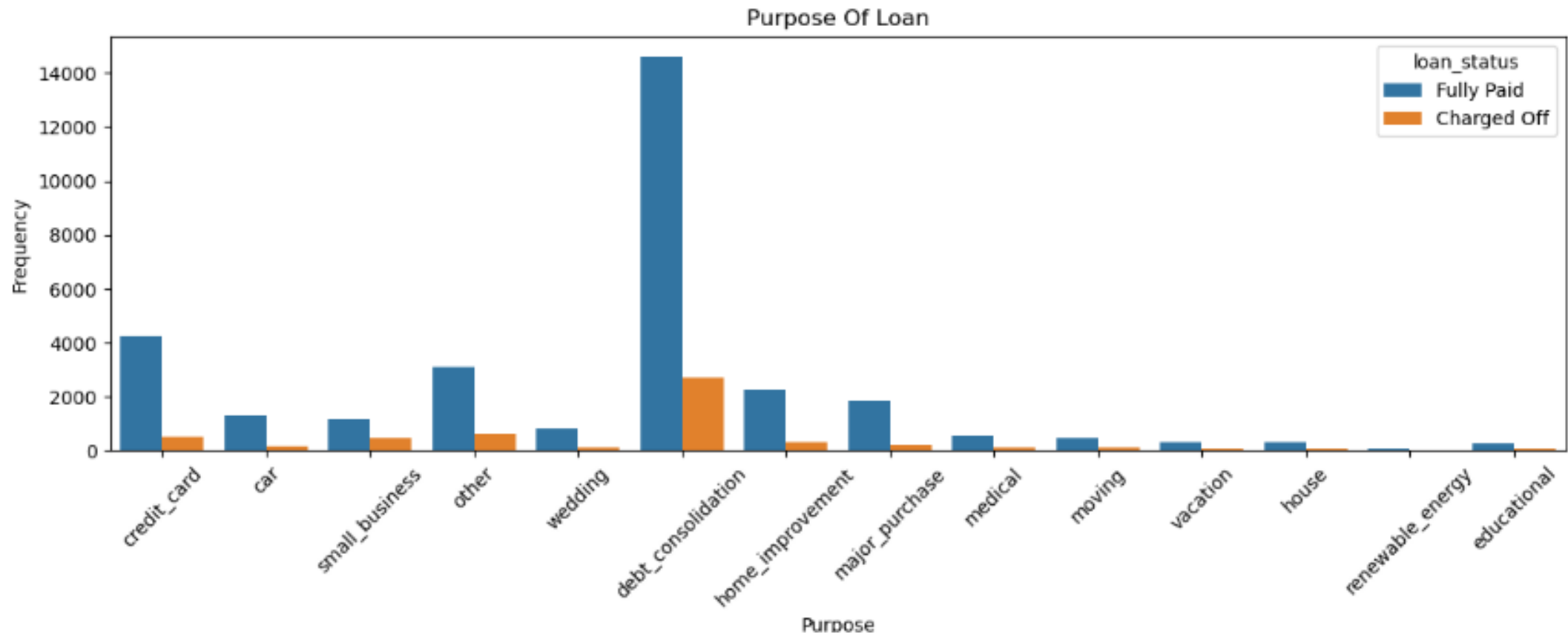
UNORDERED CATEGORICAL VARIABLES

ANALYZING LOAN STATUS

Observation:

- 85.7% have fully paid whereas 14.3% are charged off

Purpose Of Loan

# ANALYZING PURPOSE OF LOAN

Observation:

• Most of the borrowers have taken loan for debt consolidation and paying credit card bills

• Charged Off loan status is high for debt consolidation

ANALYZING HOME OWNERSHIP

Observation:

- Most of the borrowers have taken loan who are staying in rented home or have mortgaged their home

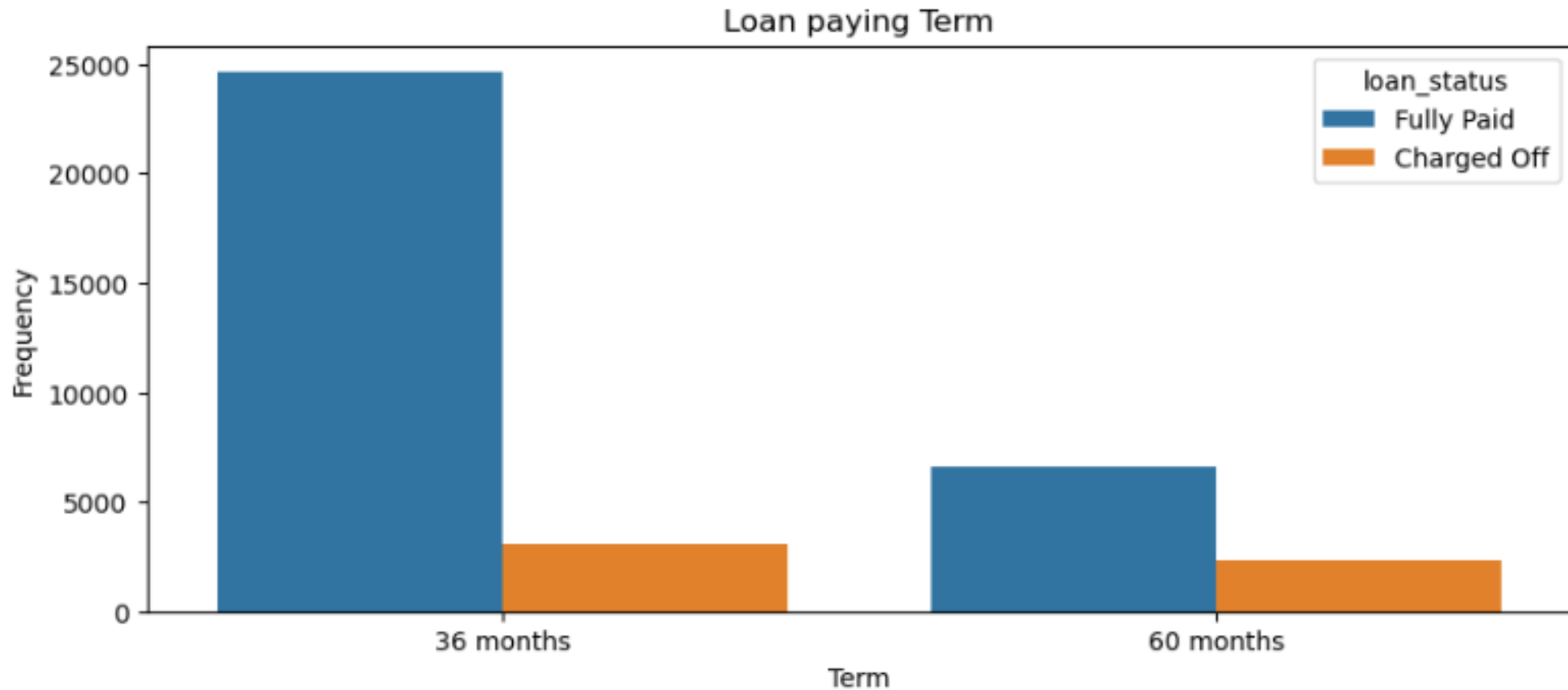- Charged Off loan status is high for these home ownerships
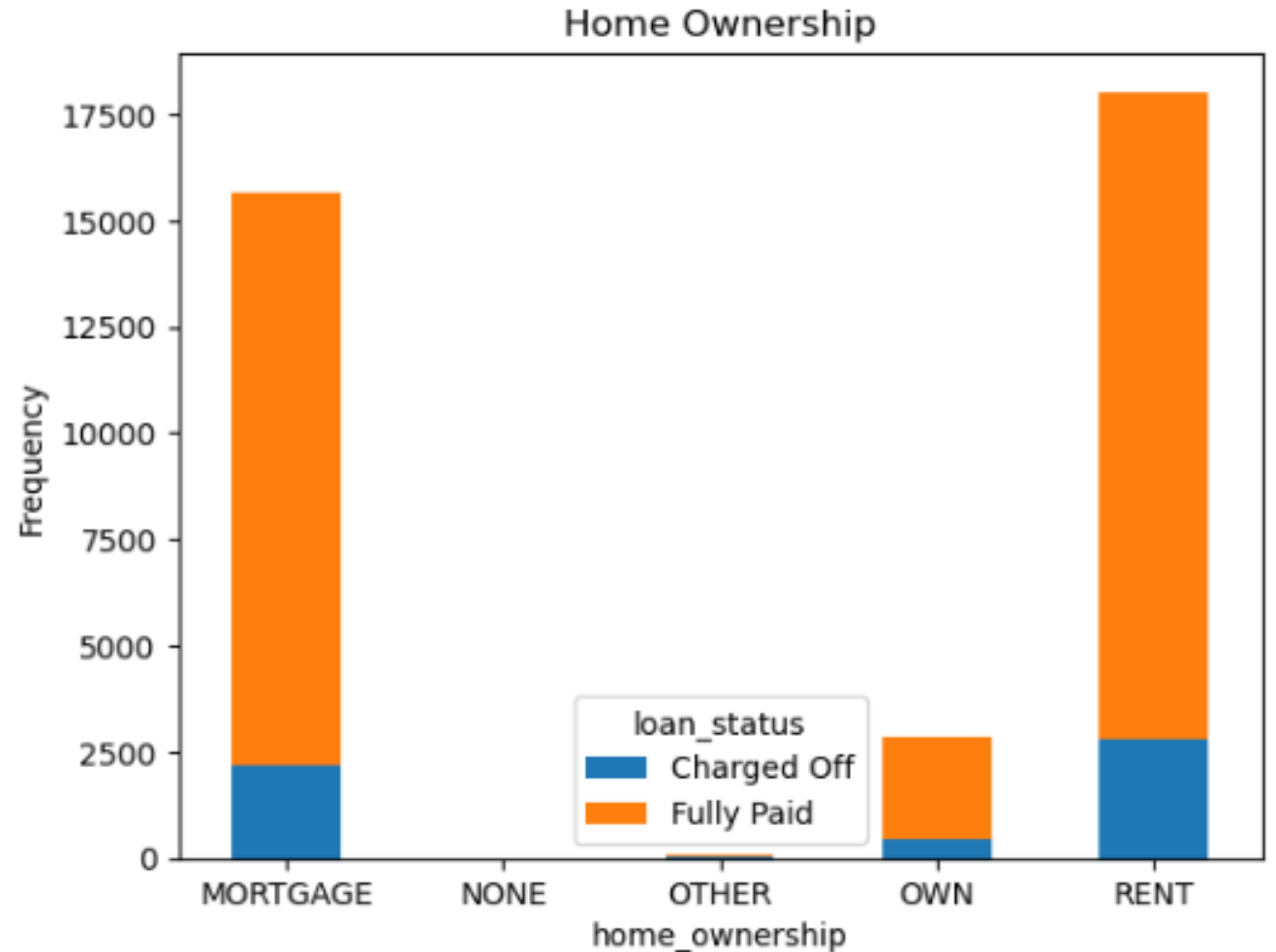
UNIVARIATE ANALYSIS

ORDERED CATEGORICAL VARIABLES

ANALYZING LOAN PAYING TERM

Observation:

- Most of the borrowers have taken loan for 36 months as compared to 60 months term

- Charged Off loan status percent is high for 60 months term as compared to 36 months term
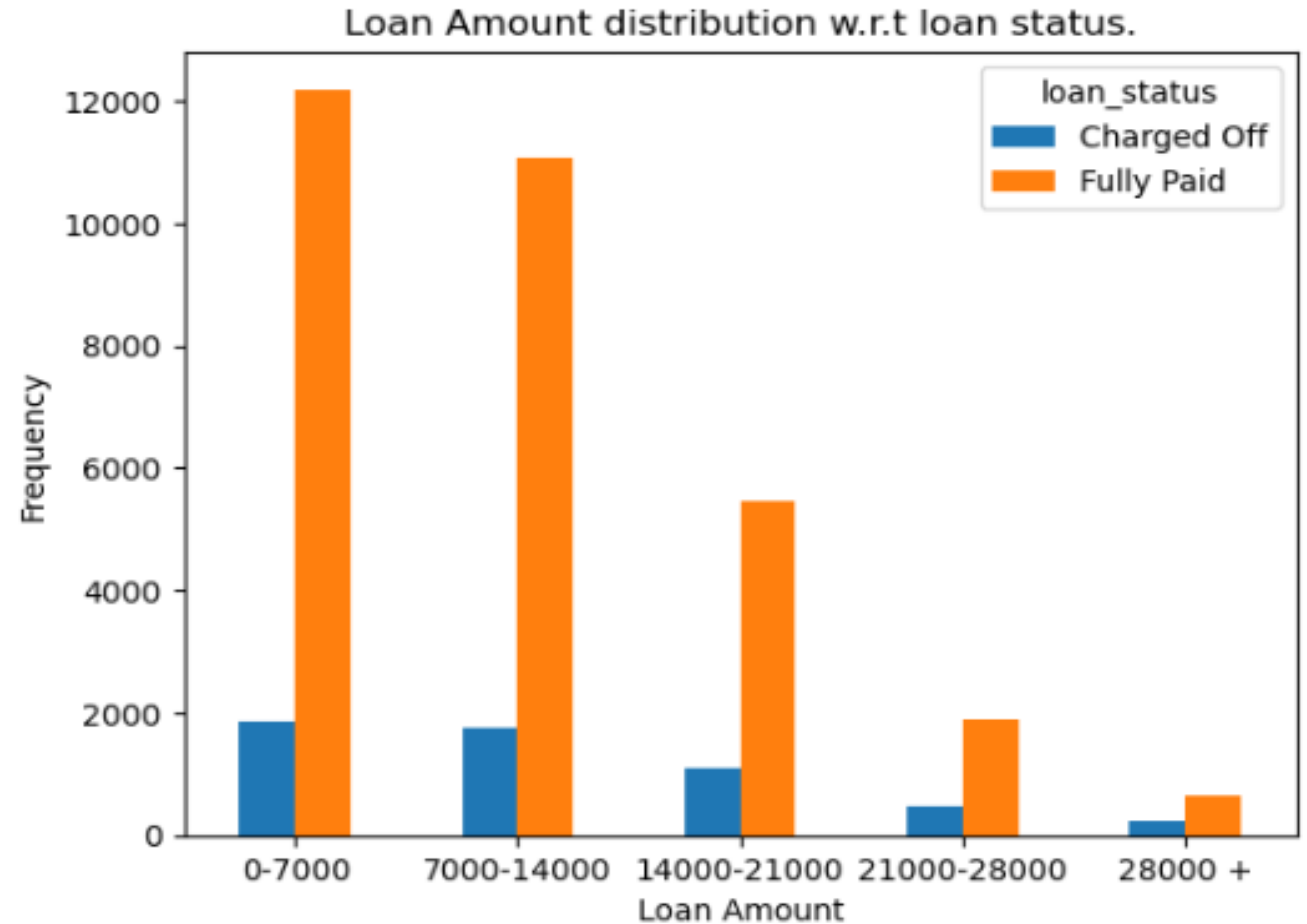
SEGMENTED UNIVARIATE ANALYSIS

LOAN AMOUNT DISTRIBUTION W.R.T LOAN STATUS

Observation:

- Most of the borrowers take or are given loan amount up to 14K
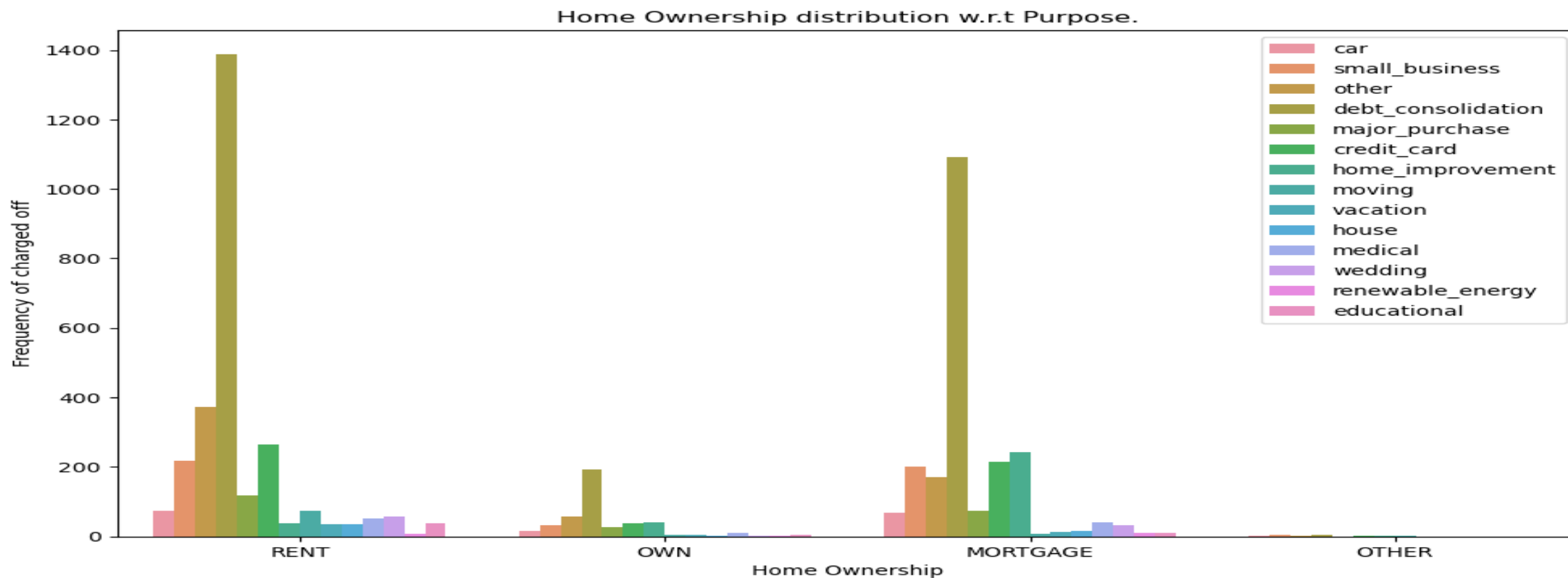
- Charged off status is high for these amounts

Loan Amount distribution w.r.t loan status.

ANNUAL INCOME DISTRIBUTION W.R.T LOAN STATUS

Observation:

- Most of the borrower's annual income is in the range of 40K to 60K

- Charged off status is high for these annual income amounts

Annual Income distribution w.r.t loan status.

Home Ownership distribution w.r.t Purpose.
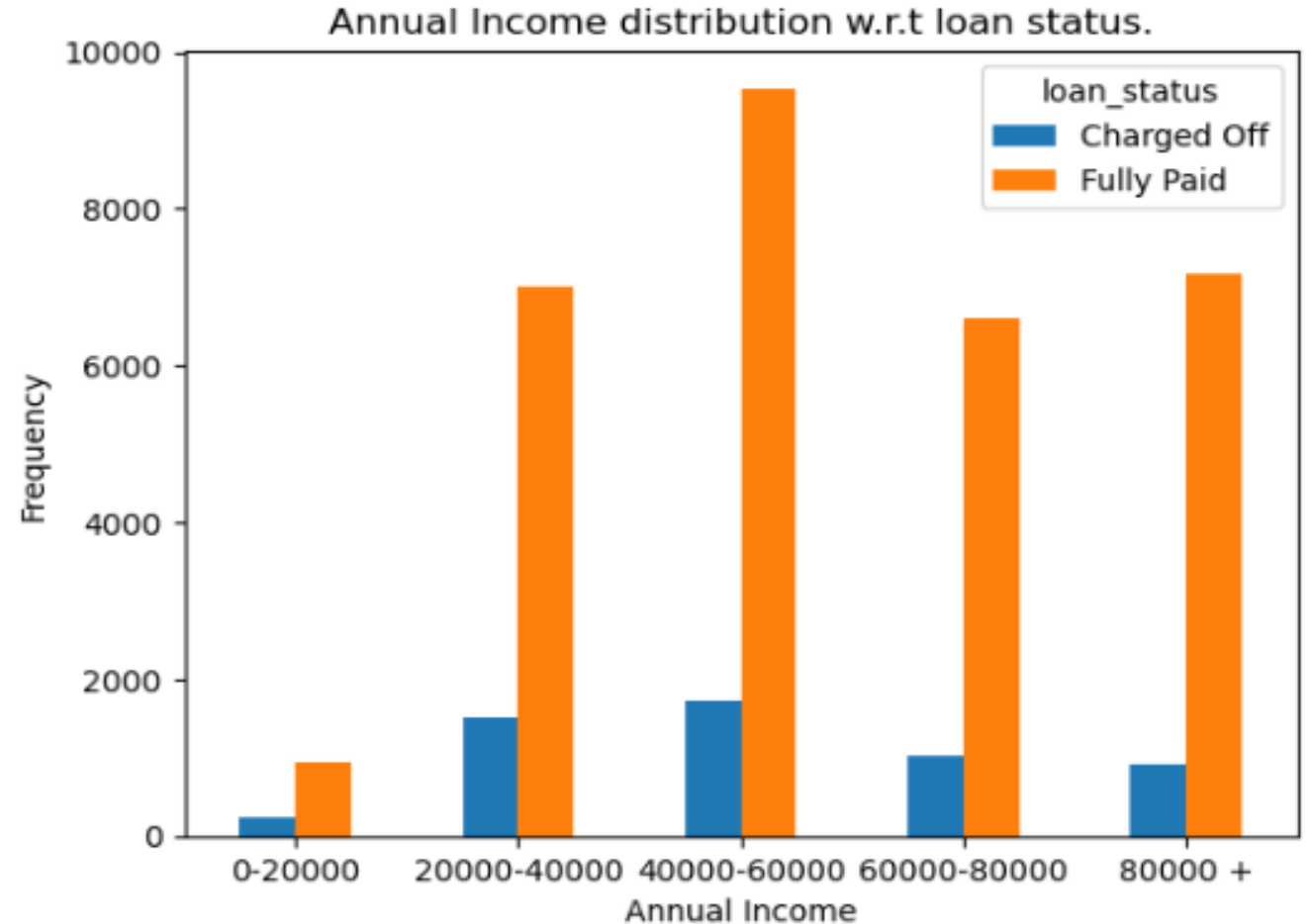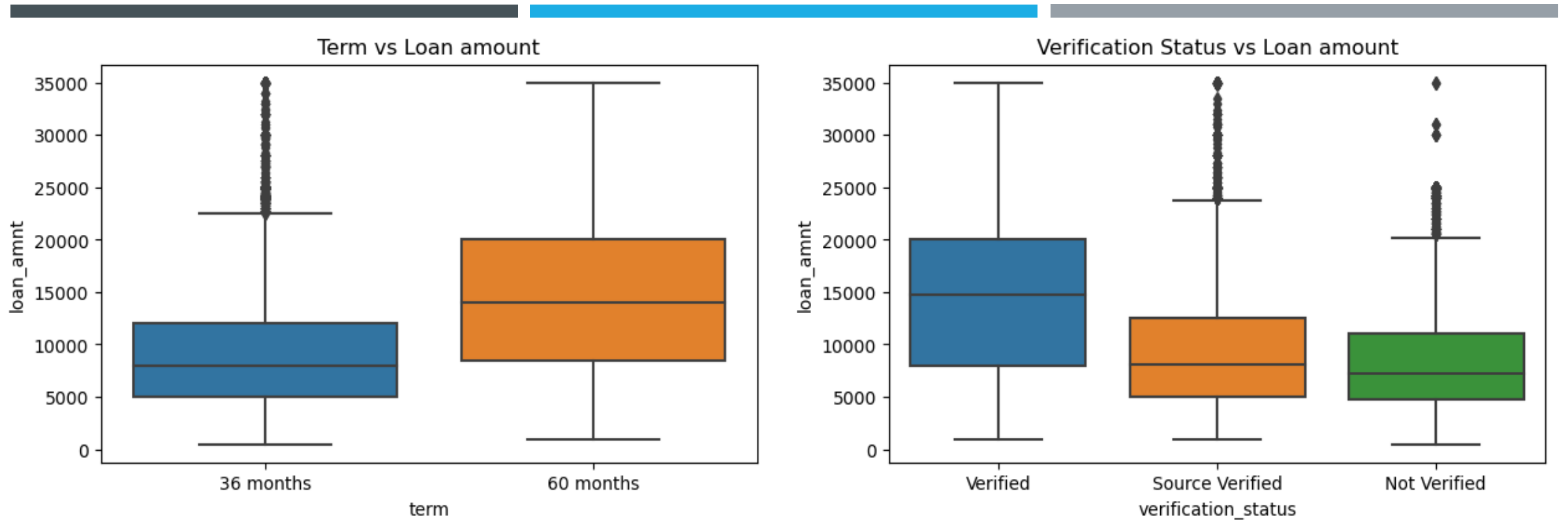
HOME OWNERSHIP DISTRIBUTION W.R.T PURPOSE

Observation:

• Most of the borrowers who took loan for the purpose of debt consolidation have highest number of Charged off status and those who are in rent as the most

BIVARIATE ANALYSIS

TERM VS LOAN AMOUNT & VERIFICATION STATUS VS LOAN AMOUNT

Observation:

- **Term Vs Loan amount:** More the loan amount higher is the tenure i.e. 60 months. The median for 60 months is 15K whereas the median for 36 month is 8K

- **Verification status vs Loan amount:** Verified borrowers gets more loan amount than Not Verified and Source Verified. Borrowers with higher loan amount are verified

Loan status vs Loan amount — Grade vs Loan amount
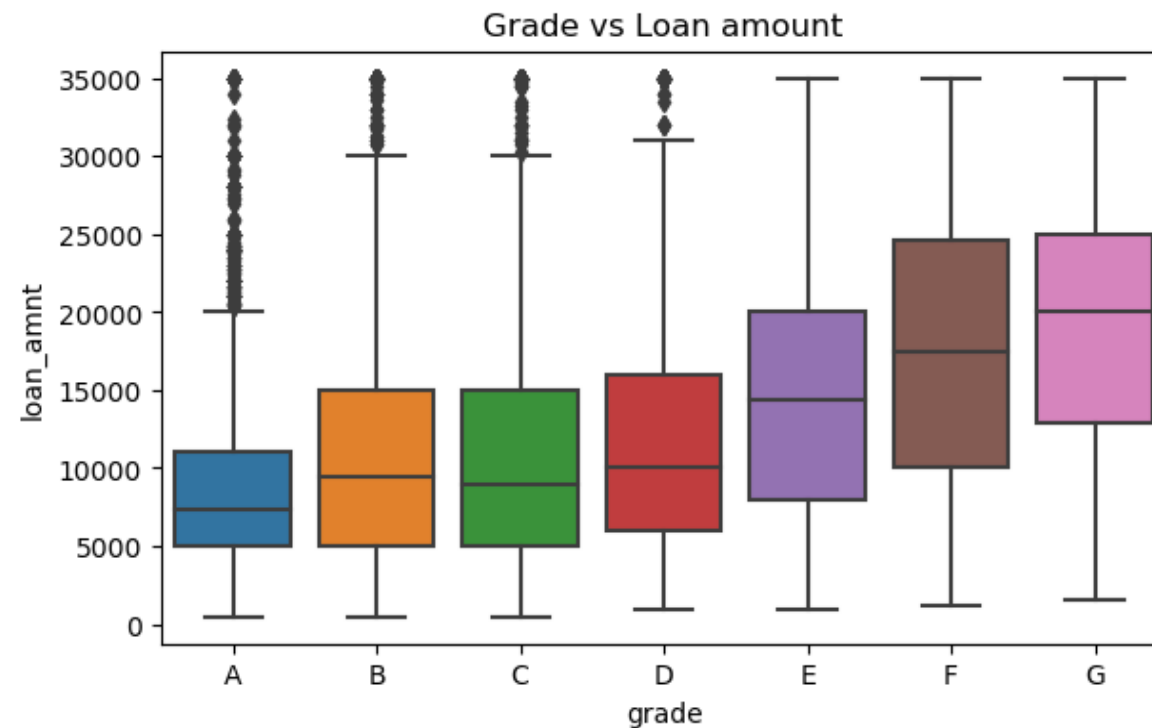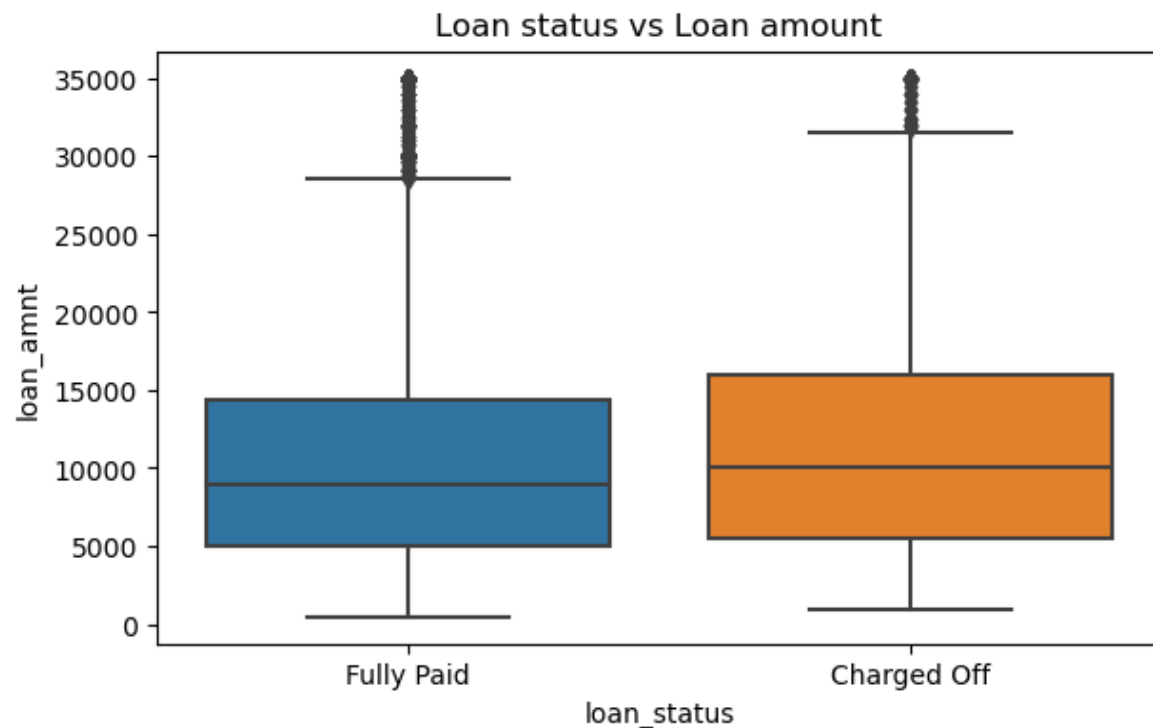
LOAN STATUS VS LOAN AMOUNT & GRADE VS LOAN AMOUNT

Observation:

- **Loan status Vs Loan Amount:** Charged off were having higher loan amount than fully paid

- **Grade vs Loan Amount:** Grade F & G are having max amount of loan, as the grade decreases amount of loan is increasing

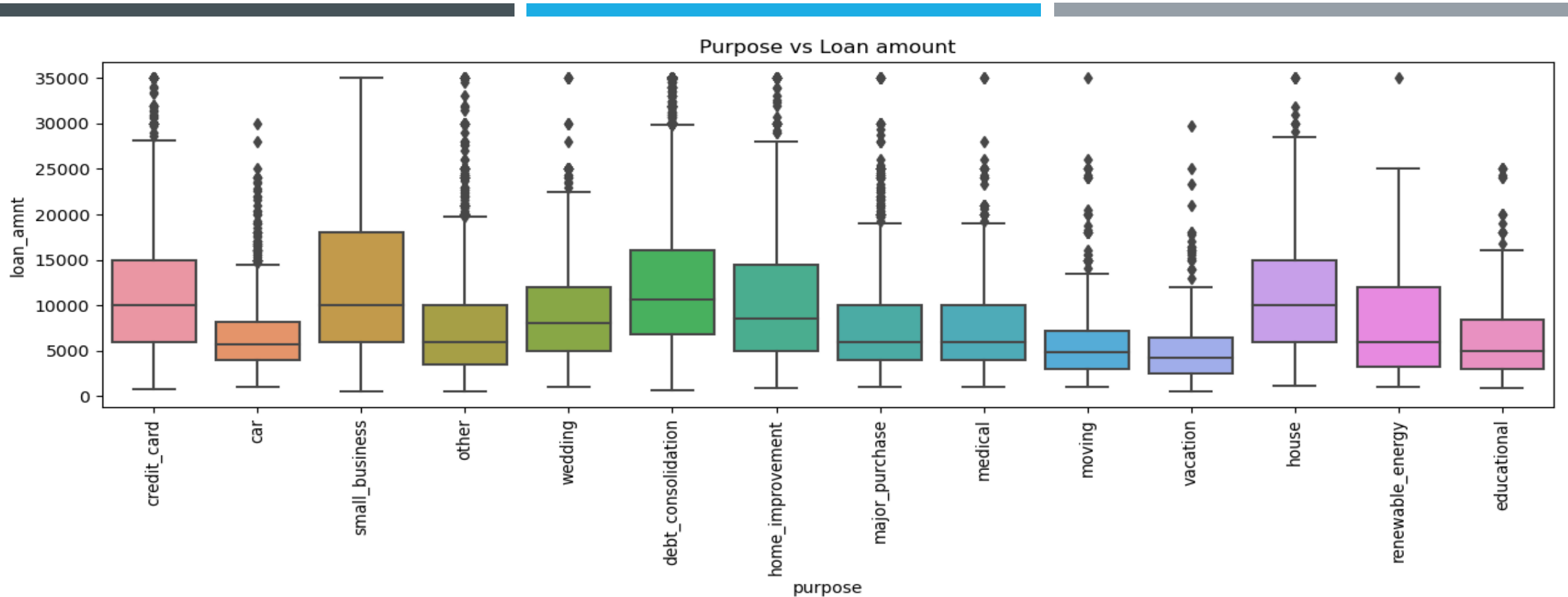- **Inference:** Higher the grade more is the risk of default

Home Ownership vs Loan amount
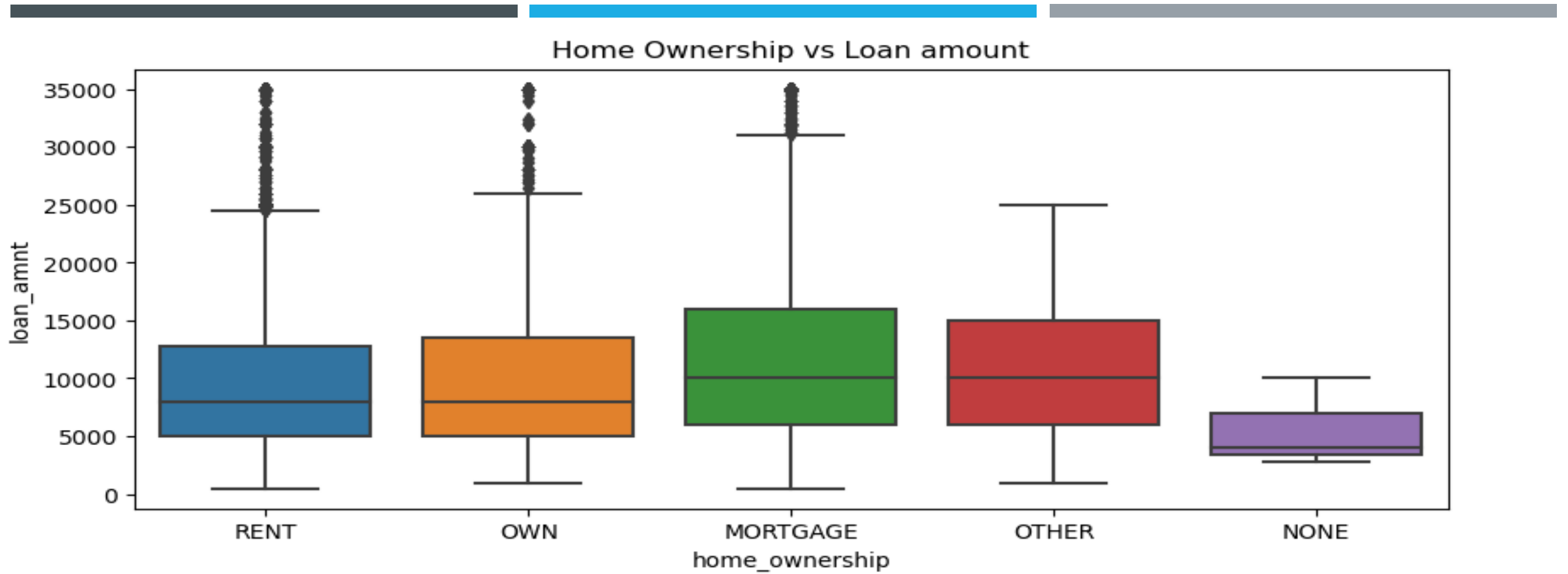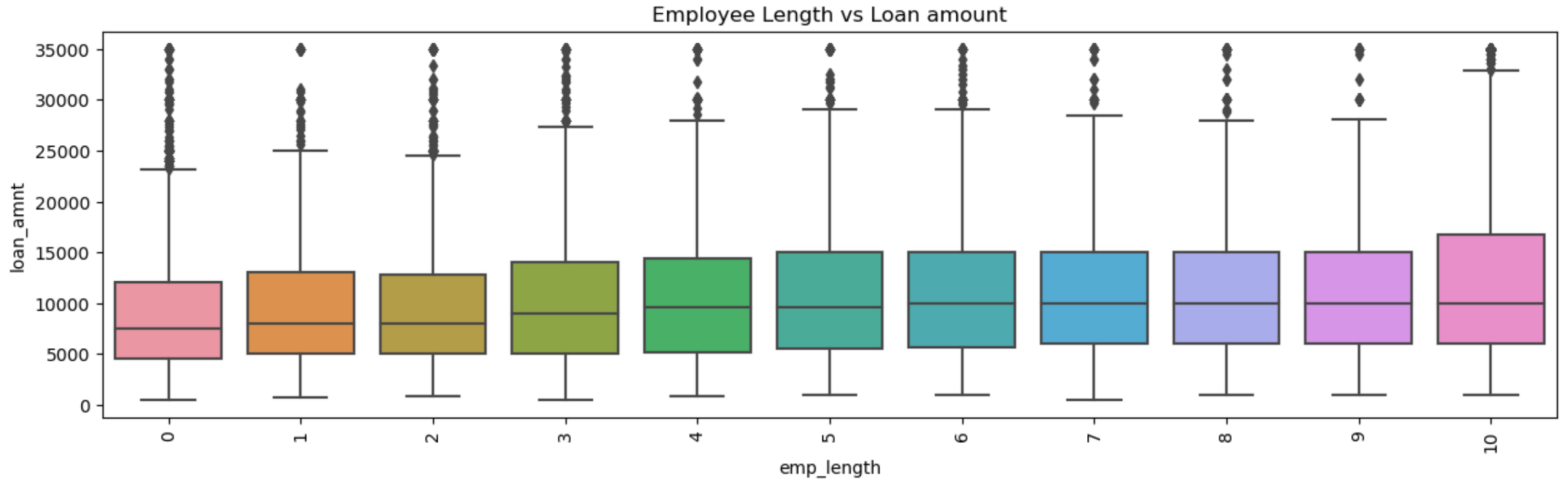
HOME OWNERSHIP VS LOAN AMOUNT

Observation:

- The borrowers who have mortgaged their homes have taken higher amount of loan

PURPOSE VS LOAN AMOUNT

Observation:

- Small business purpose borrowers are taking high amounts of loan than others

- Debt consolidation purpose borrowers as well

Employee Length vs Loan amount

EMPLOYEE LENGTH VS LOAN AMOUNT

Observation:

• The borrowers who have 10 or 10+ years of experience are taking high amounts of loan than others

• The borrowers with less than 2 years of experience are taking lesser amount of loan compared to others
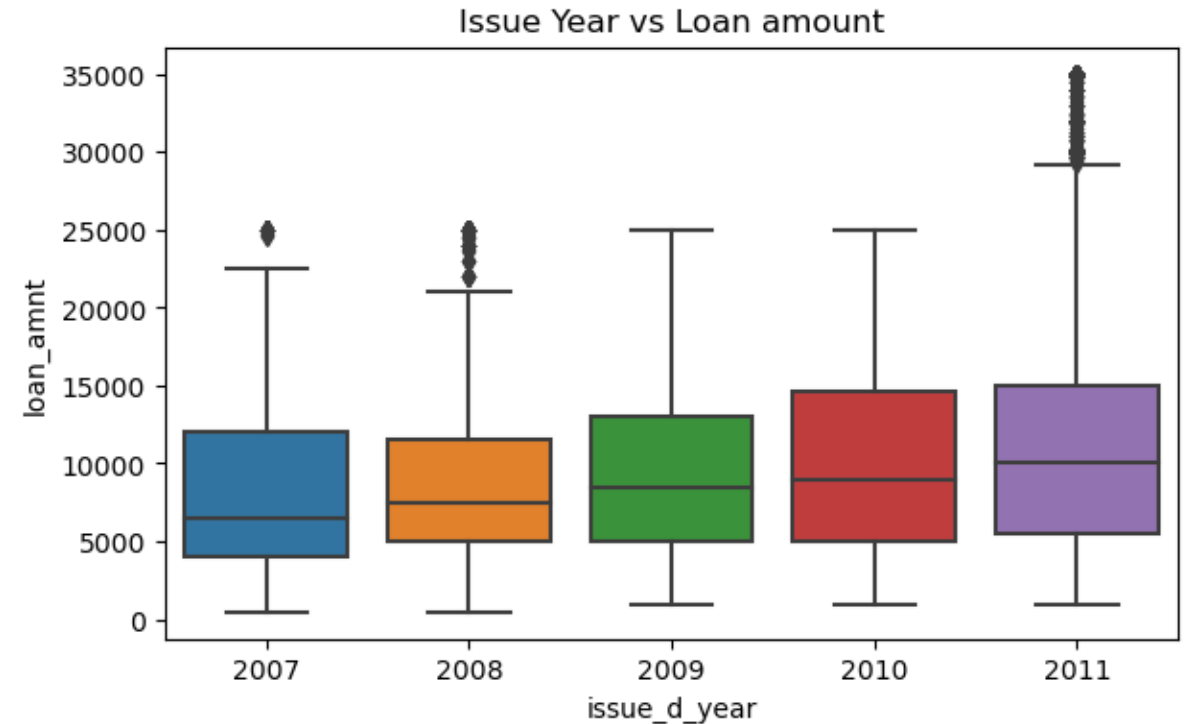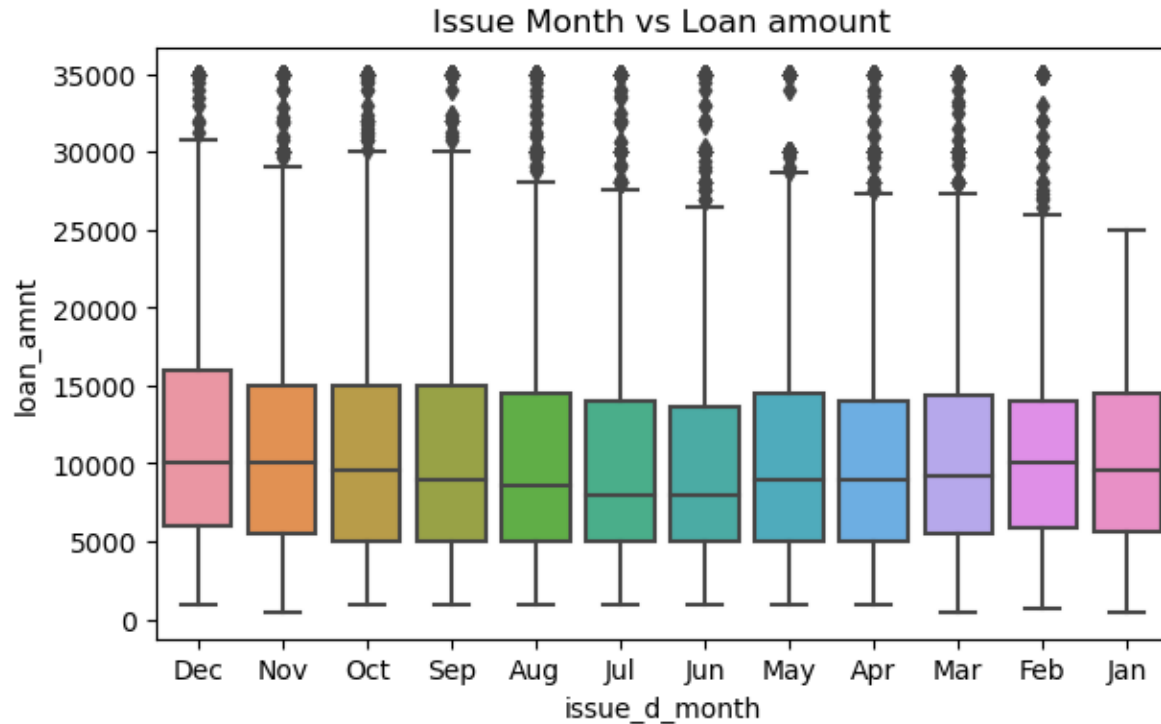
ISSUE MONTH VS LOAN AMOUNT & ISSUE YEAR VS LOAN AMOUNT
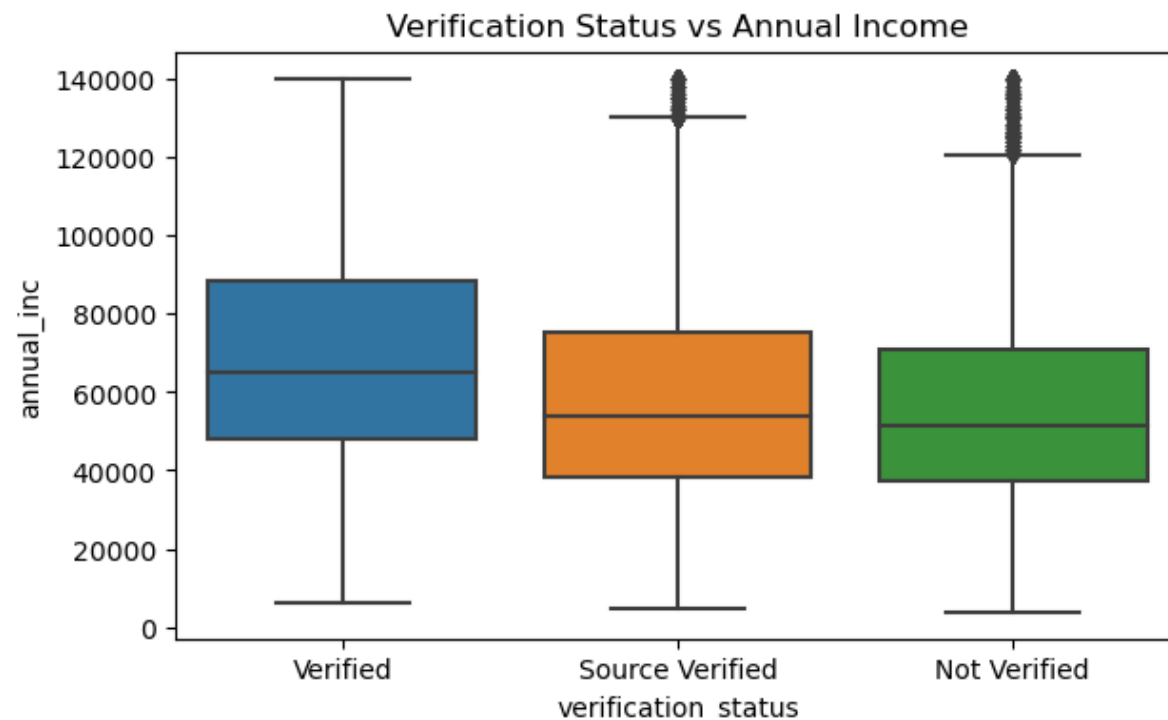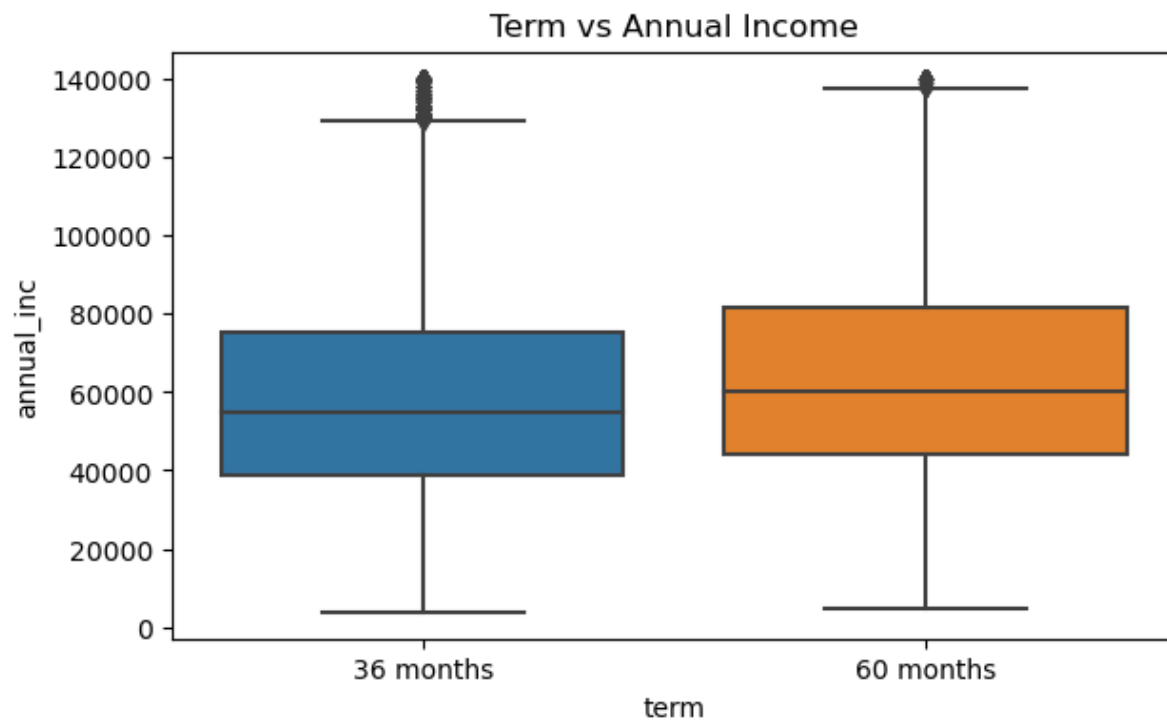
Observation:

- **Issue Month Vs Loan Amount:** Highest amounts of loan are taken in the month of Dec and May for which median value doesn't vary too much.

- **Issue Year vs Loan Amount:** Highest amounts of loan are taken in the year 2010 and 2011. Median value doesn't vary too much but as the year increases high amount of loans are taken.
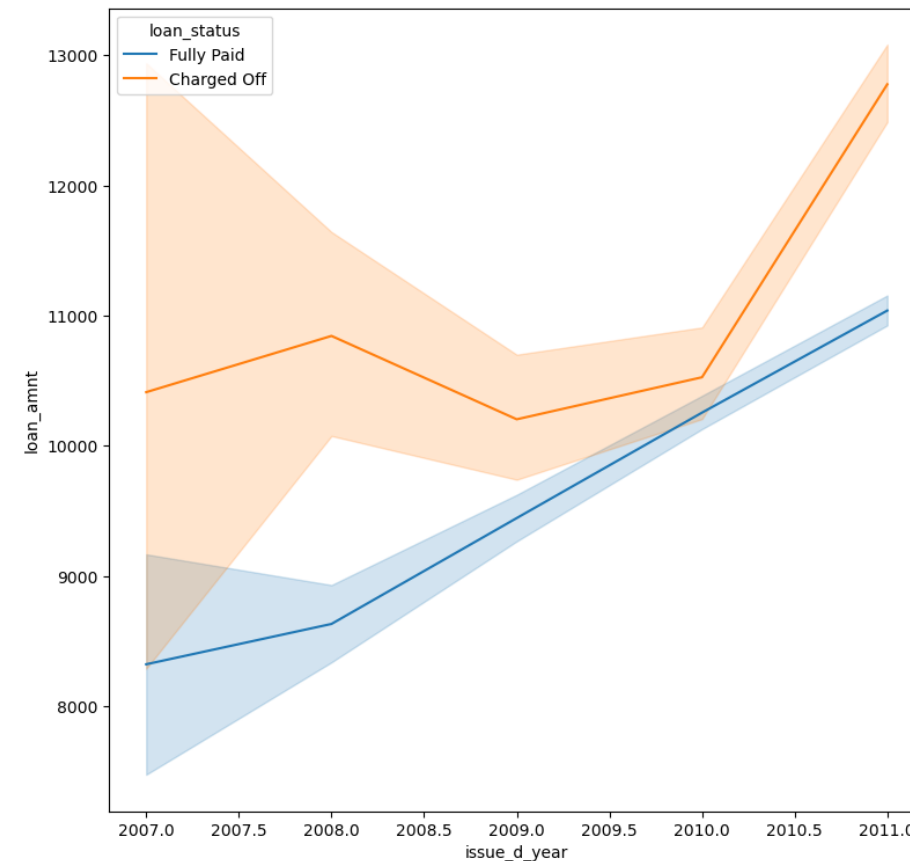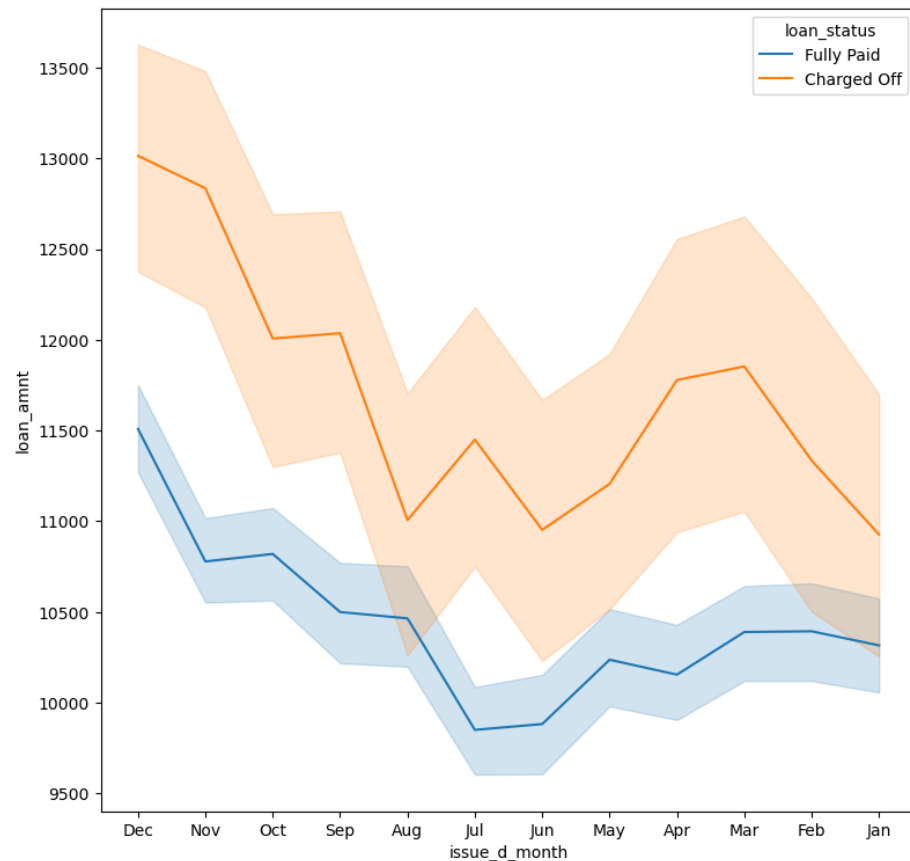
# ISSUE MONTH VS LOAN AMOUNT & ISSUE YEAR VS LOAN AMOUNT

Observation:

• Charged off frequency is high for higher amounts

• The borrower who took the loan in the months of October, November and December are having highest charged off ratio

TERM VS ANNUAL INCOME & VERIFICATION STATUS VS ANNUAL INCOME
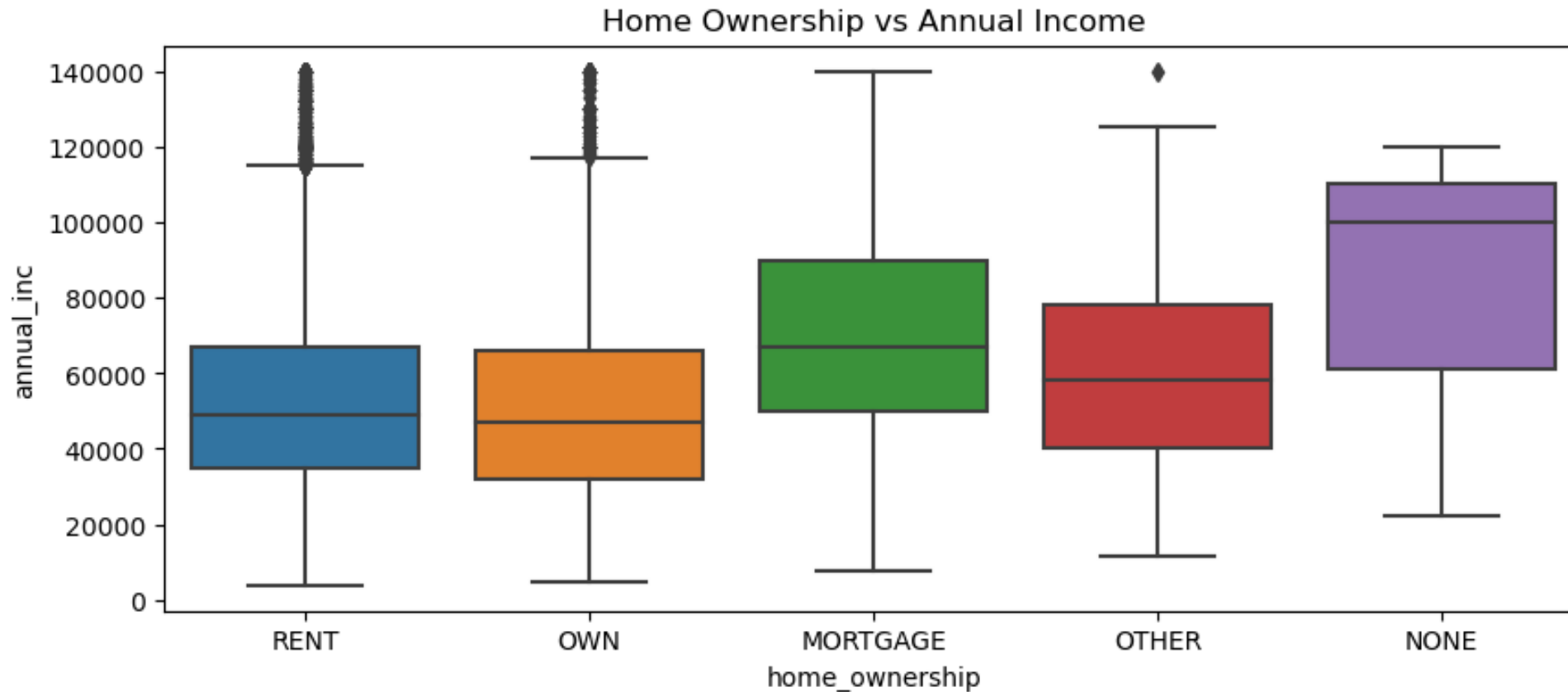
Observation:

- **Term vs Annual Income: T**he borrowers who have high annual income are taking loans for 60 months tenure as compared to 36 months

- **Verification Status vs Annual Income:** Higher annual income borrowers are mostly verified
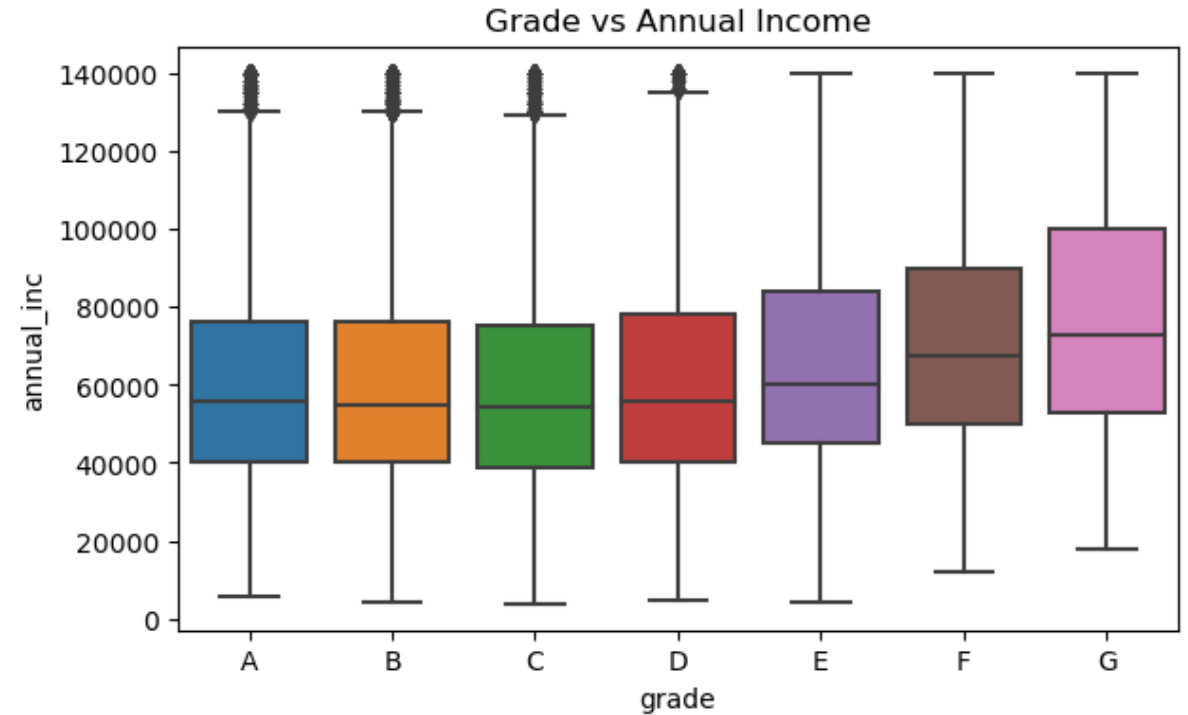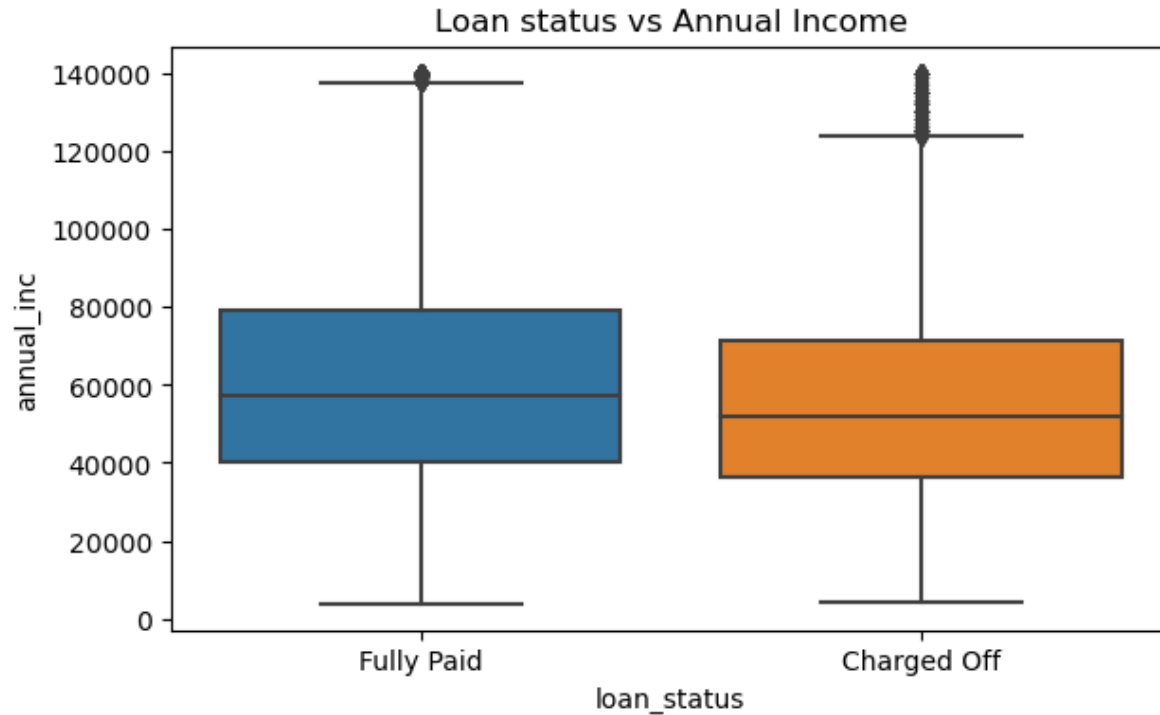
LOAN STATUS VS ANNUAL INCOME & GRADE VS ANNUAL INCOME

Observation:

- **Loan Status Vs Annual Income:** The borrowers with annual incomes between 40K and 75K have a high tendency to default

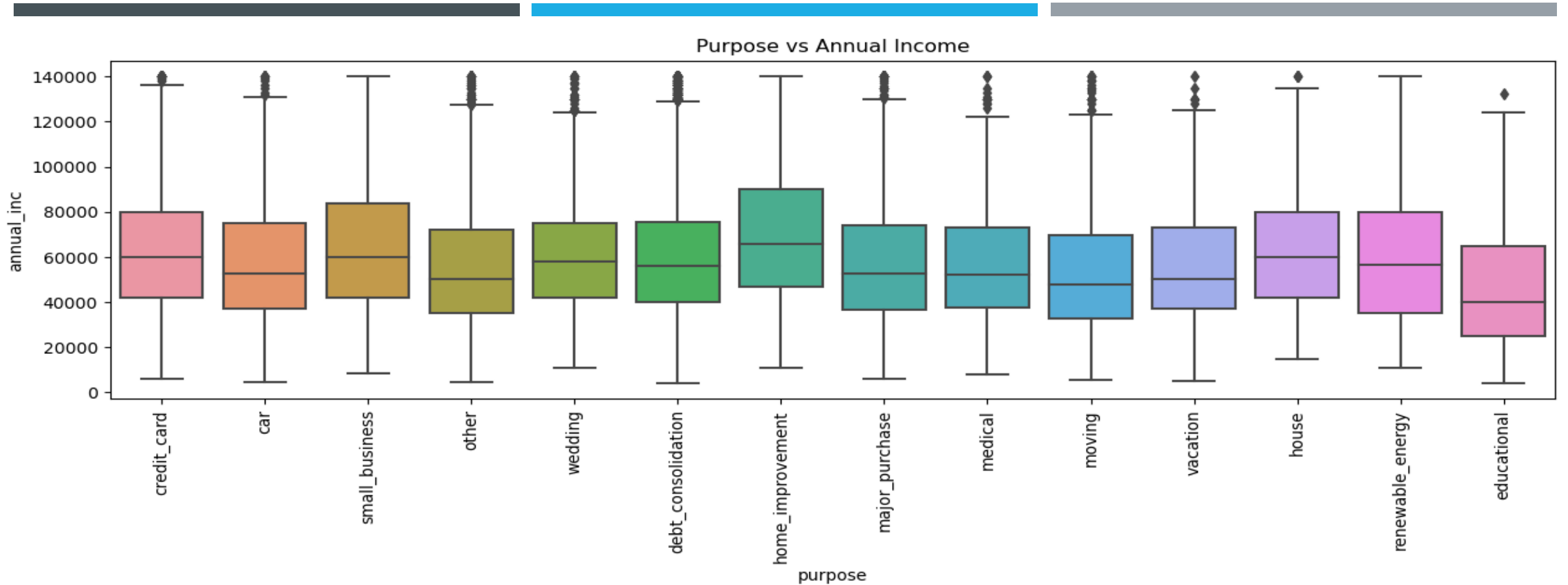- **Grade Vs Annual Income:** The borrowers with higher annual incomes are graded as F or G

Home Ownership vs Annual Income

HOME OWNERSHIP VS ANNUAL INCOME

Observation:

- The borrowers who have mortgaged their homes are having high average annual income
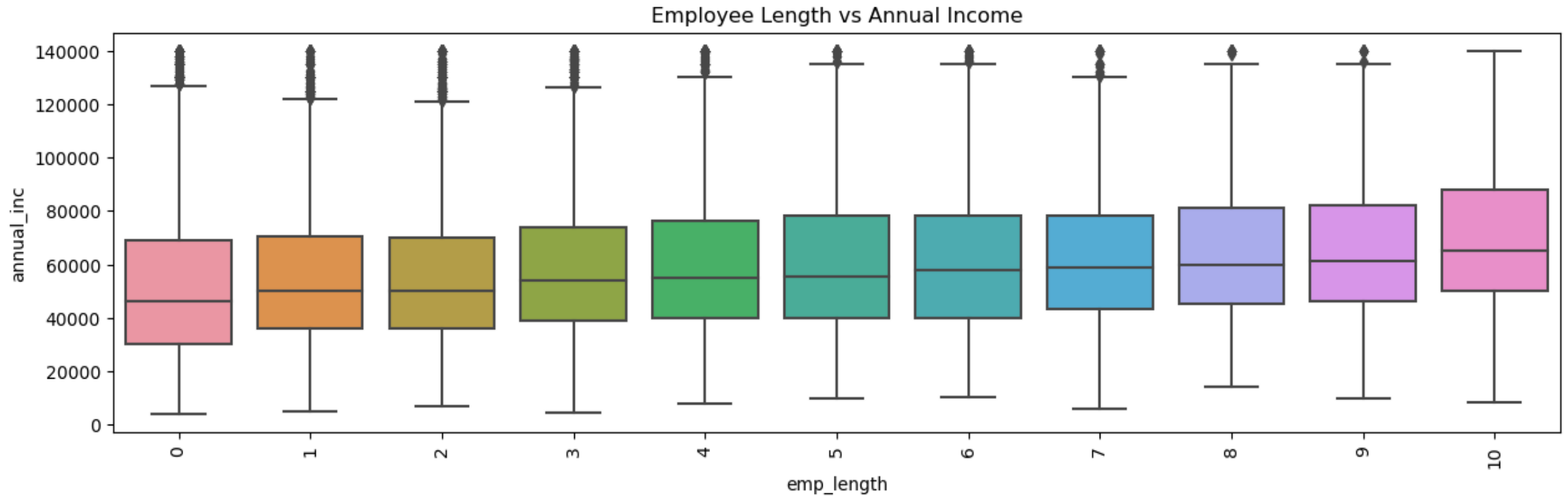
Purpose vs Annual Income

PURPOSE VS ANNUAL INCOME

Observation:

• The borrowers who have high annual income are taking loans mostly for home improvement and small business

Employee Length vs Annual Income

# EMPLOYEE LENGTH VS ANNUAL INCOME

Observation:

- The borrowers who have 10 or 10+ years of experience are having highest annual income than others

- The borrowers with less than 1 year of experience are having the least
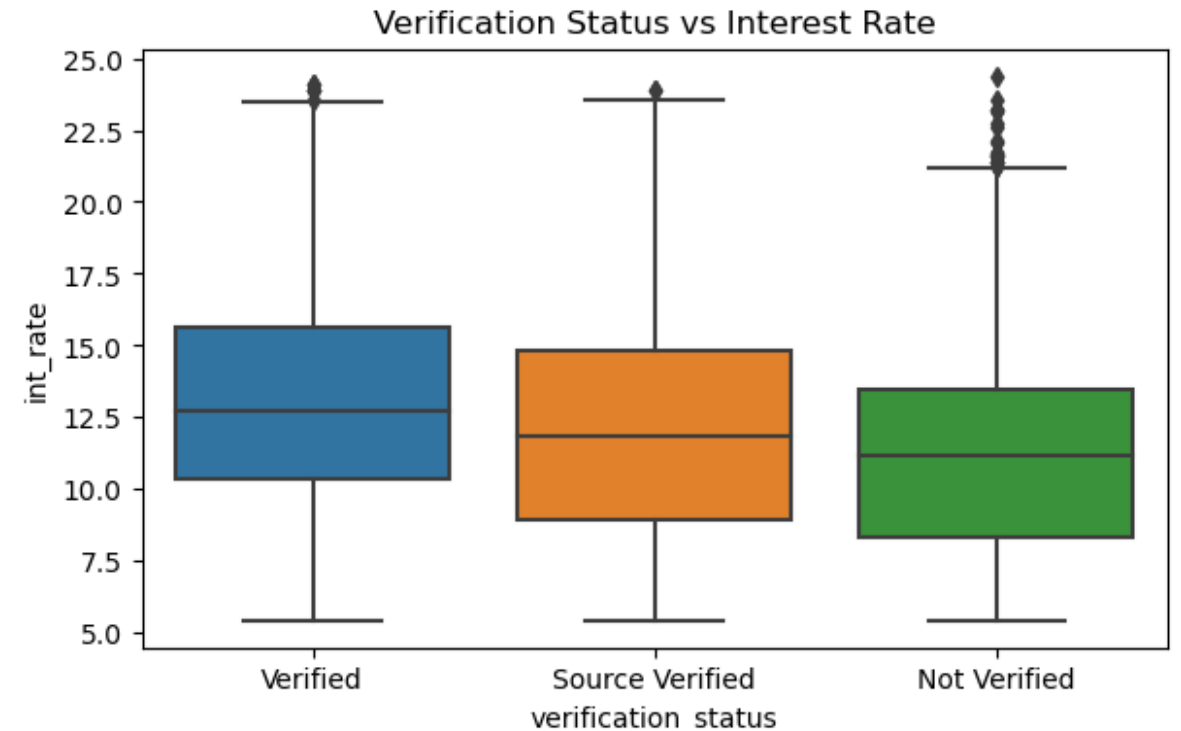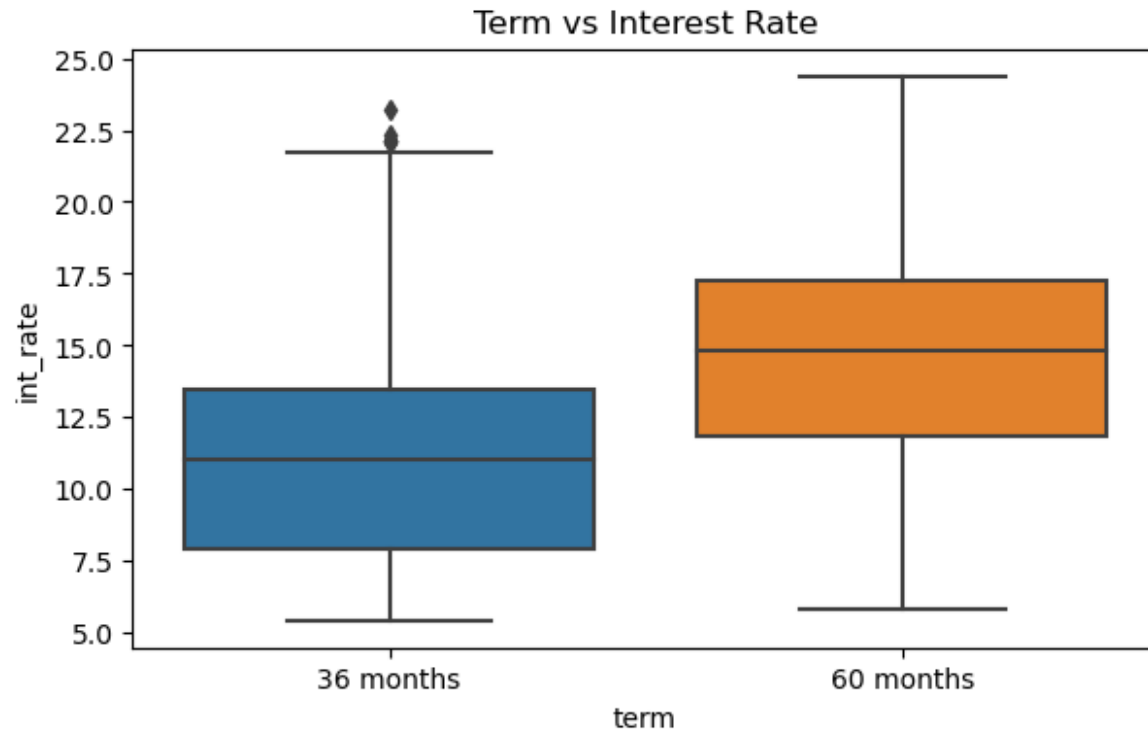
TERM VS INTEREST RATE & VERIFICATION STATUS VS INTEREST RATE
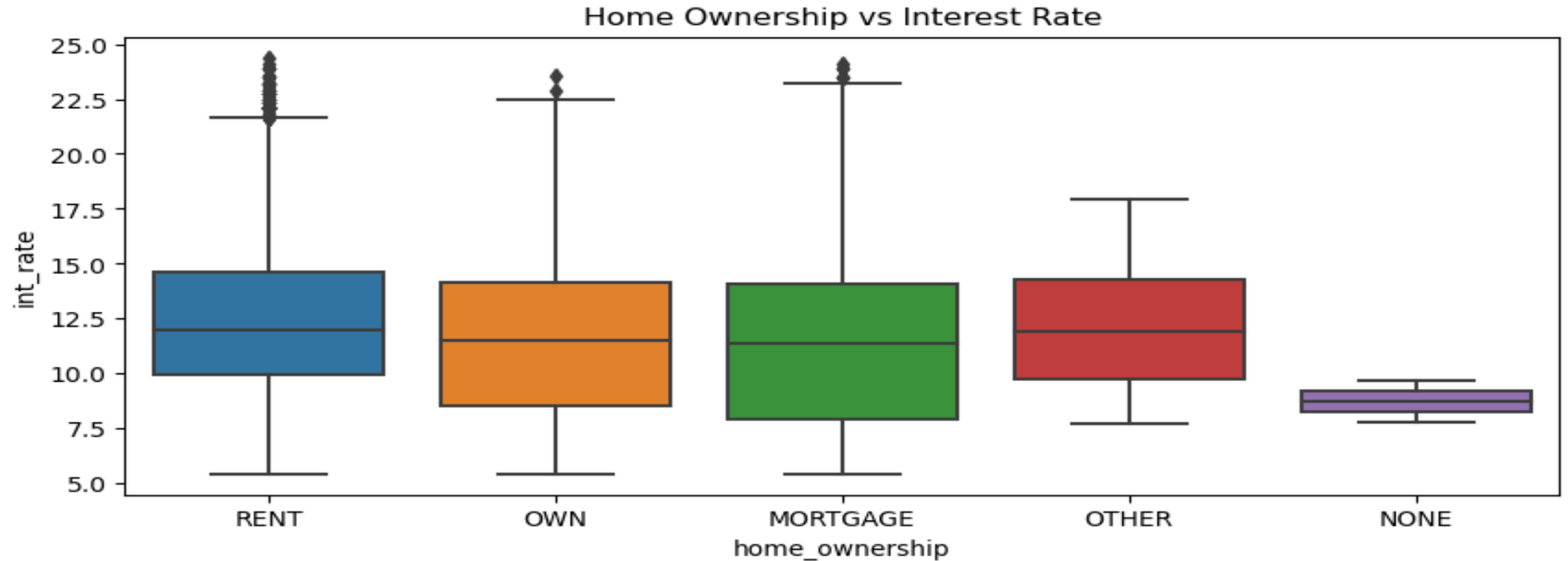
Observation:

- **Term Vs Interest Rate:** Interest rate is less for those who take loan for 36 months and higher for 60 months

- **Verification Status Vs Interest Rate:** Verified borrowers gets more loan at higher interest rate as compared to others
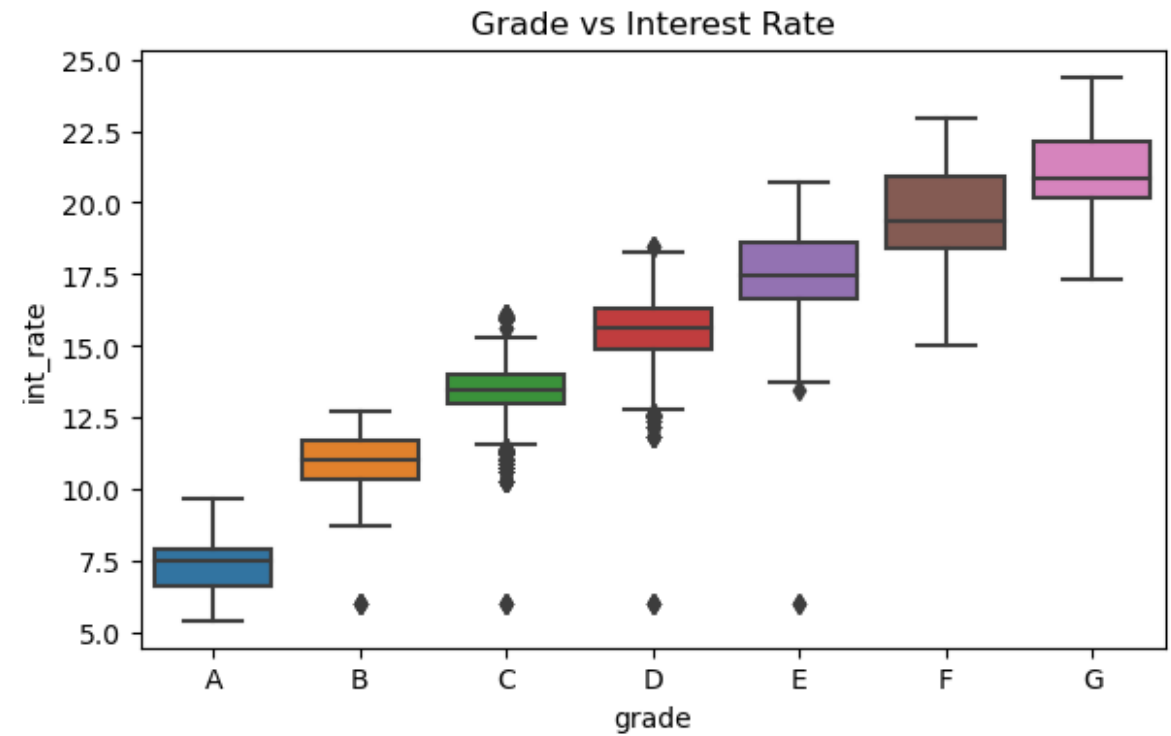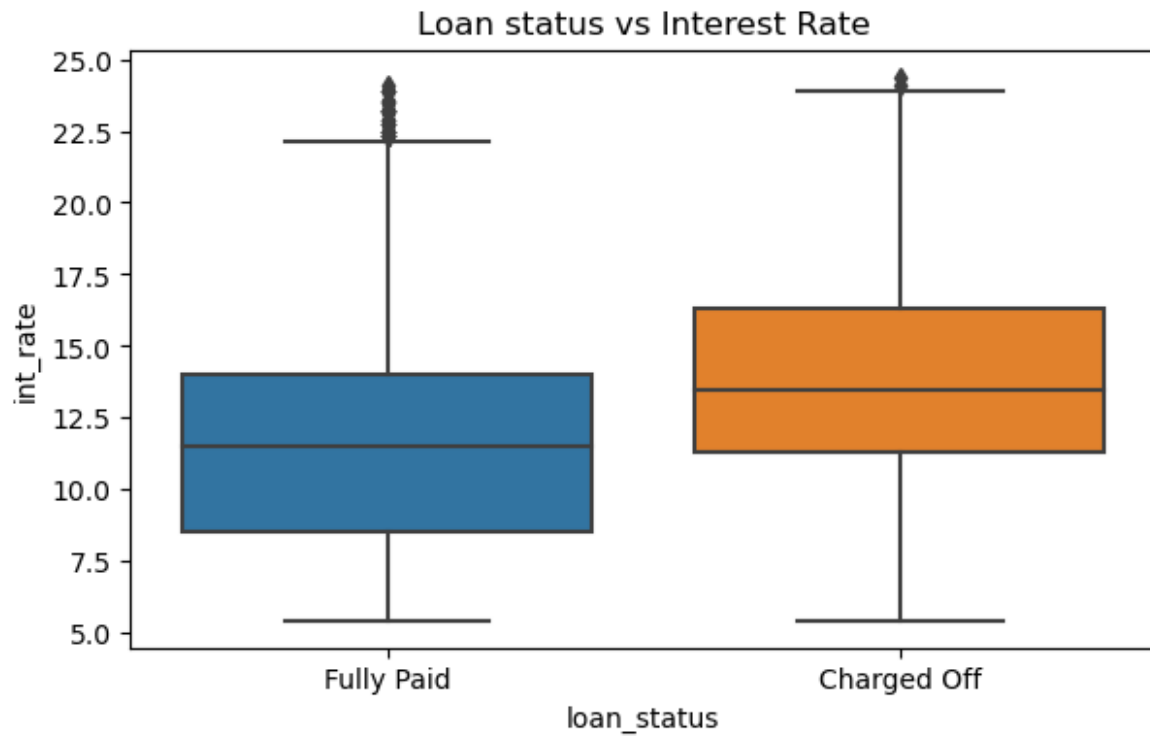
# LOAN STATUS VS INTEREST RATE & GRADE VS INTEREST RATE

Observation:

- **Loan Status Vs Interest Rate:** The borrowers who have high interest rate are mostly defaulters

- **Grade Vs Interest Rate:** As the grade decreases, interest rate is also increasing

Home Ownership vs Interest Rate

HOME OWNERSHIP VS INTEREST RATE
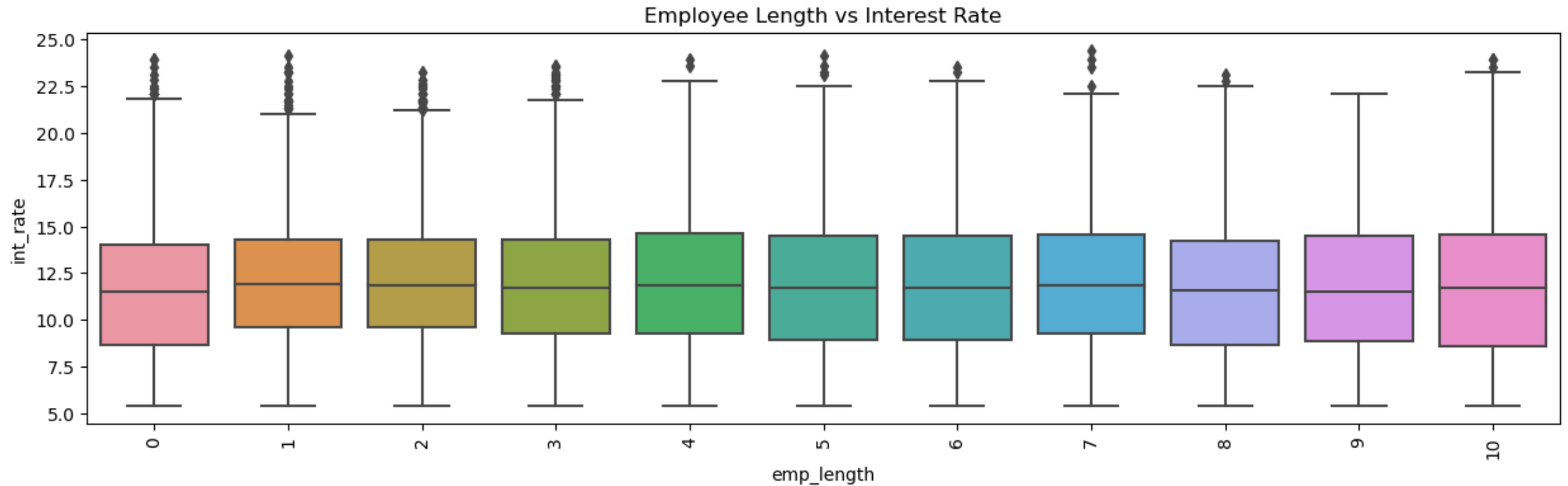
Observation:

- The borrowers who are in rented homes are getting high interest rate

- The borrowers with own homes and mortgaged homes are getting loan with less interest rate
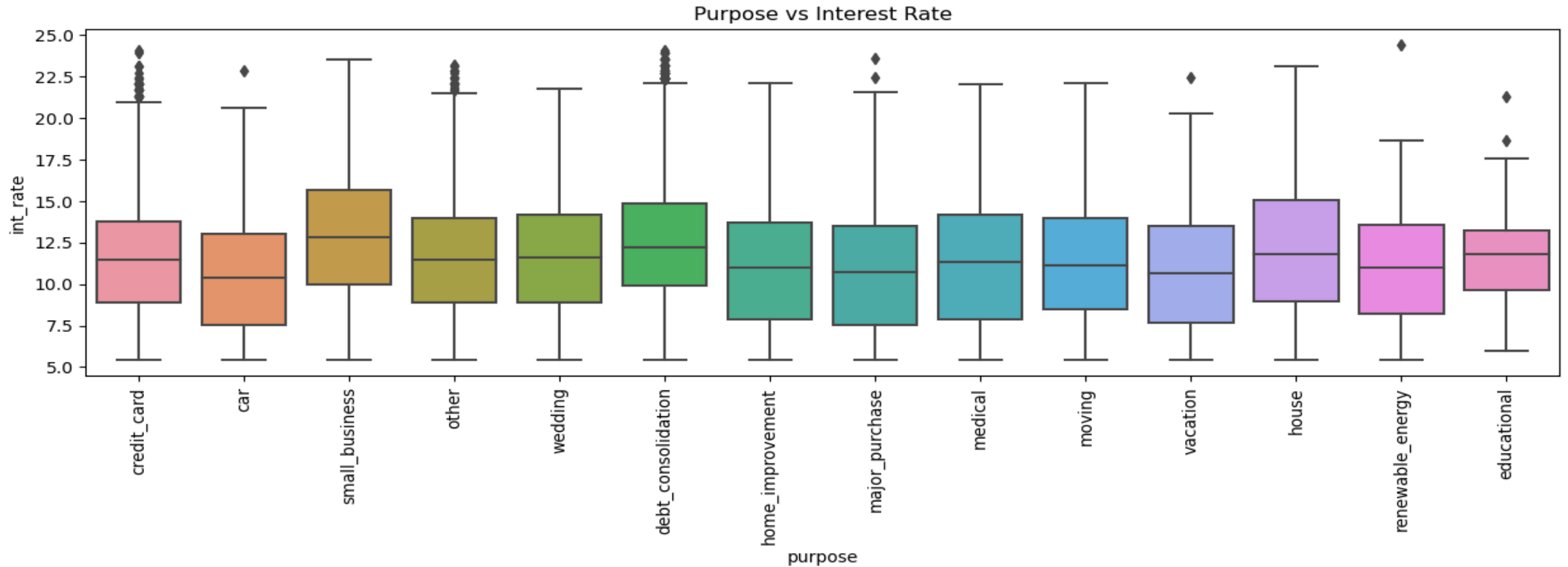
Purpose vs Interest Rate
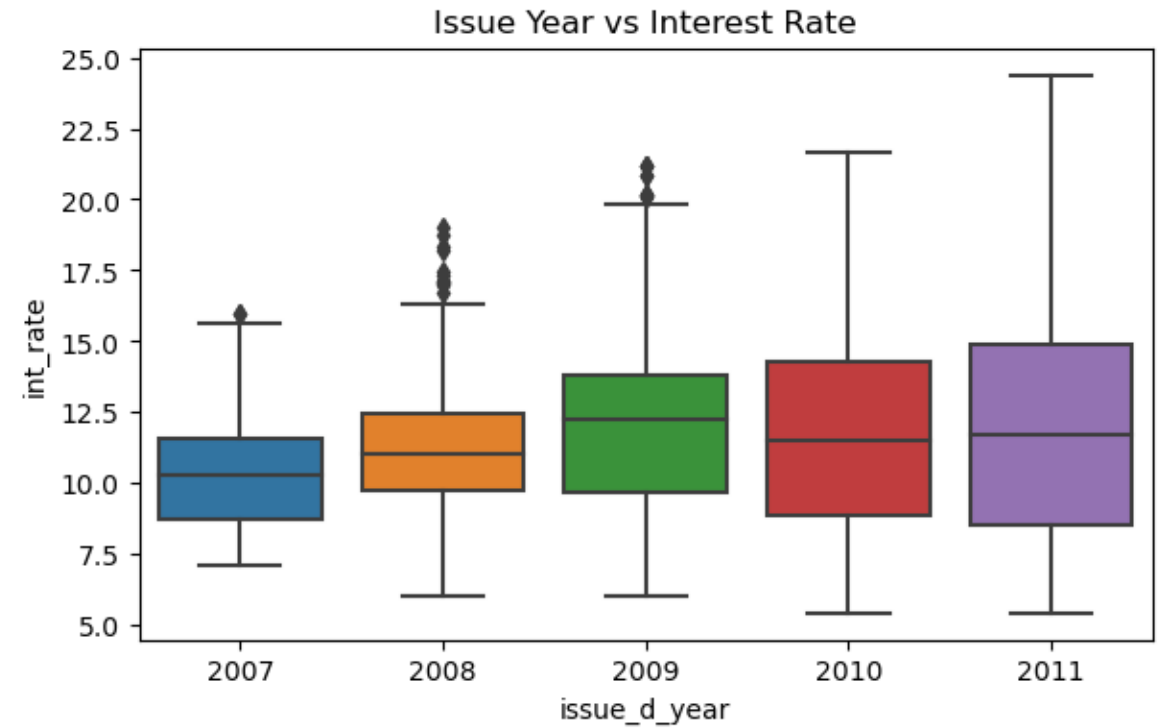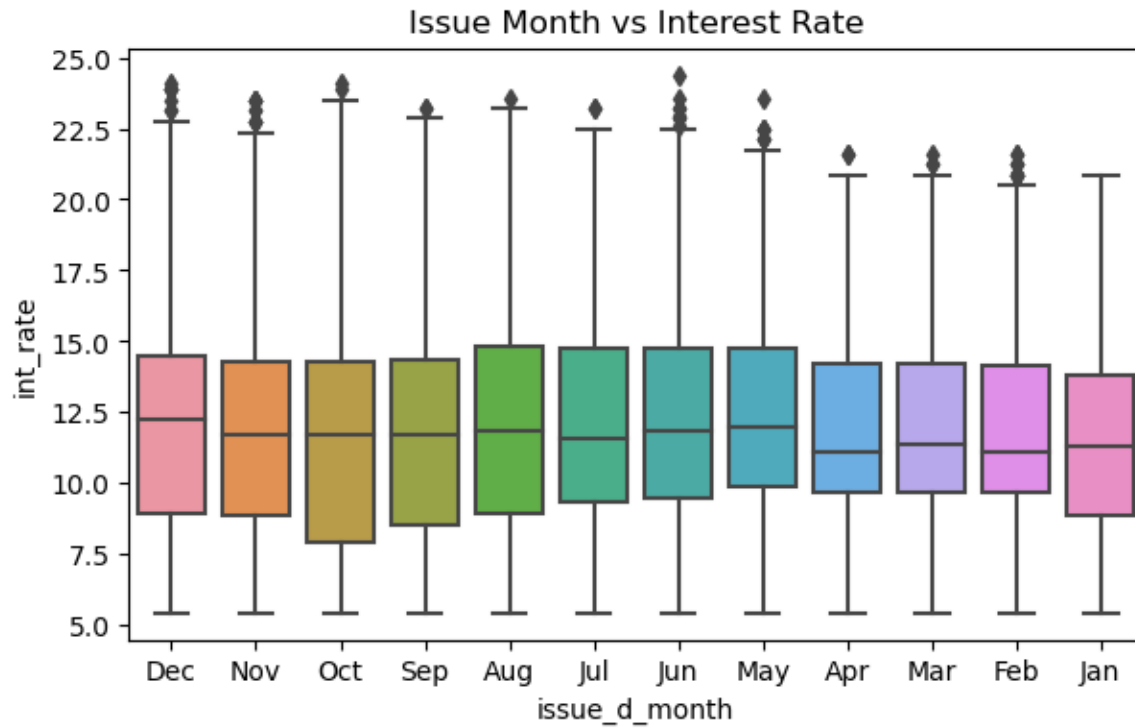
PURPOSE VS INTEREST RATE

Observation:

• The borrowers who take loan for the purpose of small business, debt consolidation, house and educational are getting loan at high interest rate than others

Employee Length vs Interest Rate

EMPLOYEE LENGTH VS INTEREST RATE

Observation:

• There is not much difference in interest rate for various employee lengths

ISSUE MONTH VS INTEREST RATE & ISSUE YEAR VS INTEREST RATE

Observation:

• **Issue Month Vs Interest Rate:** The rate of interest for the months from Jan to April are less as compared to other months, April being the least

• **Issue Year Vs Interest Rate:** The rate of interest is diversified across all years, but the median almost remains the same
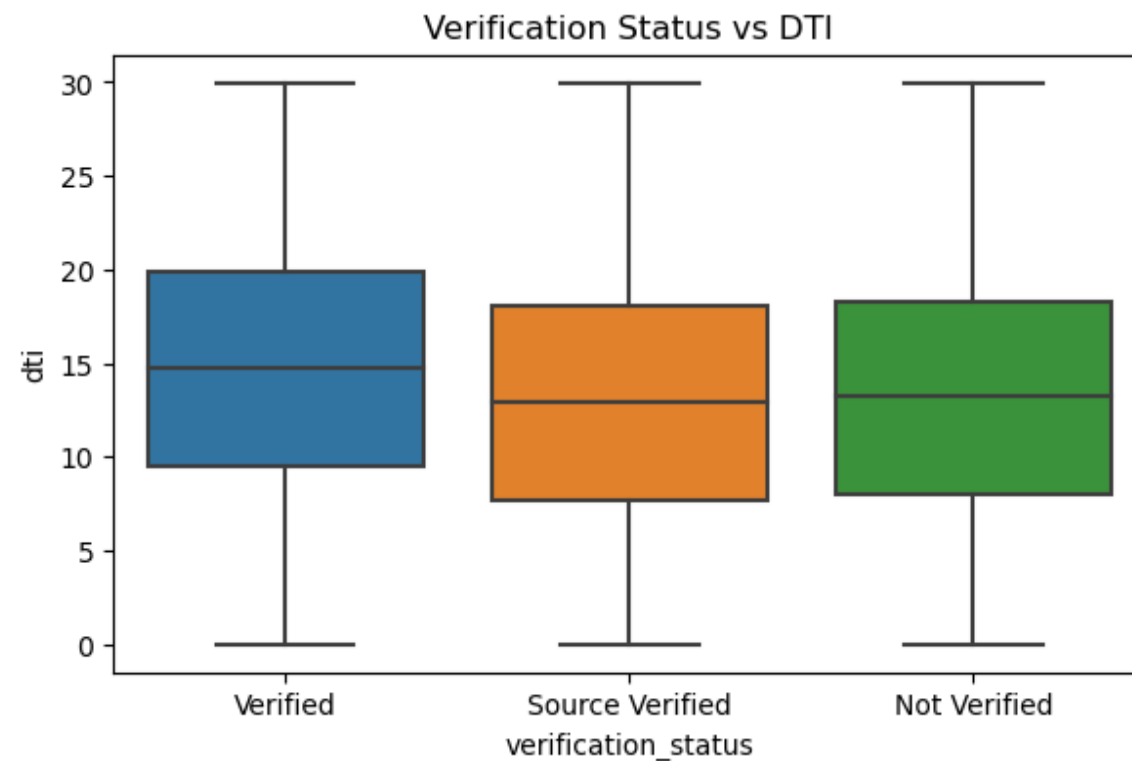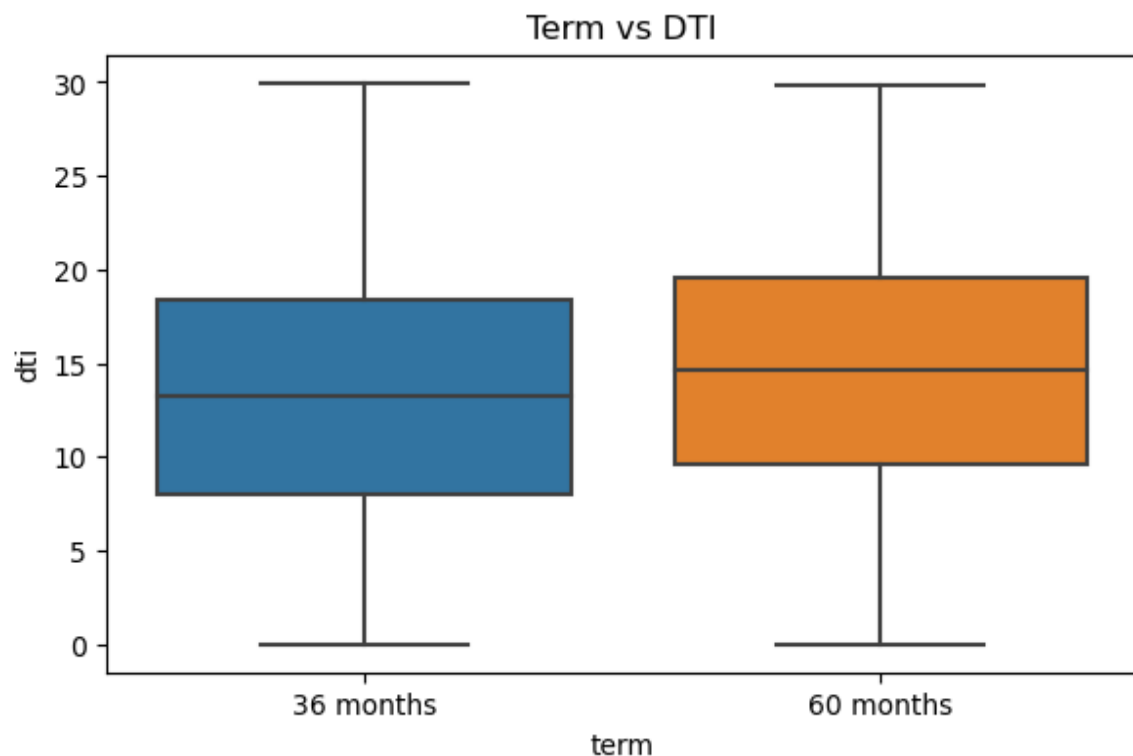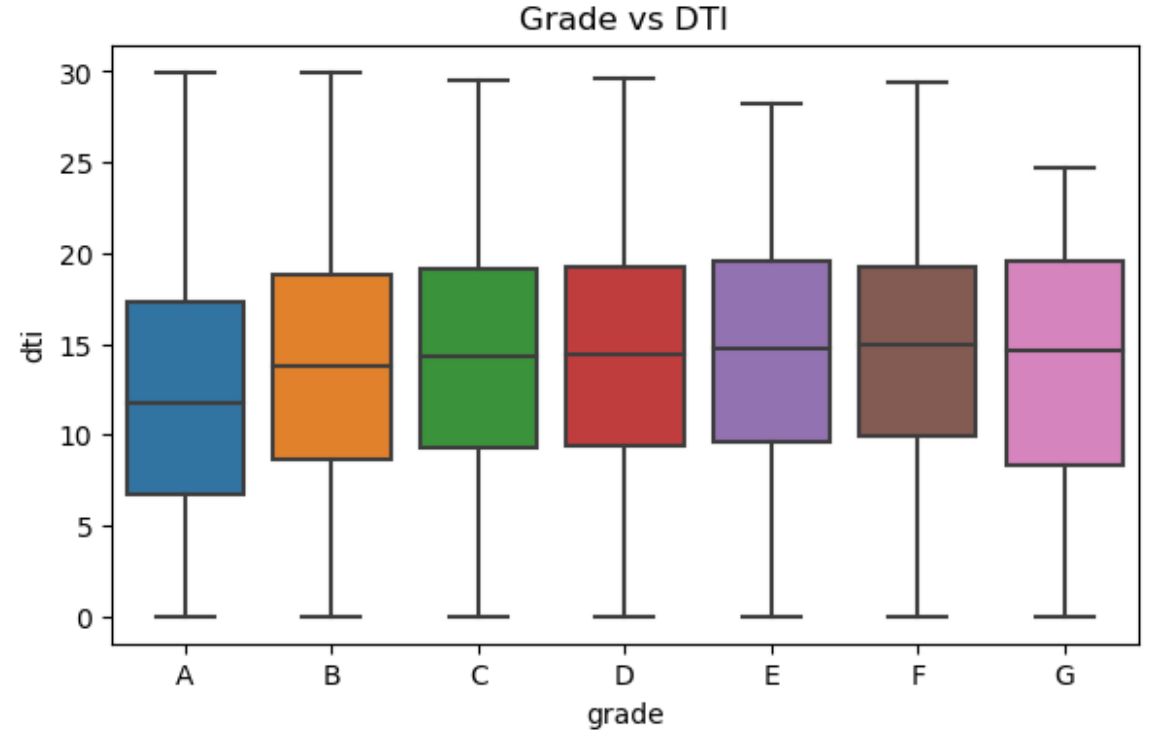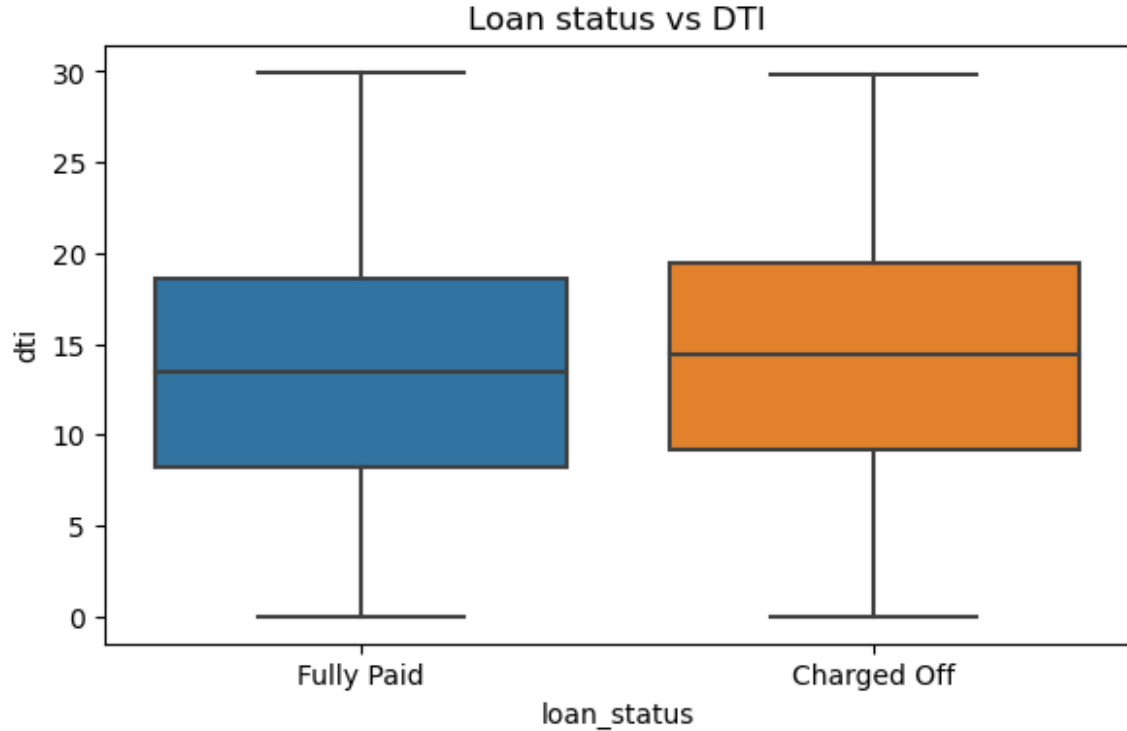
TERM VS DTI & VERIFICATION STATUS VS DTI

Observation:

• **Term Vs DTI:** DTI ratio is high for the borrowers who has 60 months term

• **Verification Status vs DTI:** Verified borrowers are having high DTI ratio

LOAN STATUS VS DTI & GRADE VS DTI

Observation:

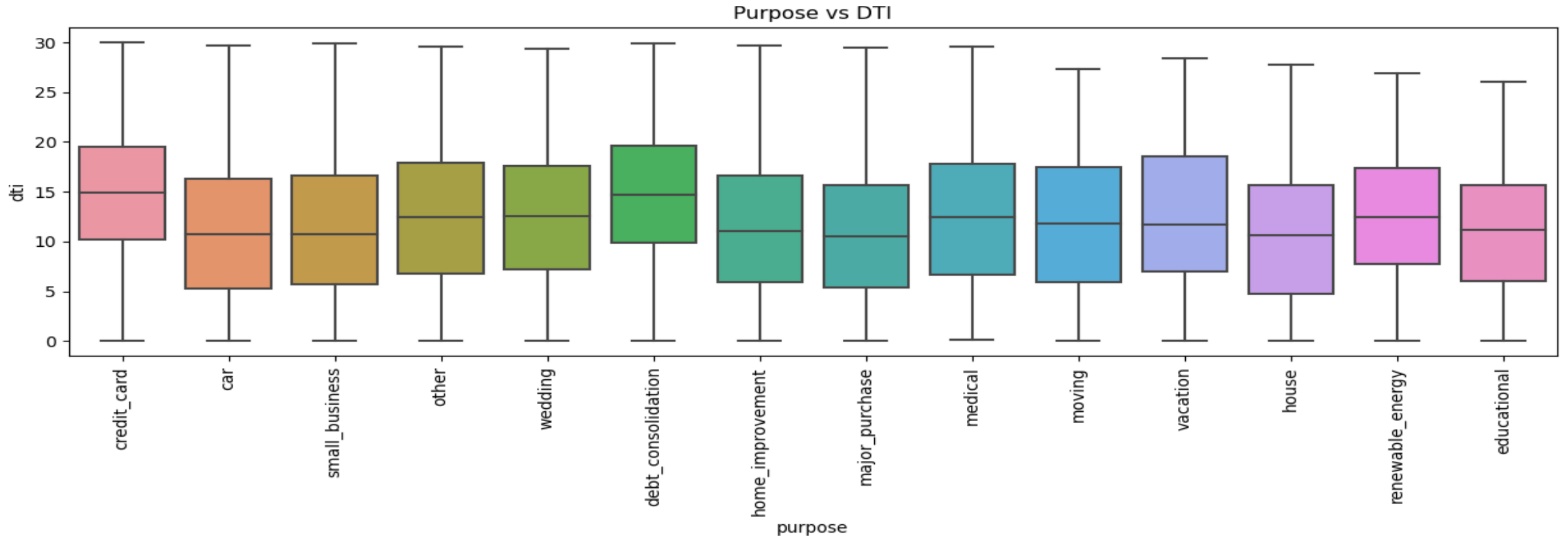- Most of the charged off borrowers are having high DTI ratio.

- As grade decreases DTI ratio increases
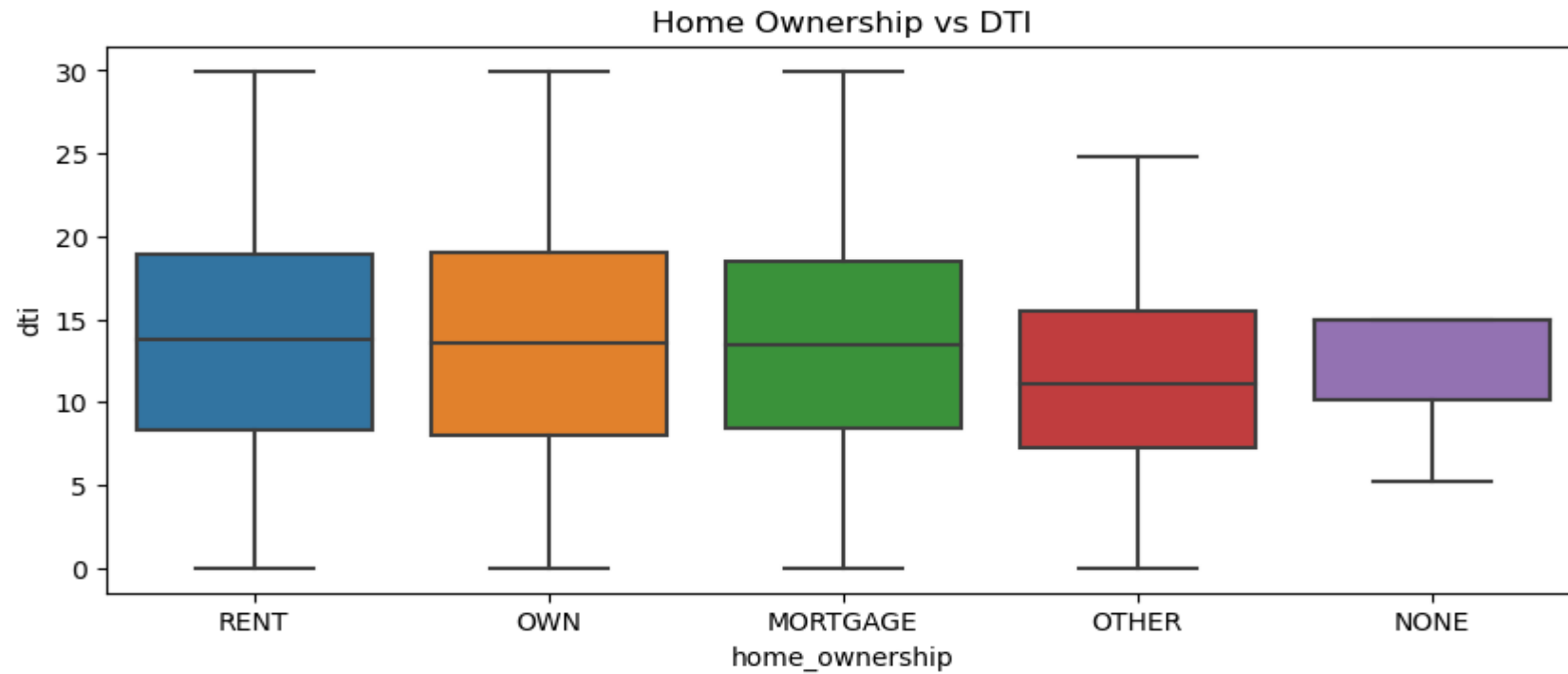
HOME OWNERSHIP VS DTI

Observation:
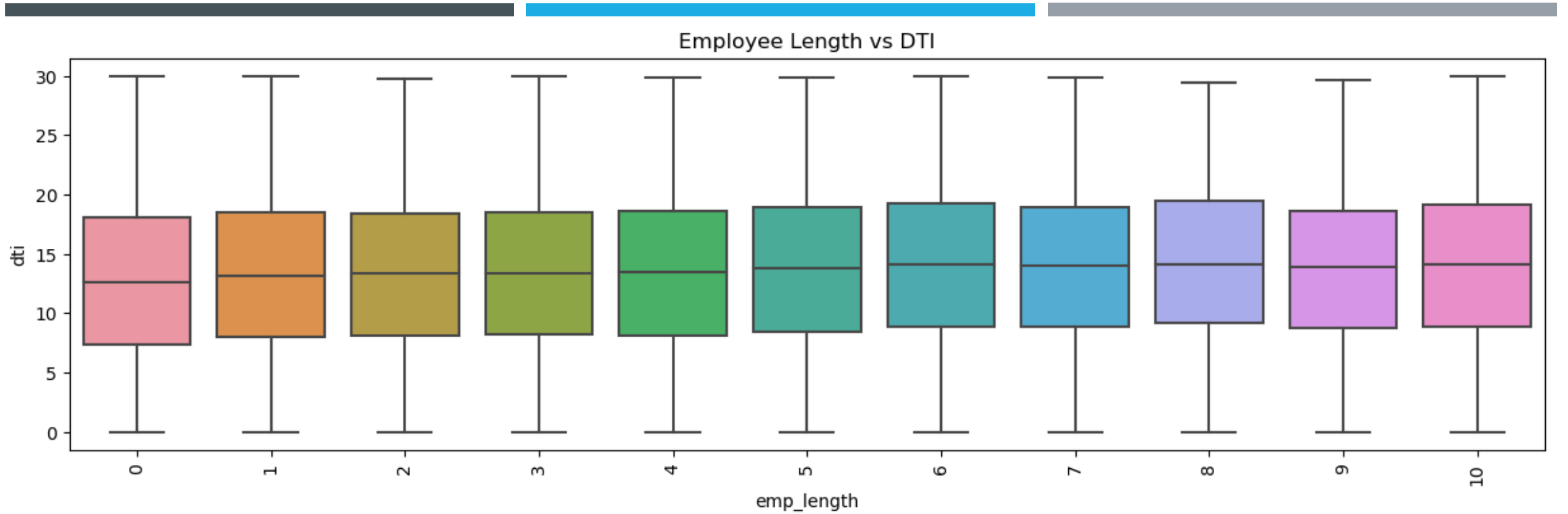
- The borrowers with own home and rented home are having high DTI ratio than others

Purpose vs DTI

PURPOSE VS DTI

Observation:

- The borrowers who take loan for the purpose of debt consolidation and credit card are having high DTI ratio than others

Employee Length vs DTI

EMPLOYEE LENGTH VS DTI

Observation:

- There is no relation between employee length and DTI ratio

Annual Income vs Chargedoff Proportion
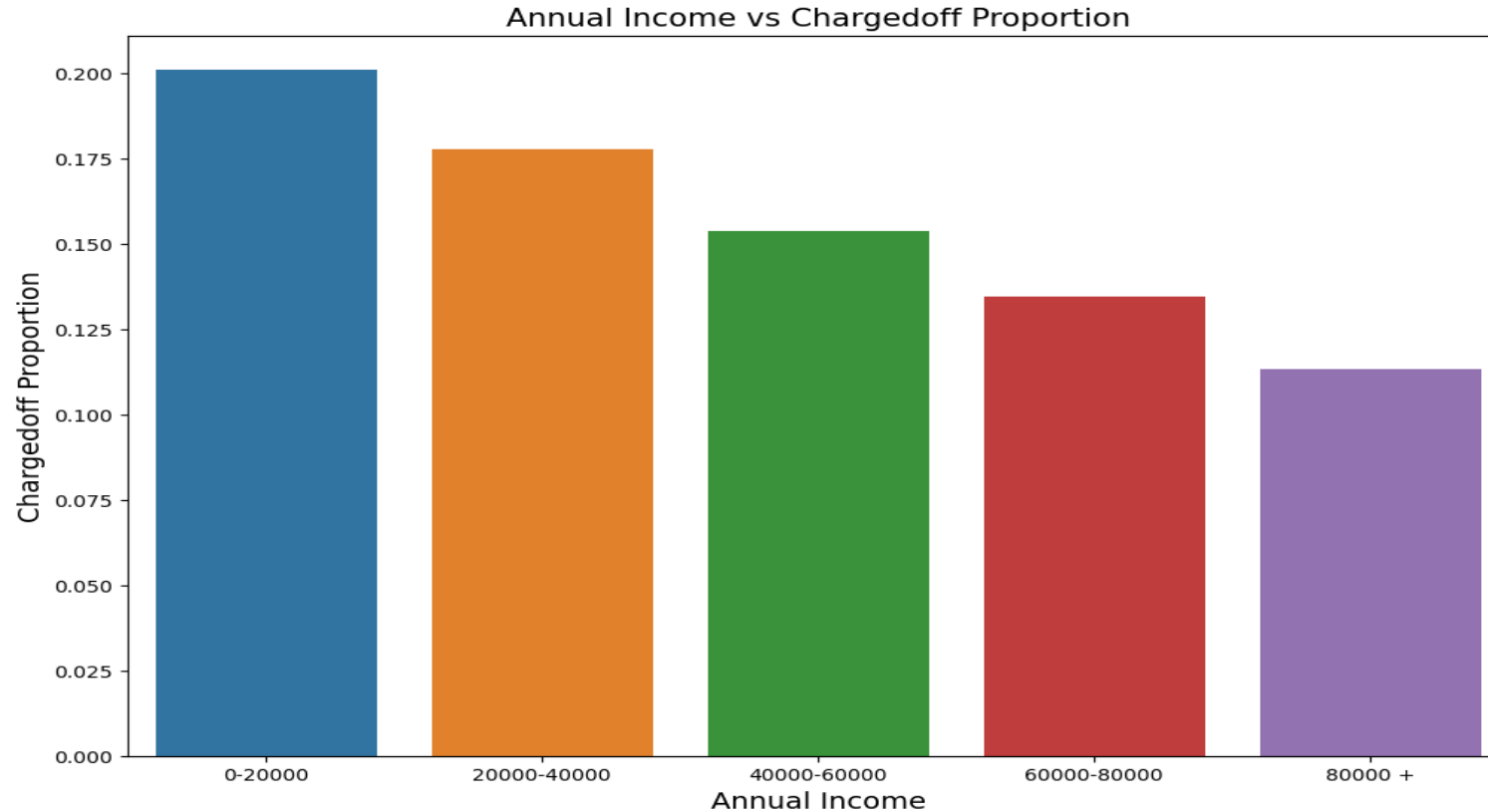
ANNUAL INCOME VS CHARGED OFF PROPORTION

Observation:

• As annual income is increases charged off proportion is decreases

• Highest charged off are for borrowers whose annual income is in the range 0 to 20K
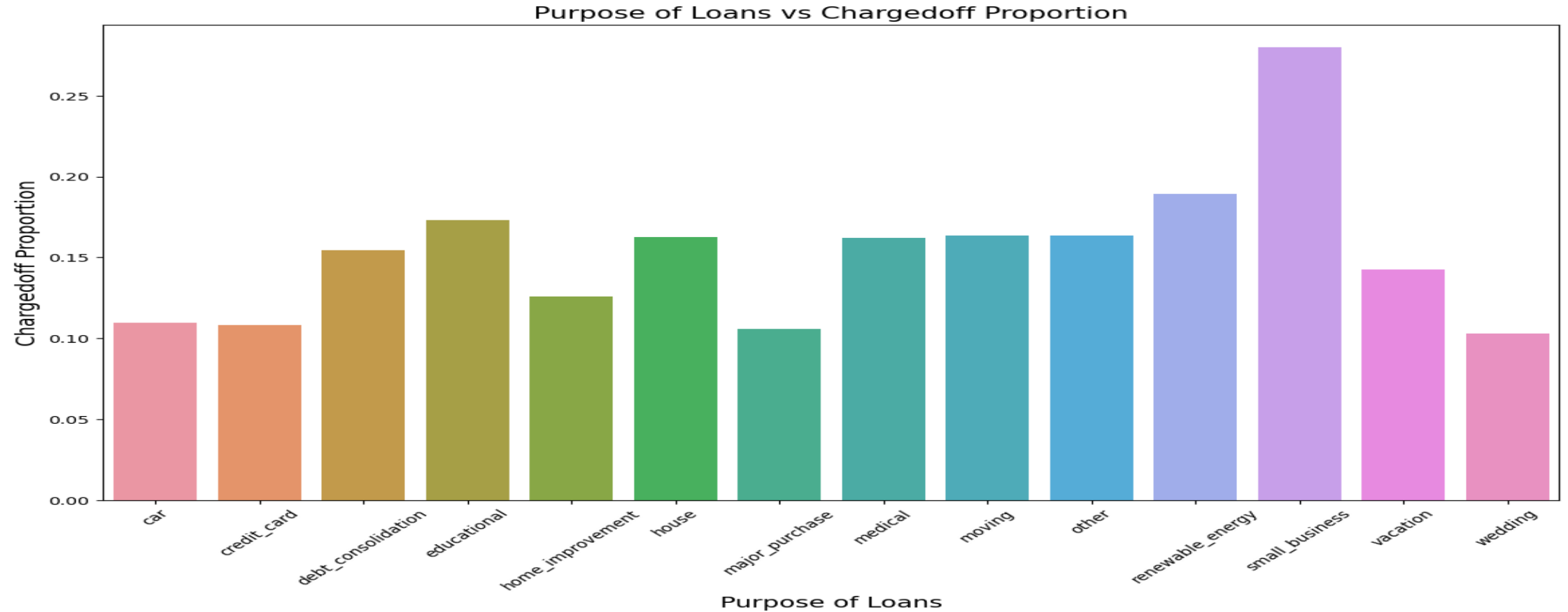
Purpose of Loans vs Chargedoff Proportion

PURPOSE OF LOANS VS CHARGED OFF PROPORTION

Observation:

• The borrowers who take loan for the purpose of small-business has the maximum charged off proportion

Grades vs Chargedoff Proportion
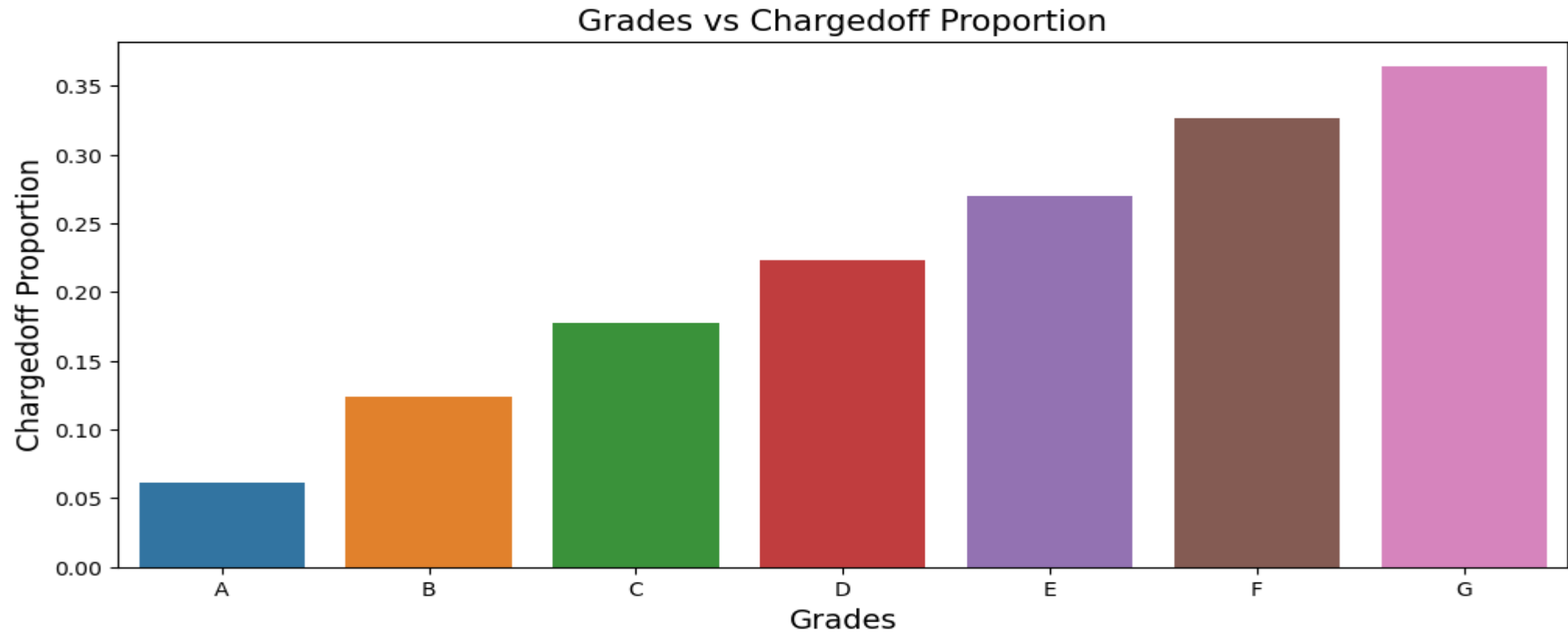
GRADES VS CHARGED OFF PROPORTION

Observation:

- As grades are decreasing charged off proportion is increasing

Sub Grades vs Chargedoff Proportion

SUB GRADES VS CHARGED OFF PROPORTION
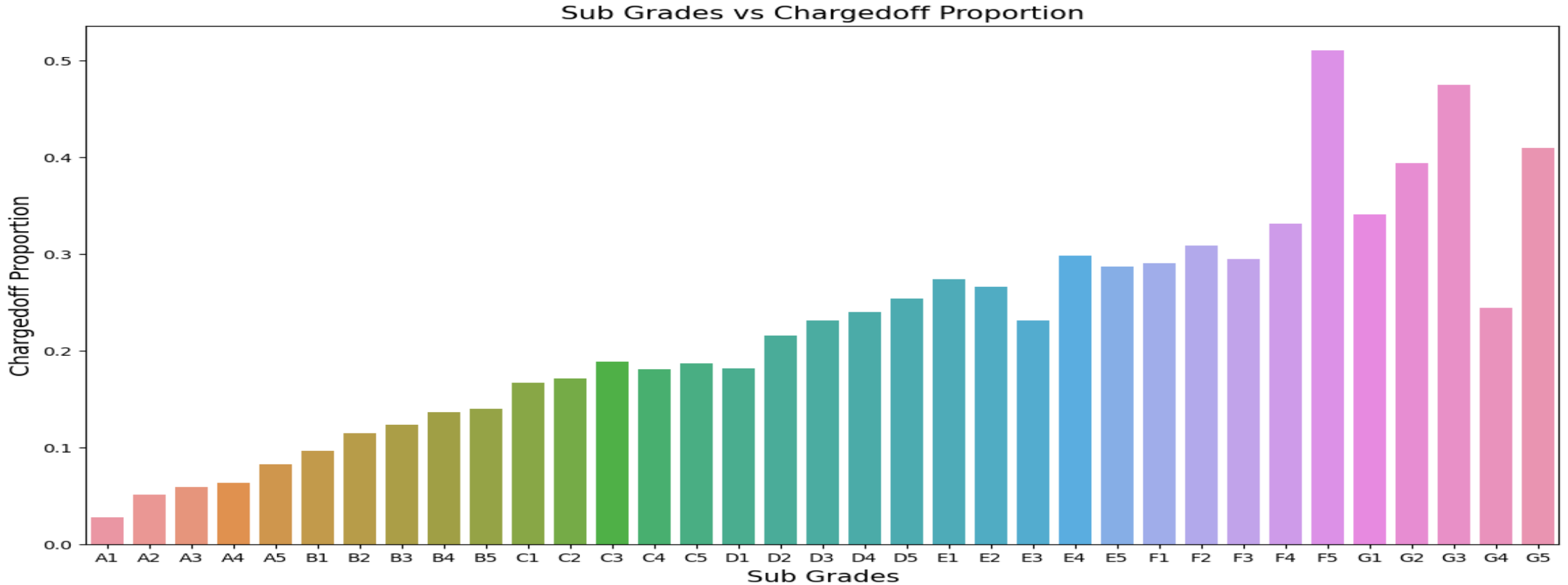
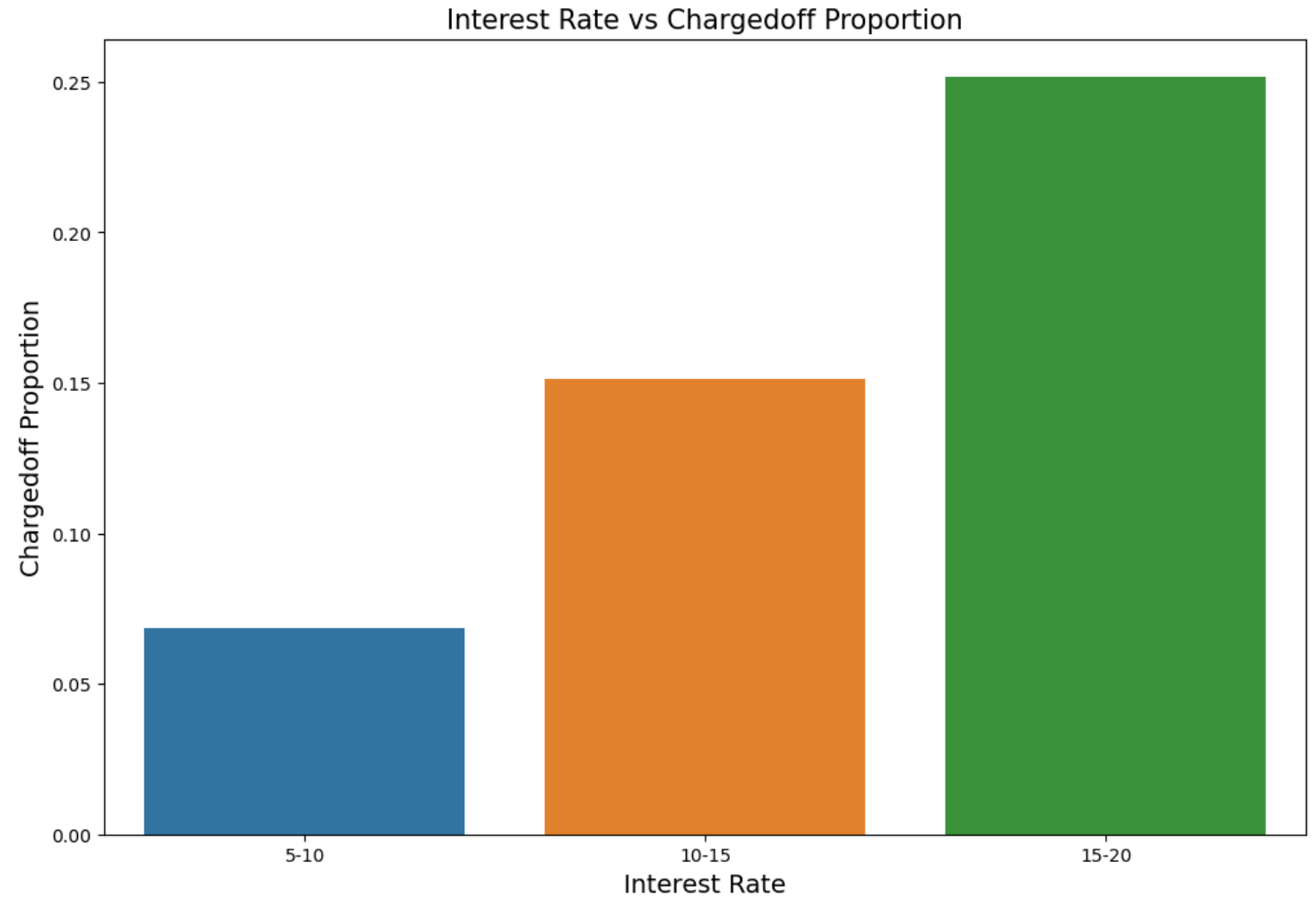**Observation:**

- Subgrade F5, G3 and G5 are having maximum charged off proportion

INTEREST RATE VS CHARGED OFF PROPORTION

Observation:

- As interest rate are increasing, charged off proportion is also increasing

- The borrowers who are given loan at the interest rate in the range of 15 to 20 percent are defaulting

Interest Rate vs Chargedoff Proportion
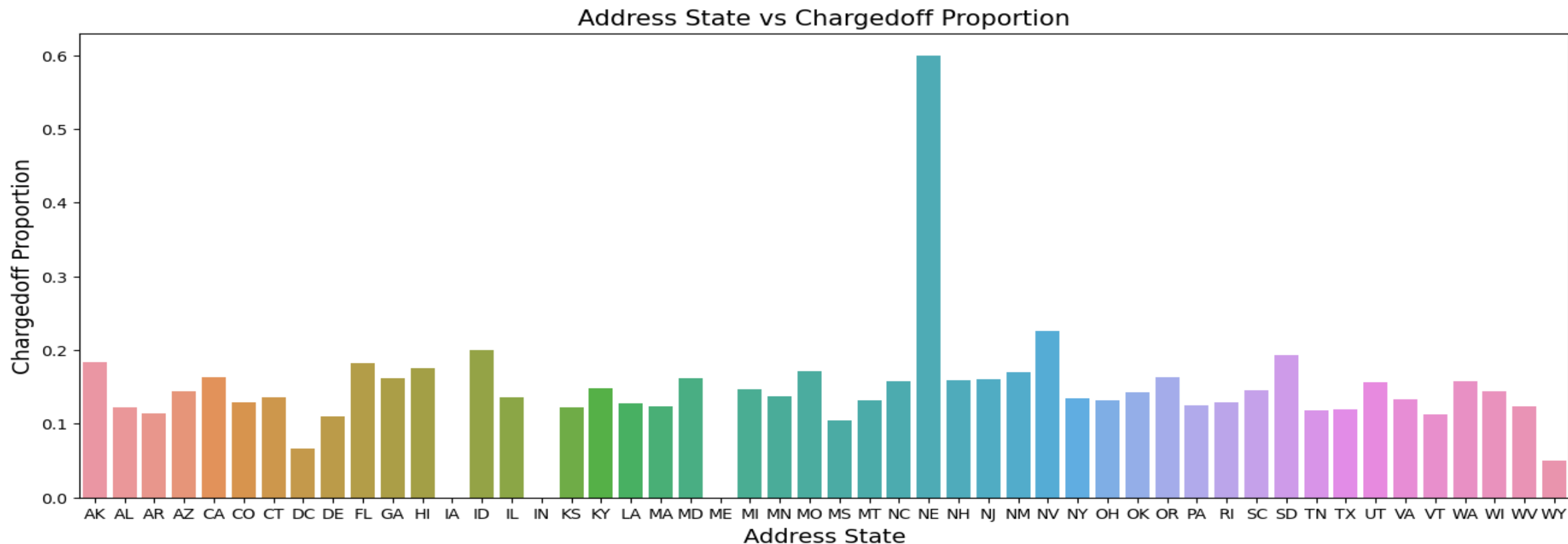
Employment Length vs Chargedoff Proportion

EMPLOYMENT LENGTH VS CHARGED OFF PROPORTION

Observation:

- The borrowers whose employee length is 1 year or less and 10 or 10+ years are mostly defaulting

Address State vs Chargedoff Proportion

ADDRESS STATE VS CHARGED OFF PROPORTION

Observation:

- The borrowers who are from NE are defaulting the most

Verification Status vs Chargedoff Proportion
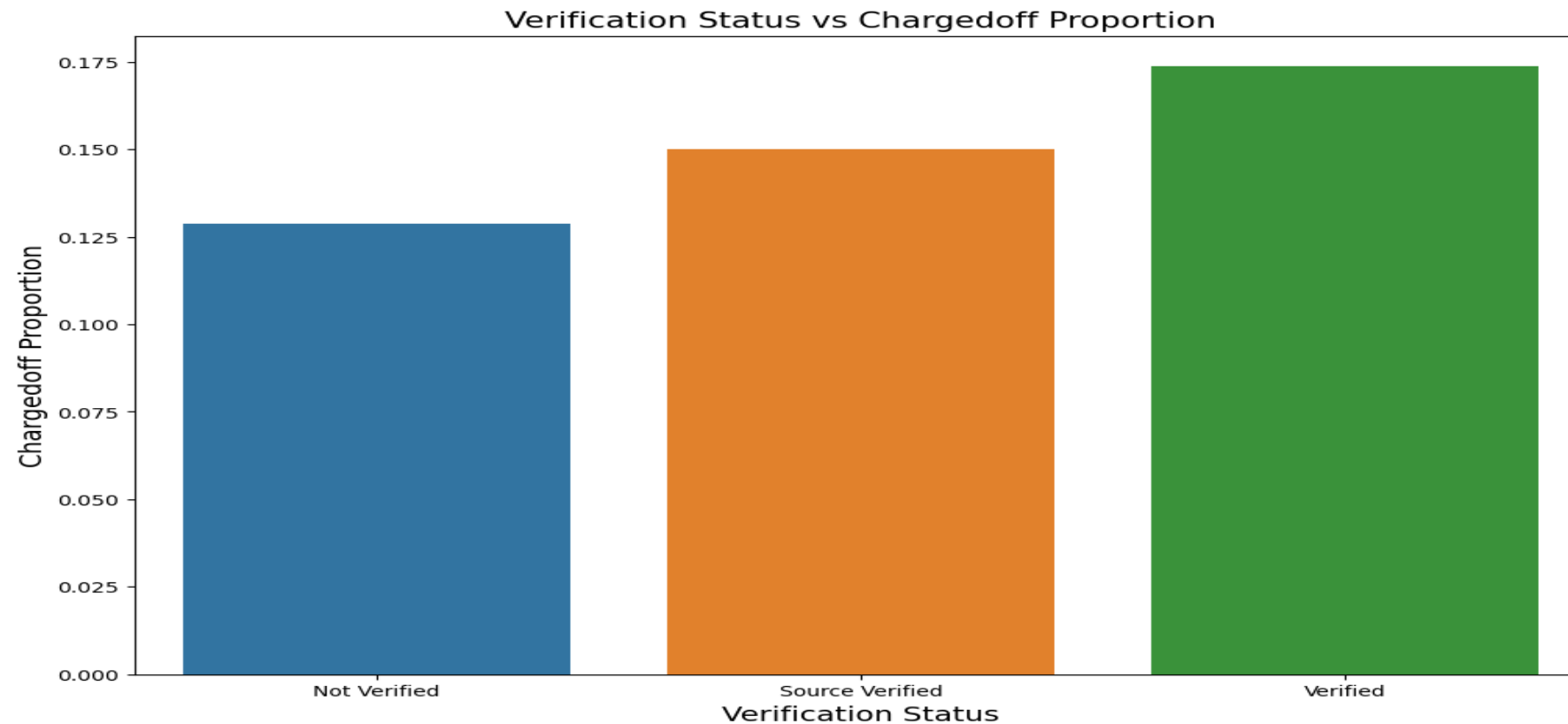
VERIFICATION STATUS VS CHARGED OFF PROPORTION

**Observation:**

- Most of the verified borrowers are defaulting

MULTIVARIATE ANALYSIS

Observation:

- loan_amnt , funded_amnt , funded_amnt_inv , installment are strongly correlated.

- annual_inc and dti is negatively correlated.

- Debt income ratio is the percentage of a borrower's monthly gross income that goes toward paying debts.

- Which means when annual_inc is low, debt is high and vice versa.
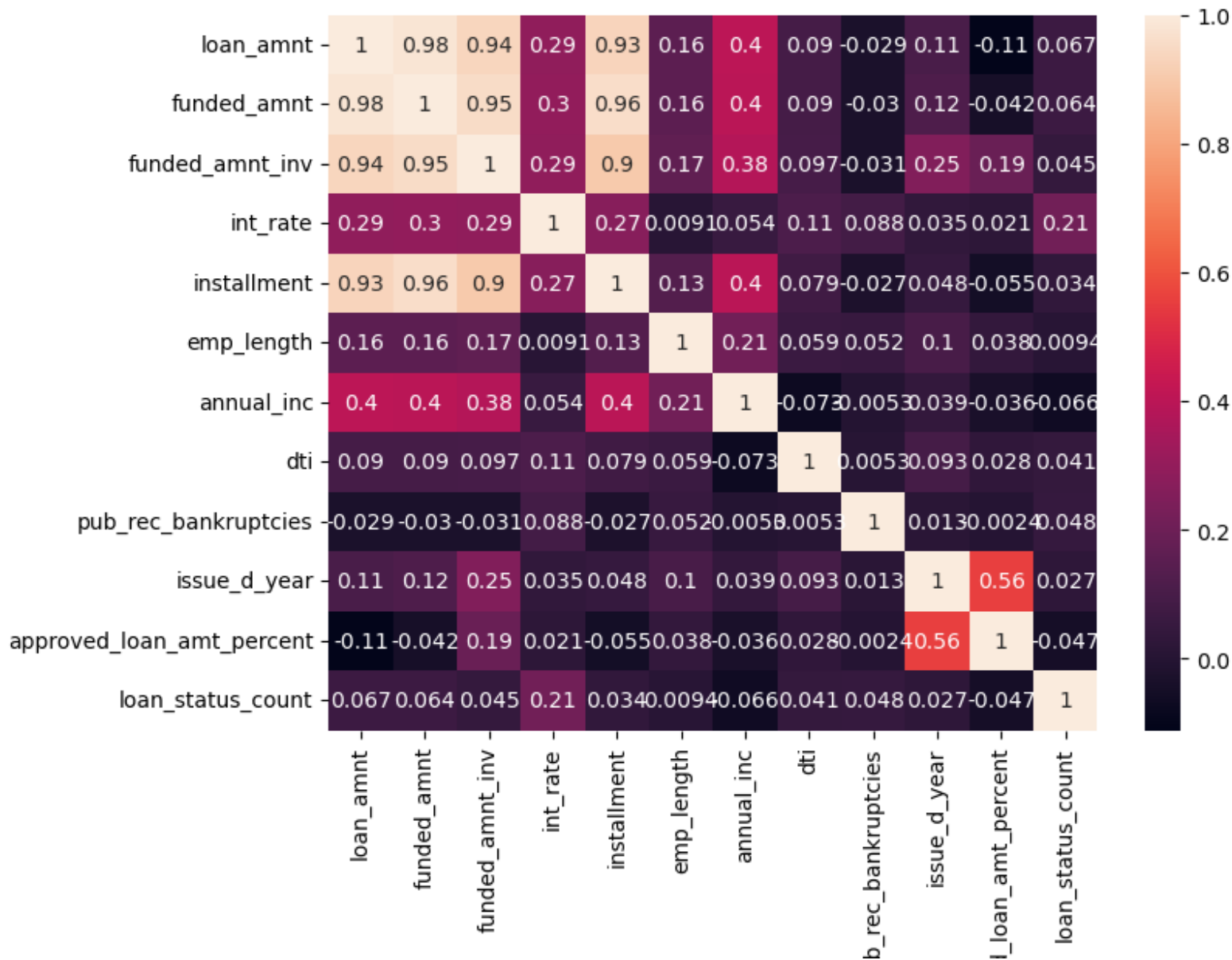
RECOMMENDATIONS

There is more probability of defaulting when

- Borrowers are taking loan for the term 60 months

- Borrowers who take loan amount in the range 0 to 14000

- Borrowers whose annual income is low i.e. (0-20000)

- Borrowers who are having home ownership as 'Rent' and take loan for the purpose of debt consolidation

- Borrowers who take loan for the purpose of small business

- Borrowers who are categorized in lower Grades i.e. F & G

- Borrowers who are further sub-categorized in subgrades F5, G3 & G5

- Borrowers who are given loan at interest rate in the range 15%-20%

- Borrowers whose employee length is 1 or less and 10 or 10+ years

- Borrowers who are from the state of NE

- Borrowers who are verified (verification process should be made better)