

# PDS PROJECT BUSINESS REPORT

TITLE:

**Analysis of Customer Demand at Austo Motor Company.**

Subtitle:

**Improving Marketing Campaign Efficiency**

Problem Statement:

Austo Motor Company, a prominent car manufacturer specializing in SUVs, Sedans, and Hatchbacks, has raised concerns about the efficiency of their marketing campaigns. The company aims to understand customer demand better to enhance their marketing strategies and overall customer experience.

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## 1.Introduction:

Austo Motor Company is a leading car manufacturer specializing in SUV, Sedan, and Hatchback models , The concern raised on the efficiency of marketing campaign being used .This report aims to address these concerns by analysing the data and finding answers to questions about customer demand and purchasing behaviour that will help the company to improve the business .

## 2.Methodology:

In order to address the answers to the questions , we have adopted a systematic approach to explore and interpret the data effectively . here are the steps involved:

### 2.1 Overall Approach

- Perform an initial data overview to understand its structure, types, missing values, and basic statistics.
- Clean and preprocess the data to ensure quality and consistency.
- Explore the data to identify patterns, trends, and insights related to the problem statement.
- Apply statistical analyses and visualization techniques to extract meaningful information.
- Summarize the key findings and provide actionable recommendations for the company.

### 2.2 Tools and libraries used:

We have used various python libraries to perform the data analysis:

- Python: The primary programming language used for data analysis.
- Pandas: For data manipulation and analysis.
- Numpy: For numerical operations.
- Matplotlib & Seaborn: For data visualization.
- Google colab: For an interactive environment to perform and document the analysis.

## 3.Data Overview

### 3.1 importing the libraries :

- To conduct the data analysis, we utilized several key Python libraries, including pandas, numpy, matplotlib, and seaborn. These libraries were chosen for their powerful capabilities in data manipulation, numerical computation, and visualization.

### 3.2 Data loading :

- The dataset was imported into google colab for analysis
- The data file was loaded using pandas functions, which allowed us to efficiently handle and manipulate the dataset

### 3.3 check the structure of data

- Used the function like head() and tail() in order to understand the data with the first five rows here's it

	Age	Gender	Profession	Marital_status	Education	No_of_Dependents	Personal_loan	House_loan	Partner_working	Salary	Partner_salary	Total_salary	Price	Make
0	53	Male	Business	Married	Post Graduate	4	No	No	Yes	99300	70700.0	170000	61000	SUV
1	53	Femal	Salaried	Married	Post Graduate	4	Yes	No	Yes	95500	70300.0	165800	61000	SUV
2	53	Female	Salaried	Married	Post Graduate	3	No	No	Yes	97300	60700.0	158000	57000	SUV
3	53	Female	Salaried	Married	Graduate	2	Yes	No	Yes	72500	70300.0	142800	61000	SUV
4	53	Male	Salaried	Married	Post Graduate	3	No	No	Yes	79700	60200.0	139900	57000	SUV

- Here is the data description(columns) :

- 1 Age: The age of the individual in years.
- 2 Gender: The gender of the individual, categorized as male or female.
- 3 Profession: The occupation or profession of the individual.
- 4 Marital status: The marital status of the individual, such as married &, single
- 5 Education: The educational qualification of the individual Graduate and Post Graduate
- 6 No of Dependents: The number of dependents (e.g., children, elderly parents) that the individual supports financially.
- 7 Personal loan: A binary variable indicating whether the individual has taken a personal loan "Yes" or "No"
- 8 House loan: A binary variable indicating whether the individual has taken a housing loan "Yes" or "No"
- 9 Partner working: A binary variable indicating whether the individual's partner is employed "Yes" or "No"
- 10 Salary: The individual's salary or income.
- 11 Partner salary: The salary or income of the individual's partner, if applicable.
- 12 Total salary: The total combined salary of the individual and their partner (if applicable).
- 13 Price: The price of a product or service.
- 14 Make: The type of automobile

**There are 1581 rows and 14 columns in the dataset**

### 3.4 Checking the datatype for the dataset:

To understand the nature of our dataset, we examined the data types of each column using the dtypes attribute in pandas. This step is crucial for identifying whether the data types are appropriate for analysis and for detecting any necessary data type conversions , Heres the summary of datatypes in the dataset.

- Categorical data = Gender, Profession, Marital\_status, Education, Personal\_loan, House\_loan, Partner\_working, Make
- Numerical data = Age, No\_of\_Dependents, Salary, Partner\_salary, Total\_salary, Price
- 8 columns are object(categorical) and 6 are numerical columns
- When proceeding with the analysis, these data types guide how we treat each column. For instance:
- Numerical columns may undergo statistical analysis and visualization through histograms or scatter plots.
- Categorical columns might be analysed using bar charts, and in some cases, converted to numerical format using encoding techniques for machine learning models.

### 3.5 Checking for the missing values and treating the missing values :

We checked missing values using `isnull().sum()`

- All the columns have 1581 observations except the gender and partners salary columns
- The **gender** column has 53 missing values
- Here I have treated the missing value of gender column with the mode because mode imputation assumes the most frequent category and is best guess for missing values
- For Gender 'Male' appears more frequently than female, it suggests that missing values are most likely to belong to more frequent category
- Steps used: calculate the mode of gender column and then replace the missing values in Gender column with this mode
- The **partners salary** has 106 missing values
- First we have checked the distribution of the column partners salary and we have done that by using boxplot we have also checked the skewness of the column which is 0.338 which is a positively skewed
- Considering the skewness we have replaced the missing values with the median that represents the middle value of dataset when it is ordered from smallest to largest
- Using median helps maintain the overall distribution of data without affected by extreme values
- It provides a more accurate representation of central tendency of data , especially for outliers and skewed distribution
- Steps used: calculate the median of partners salary column and replace the missing values in partners salary column with this calculated median i.e 25600
- This maintains the datasets central tendency and distribution properties.

### 3.6 Checking the statistics of data:

We get the statistical summary of the data by using the `describe()` , this provides a very insightful statistical summary it tells the average, count, maximum, minimum, 25<sup>th</sup> percentage , 50<sup>th</sup> percentage and 75<sup>th</sup> percentage of the data which makes it easy to draw the conclusions

	count	mean	std	min	25%	50%	75%	max
<b>Age</b>	1581.0	31.922201	8.425978	22.0	25.0	29.0	38.0	54.0
<b>No_of_Dependents</b>	1581.0	2.457938	0.943483	0.0	2.0	2.0	3.0	4.0
<b>Salary</b>	1581.0	60392.220114	14674.825044	30000.0	51900.0	59500.0	71800.0	99300.0
<b>Partner_salary</b>	1475.0	20225.559322	19573.149277	0.0	0.0	25600.0	38300.0	80500.0
<b>Total_salary</b>	1581.0	79625.996205	25545.857768	30000.0	60500.0	78000.0	95900.0	171000.0
<b>Price</b>	1581.0	35597.722960	13633.636545	18000.0	25000.0	31000.0	47000.0	70000.0

Statistical summary of dataset

## 4.Exploratory data analysis :

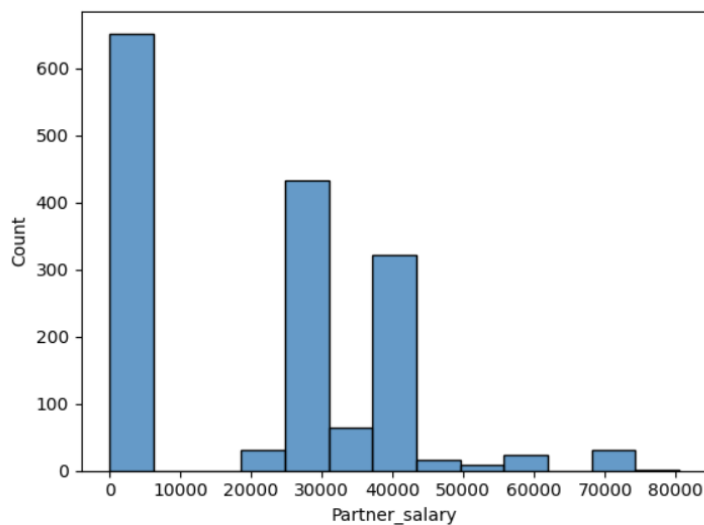
We perform Analysis by using Univariate, Bivariate and multivariate analysis

### 4.1univariate analysis:

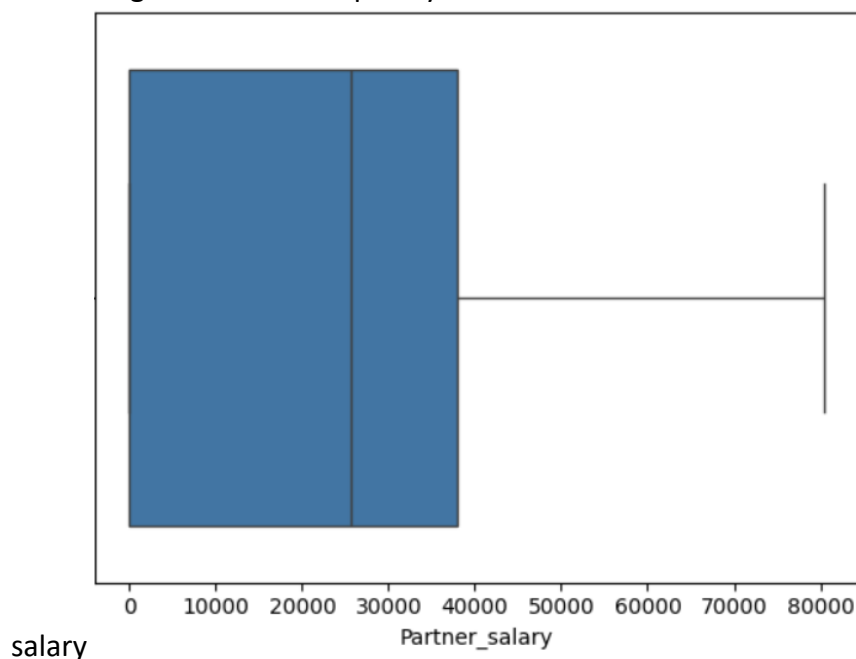
analysing each variable individually , both categorical and numerical variable and checking for the outliers.

- **numerical columns :**

1. **observing Partners salary column:** first we have plotted the histogram and boxplot to analyse if any outliers in the data



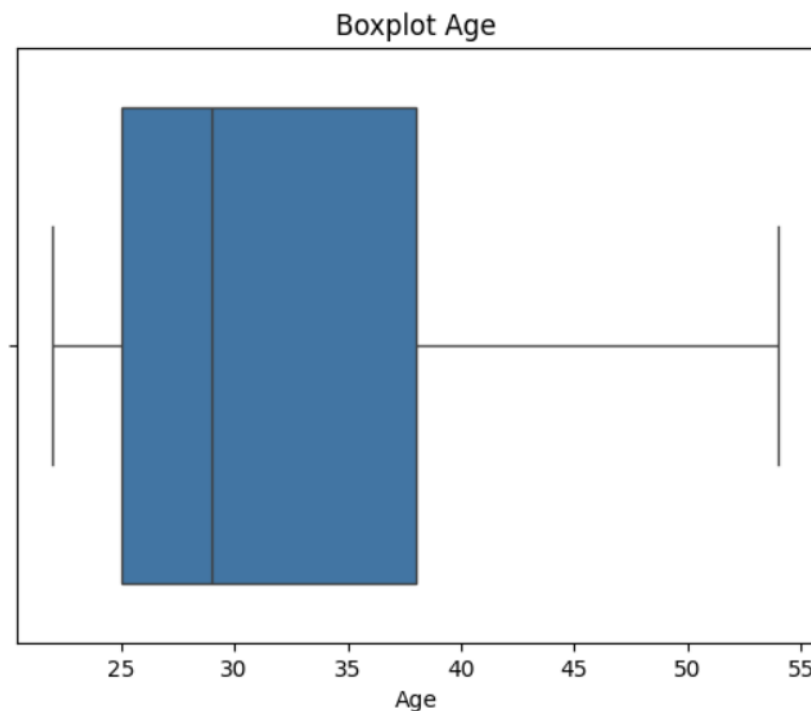
- The range of partners salary is from 0 to 80000k
- There are many people who have count from 0 to 10000
- It is slightly positively skewed
- The histogram does not explicitly show outlier but indicates bin with many people have a good salary
- The histogram does not explicitly show outlier but indicates bin with many people have a good



- The median of the partner salary is approx. 25600 representing the central salary around which the rest data is distributed.
- The interquartile range is 38000 indicating that the middle 50% of partners salaries lie in this range.

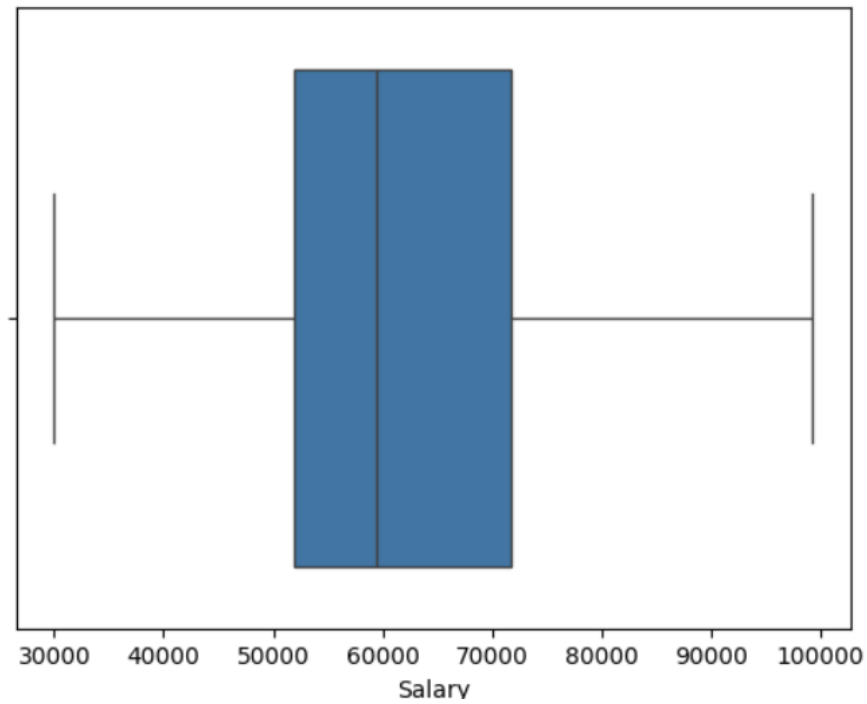
## 2.Observing the age:

We have plot the boxplot for the age



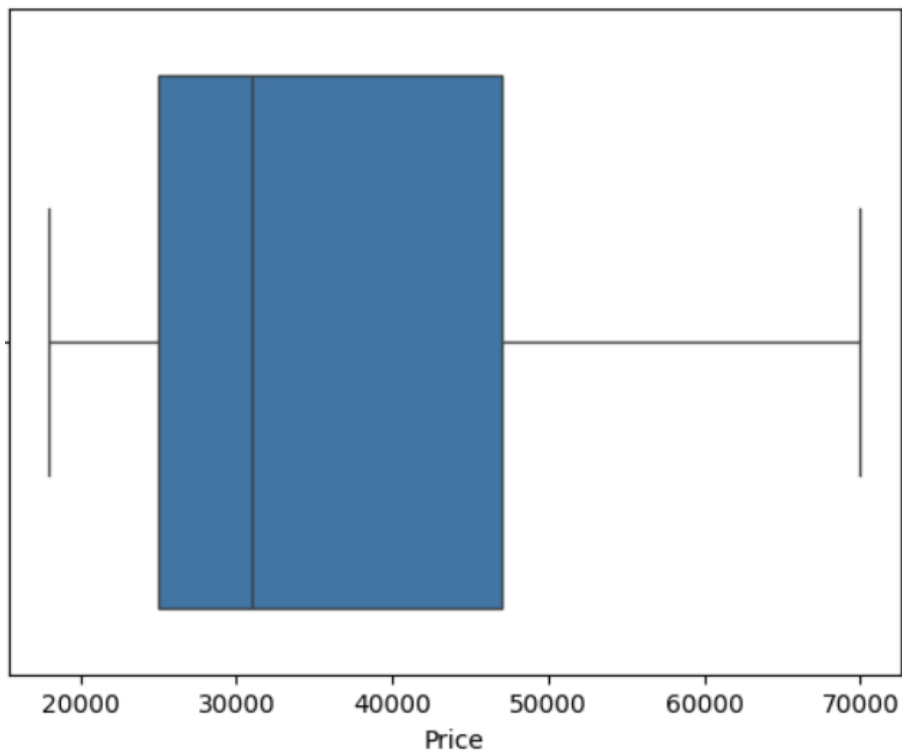
- The minimum age in the dataset is 22 years, and the maximum age is 55 years
- The median age is approximately 30 years, indicating that half of the individuals are younger than 30 and half are older.
- The age distribution is positively skewed, suggesting there are more younger individuals and fewer older individuals in the dataset. This can be confirmed by calculating the skewness coefficient or inspecting a histogram.
- After inspecting a box plot it appears there are no significant outliers in the age data.

### 3.Observation on salary:



- The minimum salary in the dataset is 30,000 ,The maximum salary in the dataset is 95,000.
- The average (mean) salary is 60,000.
- The salary distribution appears to be symmetric.

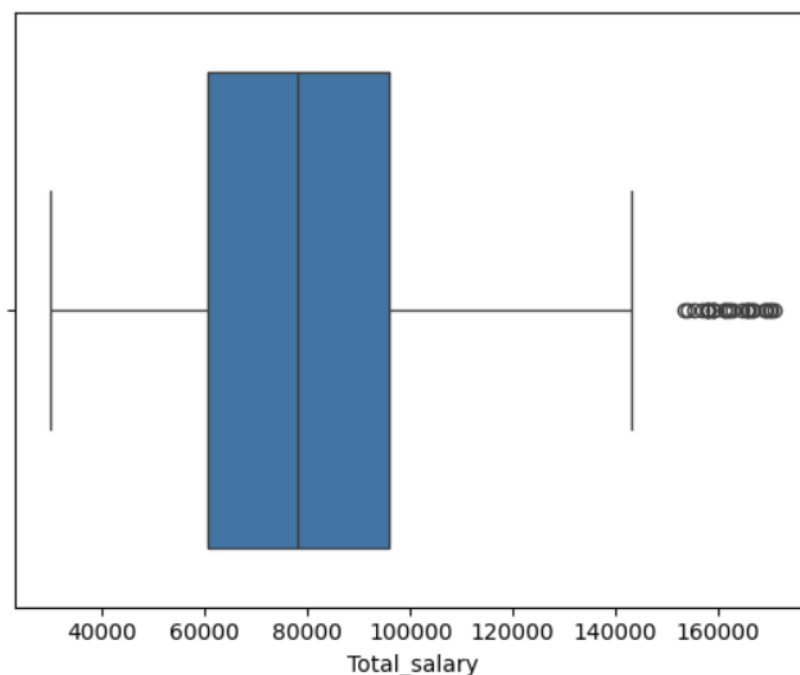
### 4.observation on price:



- The price of automobile ranges from 18000 to 70000
- The average (mean) price of automobile is 30k

- The median price of automobiles is 31000 indicating the central price point around which half the automobiles are priced below and half above.
- The distribution of automobile prices is right-skewed, meaning that there are more automobiles priced below the average, with fewer high-priced outliers stretching the tail to the right.
- The 25th percentile (Q1) of automobile prices is 25000, and the 75th percentile (Q3) is 47000, giving an Interquartile Range (IQR) of 31000. This indicates the central 50% of prices.
- The standard deviation of the prices is 13633.63 showing the average deviation from the mean price.
- The box plot confirms that there are no significant outliers in the price data. The right skewness is evident, with the majority of data points clustered toward the higher end of the price range.

### 5.Observation on total salary:



- The total salary ranges from 30000 to 171000.
- The average total salary is 79000.
- The median total salary is 78000 indicating the point where half of the individuals earn less and half earn more.
- The distribution of total salary is right-skewed, indicating that most individuals earn below the average, with a few earning markedly higher salaries.
- The 25th percentile (Q1) of total salary is 60500 and the 75th percentile (Q3) is 95900, resulting in an Interquartile Range (IQR) of 78000 This covers the middle 50% of salaries.
- The standard deviation of total salaries is 25545.87, which shows the average deviation from the mean salary.
- There are numerous outliers in the total salary data. These outliers are individuals earning significantly more than the majority.
- The bar plot visual confirms the right-skewness of the salary distribution, with a long tail on the higher end, and highlights the presence of outliers.



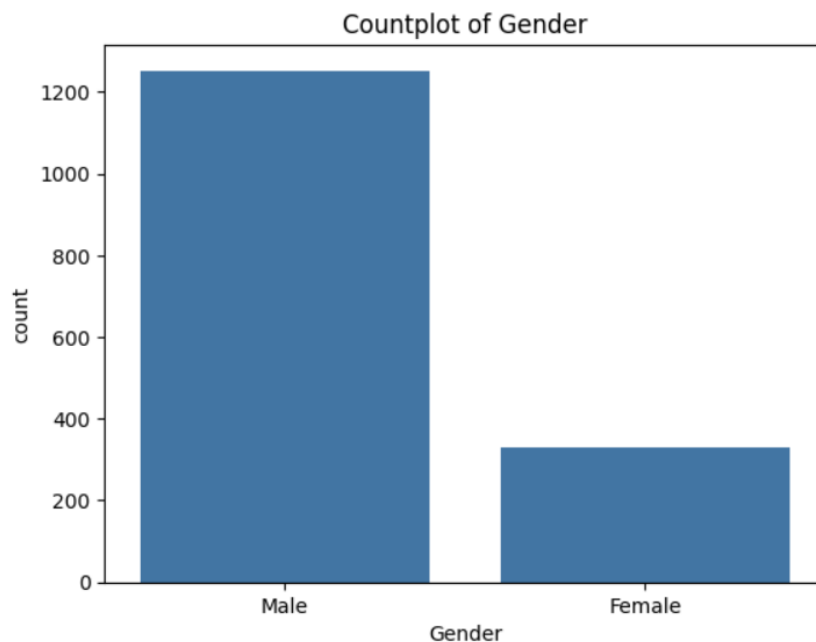
- **Categorical columns:**

To understand the distribution and relationships of categorical variables in the dataset, the following columns were analysed:

- Gender
- Profession
- Marital status
- Education
- Personal loan
- House loan

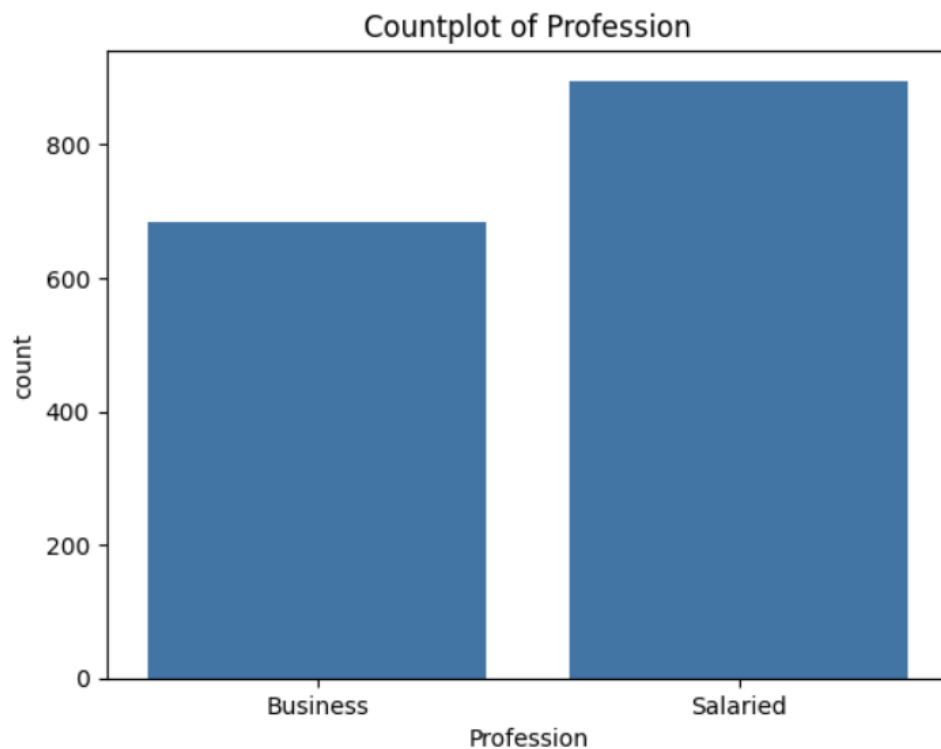
For each of these categorical variables, count plots were created to visualize their distributions. Below are the insights derived from this analysis:

## 1. Gender



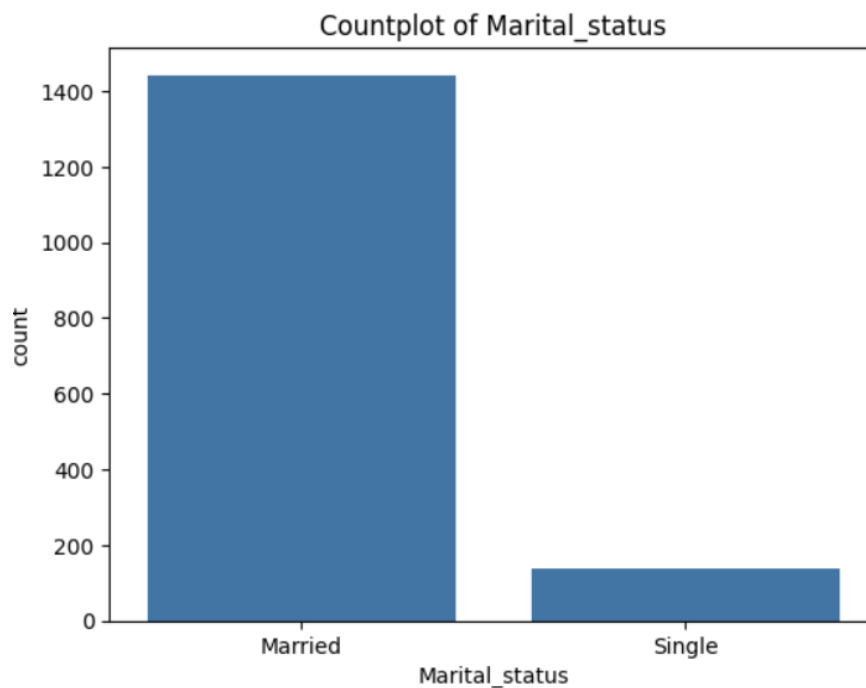
There is higher proportion of Male compared to female, this suggest a possible gender preference or demographic skew in customer base

## 2. Profession :



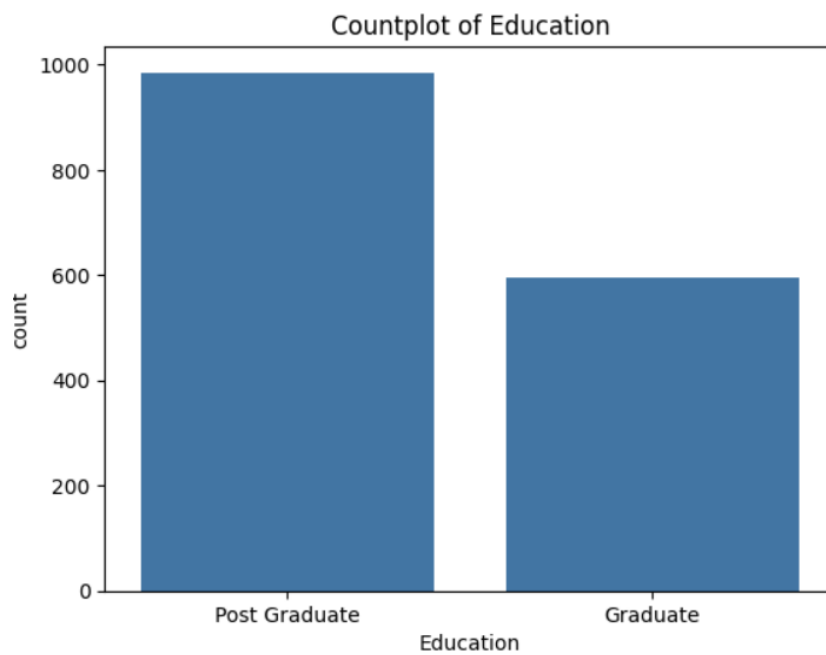
The most common profession is salaried i.e most people do jobs , indicating that majority of customer base works in these field, this insight could be valuable for targeting marketing strategies

### 3.Marital status :



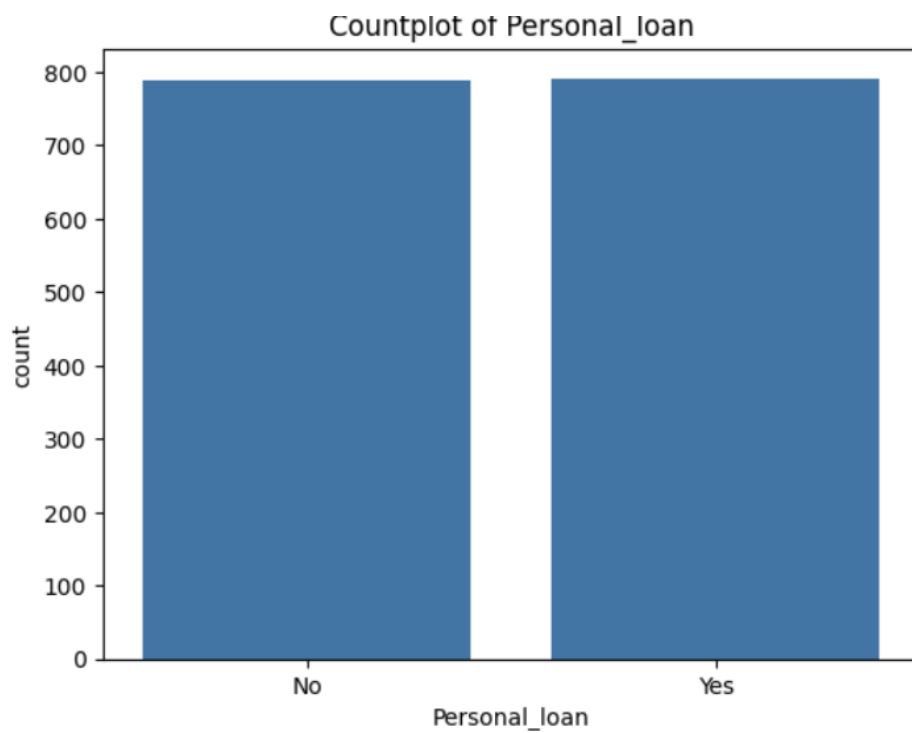
There is a higher number of married individuals compared to single This could influence purchasing power and decision-making behaviour.

### 4.Education



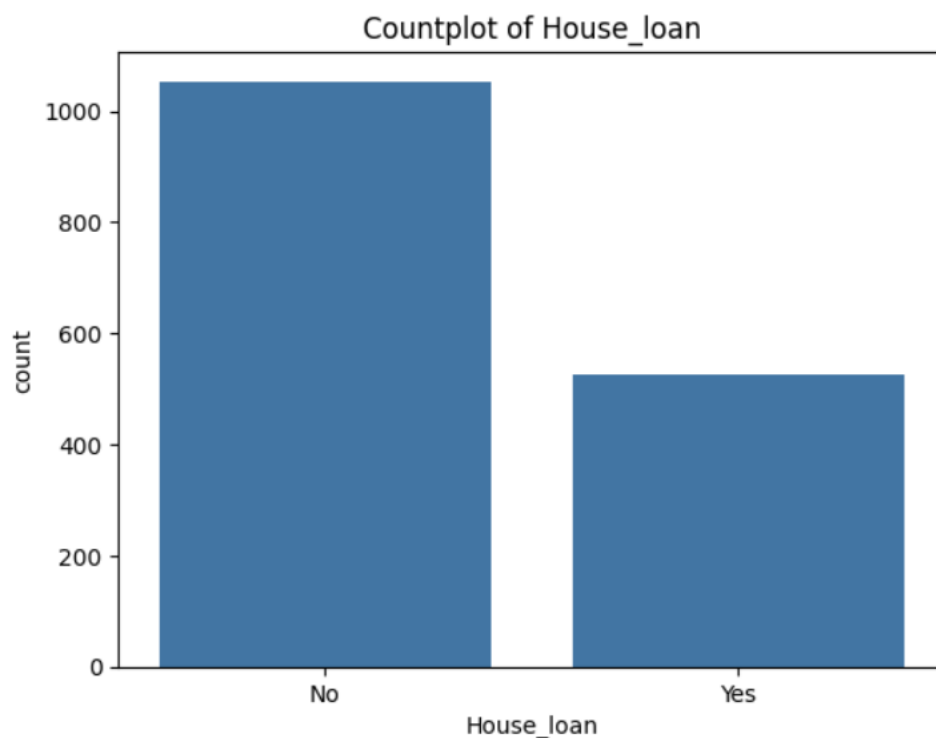
Postgraduates make up the majority of the dataset. This says that majority people earn who are postgrads earn more than graduates which might affect car preferences and affordability.

## 6. Personal loan



There's equal number of people who have taken and not taken the loan

## 7. house loan

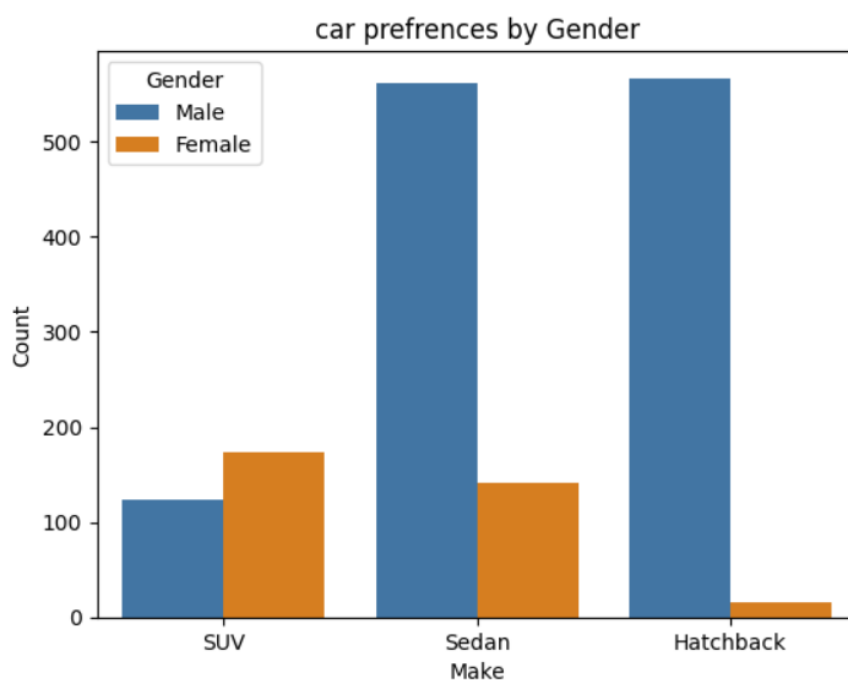


The substantial portion has taken a house loan , this might influence their income and might be useful for their car purchasing decisions

## 4.2Bivariate analysis

### 4.2.1 categorical vs categorical data

#### 1.Gender vs make :



Using a countplot helps to visualize the preference of car types (Make) among different genders. Below are the detailed insights:

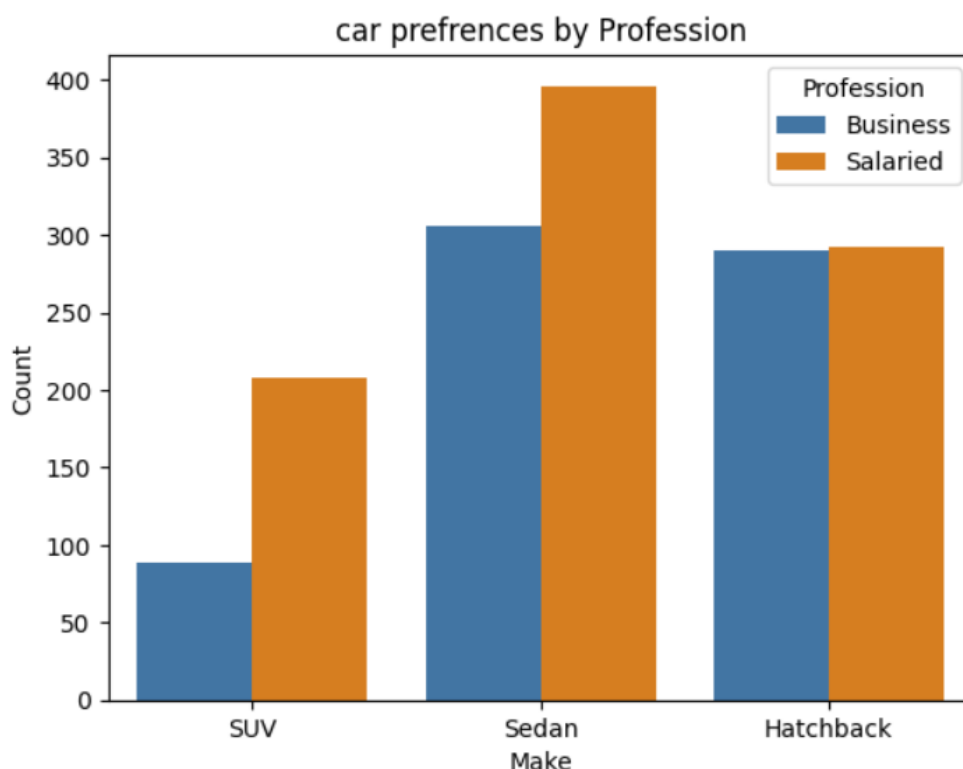
- The countplot makes it very clear that significantly higher number of female prefer the SUVs compared to males, with 190 females choosing SUVs against 120 males
- The countplot shows that males have higher preferences for sedan and hatchbacks compared to females
- Over more than 500 males prefer sedan whereas only about 150 females prefer sedan
- Over more than 500 males prefer hatchback and only approx. 30 females prefer hatchback

#### INSIGHTS:

- The company might consider targeting their SUV marketing campaigns more towards females, as data shows a higher preference among this group.
- For Sedans and Hatchbacks, campaigns could be more male-focused to align with their preferences.
- Given the higher female inclination towards SUVs, the company could explore enhancing features that appeal particularly to female customers.
- Meanwhile, ensuring that the features of Sedans and Hatchbacks cater to the preferences of the male audience could help in increasing sales.

## 2. profession vs make:

A countplot was used to analyse the car preferences of individuals based on their profession, differentiating between those with jobs and those in business.



- The countplot shows a larger number of people with jobs prefer SUVs over those in business
- Sedans see a similar trend, with a higher number of job holders preferring them over business professionals.
- The preference for Hatchbacks is almost equal among those into jobs and business.
- **MARKETING CAMPEGIN:**

- SUVs and Sedans: Target marketing campaigns and feature developments towards job holders.
- Hatchbacks: focus on the universal appeal and affordability to attract both professional groups

## 4.2.2 Numerical vs numerical data:

### 1 salary vs purchase price of automobile:

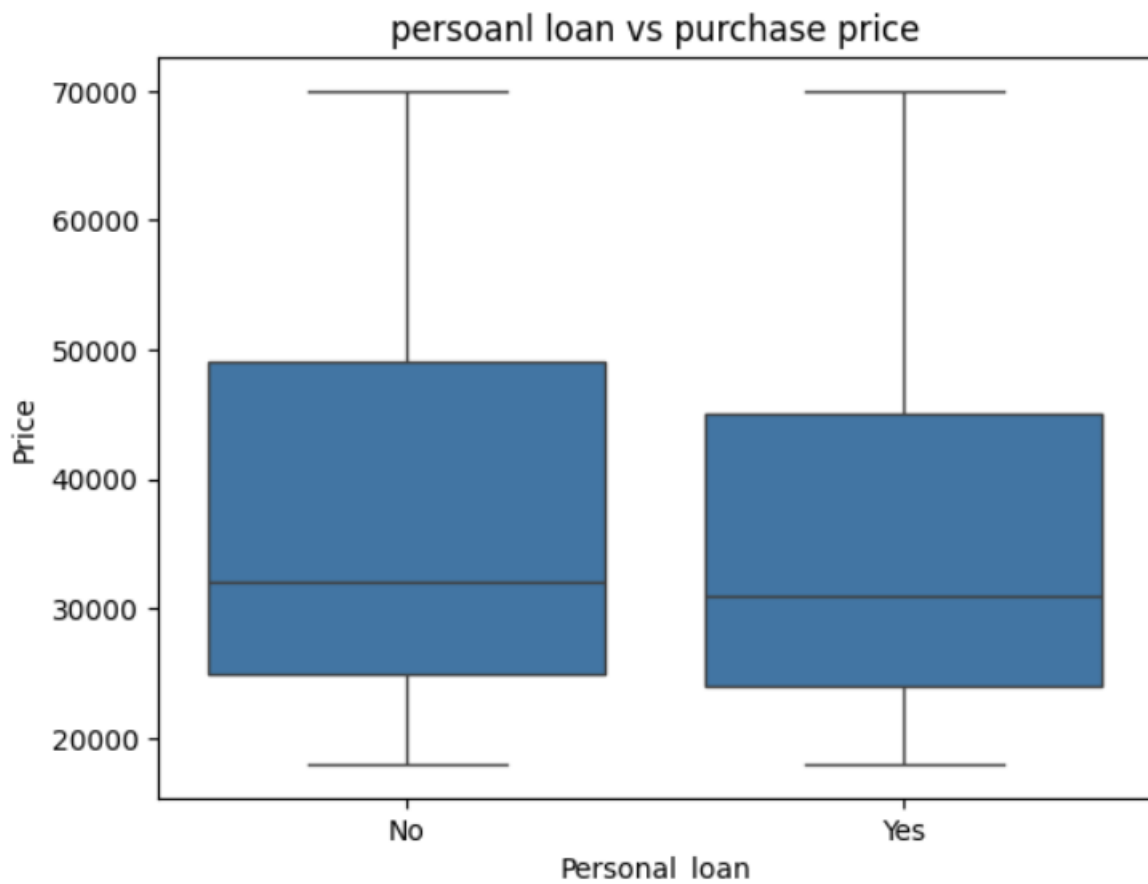
To analyse spending patterns and how much different salary groups are spending.



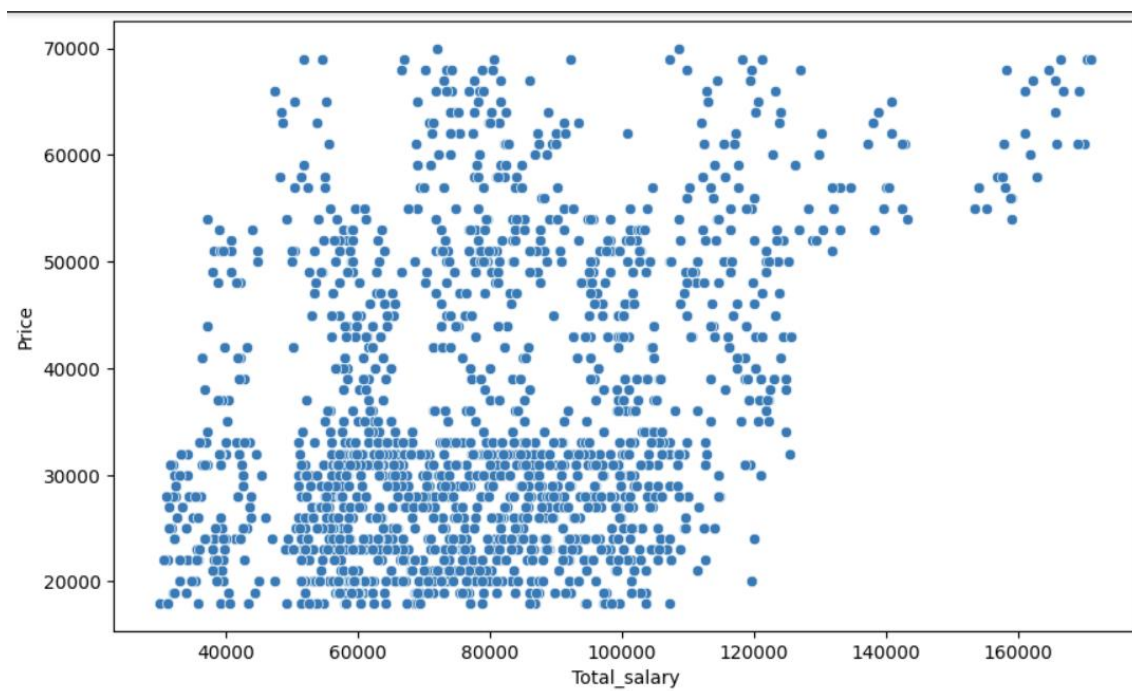
- The scatter plot reveals a positive trend, indicating that as the salary of individuals increases, the price of the automobiles they purchase also tends to increase.
- This suggests that higher-income individuals have a greater purchasing power, enabling them to afford more expensive automobiles
- The individuals with the highest salaries are seen to purchase the highest-priced cars. This cluster in the scatter plot highlights the affordability of premium automobiles within high-income groups.

### 2 . personal loan vs price of automobile

- understanding the expenditure pattern of those who took personal loan.
- Using a boxplot to analyse the impact of personal loan status on the purchase price of automobiles provides a clear understanding of how financial decisions influence spending behaviour.
- The boxplot shows the spread and central tendency of the purchase prices for both categories: those who took personal loans and those who did not.
- The median purchase price is higher for individuals who did not take a personal loan (3300) compared to those who did (2900).
- Individuals without personal loans tend to have slightly higher purchasing power, allowing them to afford more expensive automobiles.

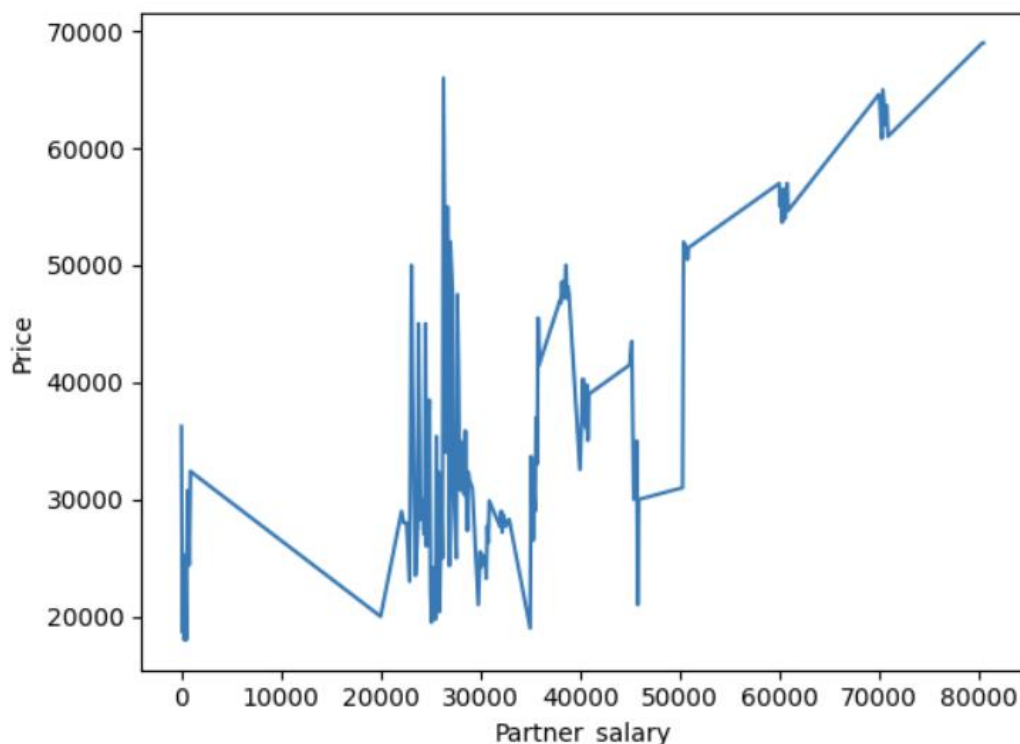


### 3. Toal salary vs price of automobile



- A scatter plot was used to analyse the relationship between Total Salary and the Purchase Price of automobiles to understand how income levels impact spending on cars.
- There is a positive trend between total household income (Total salary) and purchase price (Price), indicating that higher total salaries are associated with more expensive car purchases.
- Households with higher total incomes have greater purchasing power, allowing them to afford higher-priced automobiles.

#### 4.Partner salary vs automobile price

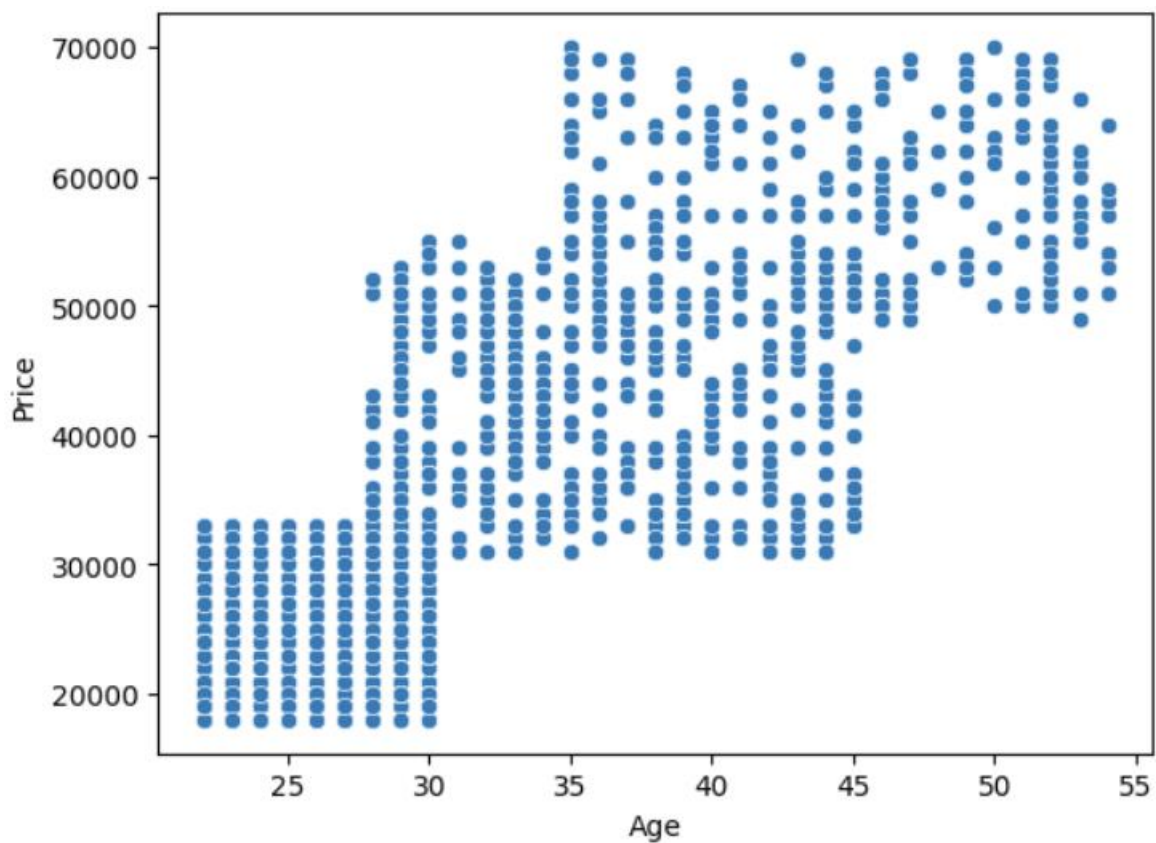


- A line plot was used to analyse the relationship between Partner Salary and the Purchase Price of automobiles to understand the impact of partner income on car purchasing power.
- The line plot indicates a positive trend between partner salary and car purchase price, showing that higher partner salaries contribute to the affordability of more expensive cars.

#### 5.Age vs salary

- Scatter plots were used to analyse the relationship between Age and the Purchase Price of automobiles to understand how age impacts car purchasing power.
- The scatter plot indicates a positive trend where older individuals tend to purchase more expensive cars
- People in the age range of 20 to 30 tend to purchase less expensive cars.





#### 4.2.3 Categorical vs numerical

##### 1 Salary vs Gender

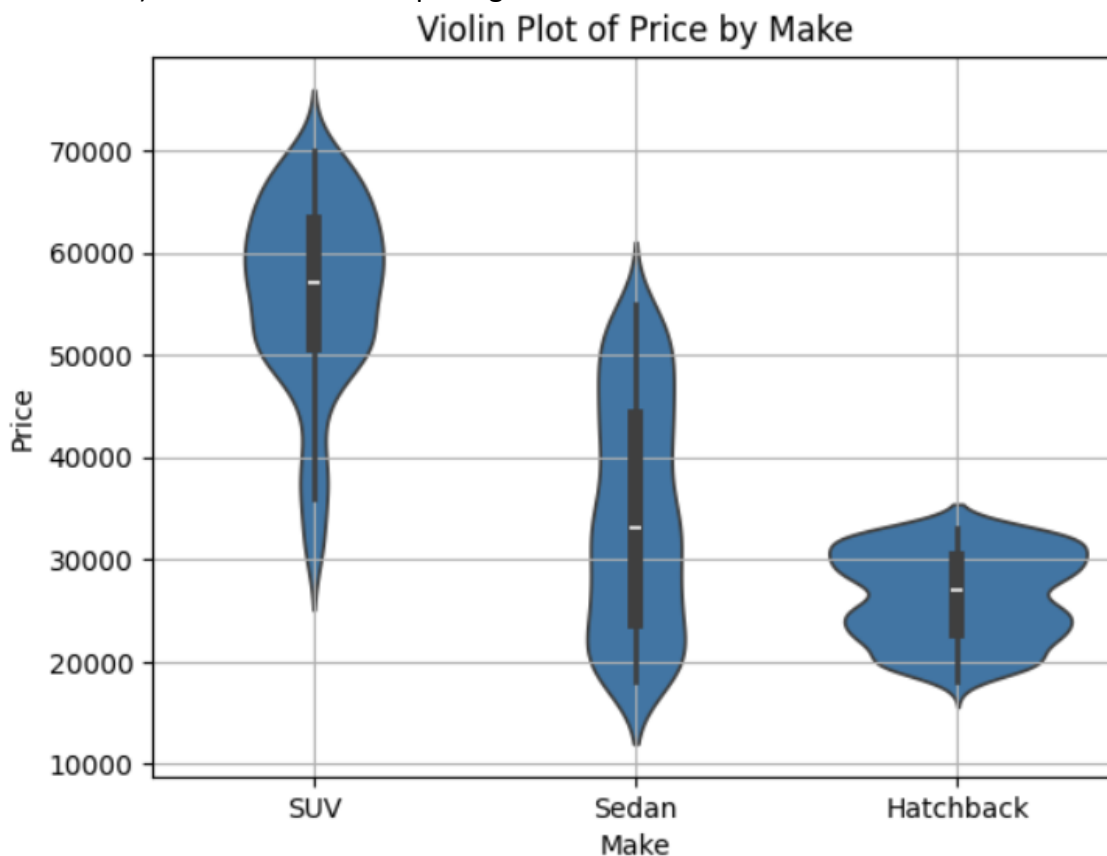
A box plot was used to analyse the distribution of salaries based on gender to understand income disparities and earning potential.



- Females have a higher median salary compared to males.
- The median line inside the box plots shows that females have a higher median salary compared to males.
- The presence of outliers in the male salary distribution indicates that while most male salaries fall within a certain range, some salaries are significantly higher or lower.
- Females have a slightly wider salary range compared to males, extending up to 100,000.
- The salary range for males is between 30,000 and 95,000, while for females, it ranges from 35,000 to 100,000.
- This wider range for females suggests higher earning potential at the upper end of the salary spectrum

## 2. make vs. Price

Using a violin plot, we analysed the distribution of prices across different car makes (SUV, Sedan, Hatchback) to understand their pricing trends.



### Suv:

- Median Price: Approximately 55,000.
- Price Range: 35,000 - 70,000.
- Insights: SUVs have the highest median price among the car types. The wide price range indicates that, while some SUVs are moderately priced, many are on the higher end. This makes SUVs the most expensive category

### Sedan:

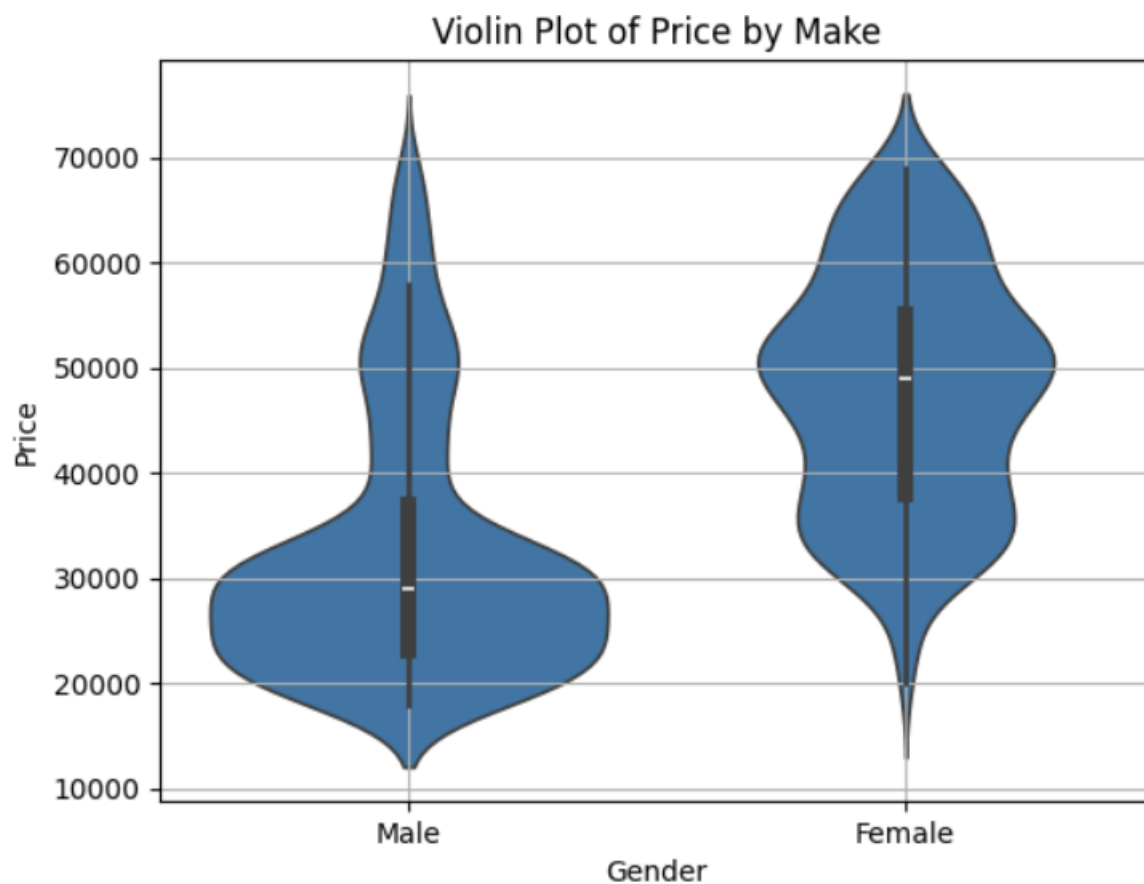
- Median Price: Approximately 33,000.

- Price Range: 18,000 - 54,000.
- Insights: Sedans fall into the mid-range category concerning price. The median price is lower than that of SUVs, and the price range is narrower, suggesting less variability in the price of Sedans

#### **Hatchback:**

- Median Price: Approximately 26,000.
- Price Range: 18,000 - 33,000.
- Insights: Hatchbacks are the most affordable category. Their lower median price and narrower price range indicate that they are generally cheaper and more consistently priced

### **4. Gender vs. Price**



We utilized a violin plot to analyse the distribution of car prices by gender, examining how the buying power varies between males and females based on the data provided.

#### **Males:**

- Price Range: 15,000 - 70,000.
- Median Price: Approximately 28,000.
- Males have a broad range of car affordability, showcasing variance in spending capacity.
- The median price of 28,000 indicates that a significant portion of male buyers opt for cars in the lower to mid-price range.

#### **Female:**

Price Range: 20,000 - 80,000.

- Median Price: Approximately 48,000.
- Females tend to afford cars within a slightly narrower range compared to males.
- The higher median price of 48,000 suggests that female buyers generally prefer more expensive cars.

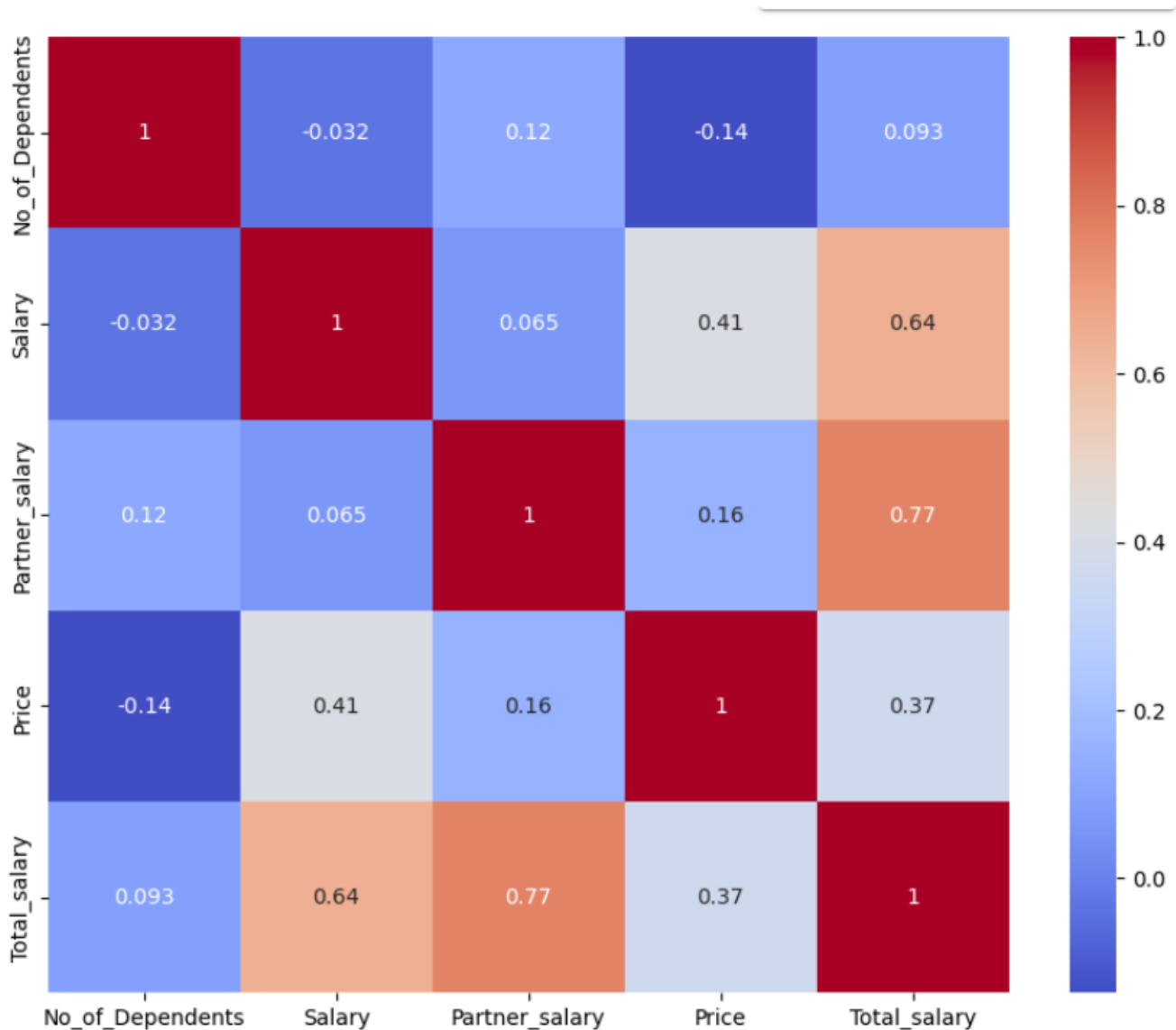
### 4.3 Multivariate analysis

- We have done multivariate analysis to find out correlation between different numerical parameters and plotted a heat map too understand the correlation in a better way.

	Age	No_of_Dependents	Salary	Partner_salary	Total_salary	Price
Age	1.000000	-0.189614	0.616899	0.121187	0.458869	0.797831
No_of_Dependents	-0.189614	1.000000	-0.031746	0.121555	0.092890	-0.135839
Salary	0.616899	-0.031746	1.000000	0.065348	0.641560	0.409920
Partner_salary	0.121187	0.121555	0.065348	1.000000	0.765446	0.161136
Total_salary	0.458869	0.092890	0.641560	0.765446	1.000000	0.367823
Price	0.797831	-0.135839	0.409920	0.161136	0.367823	1.000000

- **Age and Price (Correlation: 0.798)**
- There is a strong positive correlation between Age and Price, indicating that older individuals tend to purchase more expensive automobiles. Business Insight: Marketing strategies could consider targeting older age groups for higher-priced vehicles
- **Age and Salary (Correlation: 0.617)**
- There is a moderate positive correlation between Age and Salary, suggesting that older individuals generally have higher salaries.
- **Age and Total Salary (Correlation: 0.459)**
- Age has a moderate positive correlation with Total Salary. This aligns with the trends in individual salary and the influence of combined household income.
- **Salary and Price (Correlation: 0.410)**
- Salary has a moderate positive correlation with the price of automobiles purchased, indicating that higher-salary individuals tend to buy more expensive cars.
- **Partner Salary and Total Salary (Correlation: 0.765)**
- There is a strong positive correlation between Partner Salary and Total Salary, which is expected as Total Salary is the sum of individual and partner salaries
- **Total Salary and Price (Correlation: 0.368)**
- Total Salary has a weak positive correlation with Price, indicating that overall household income influences but does not strongly dictate automobile expenditure.
- Key Takeaways
- Strong Correlations:
  - Focus on Age and its relationship with Price and Salary for targeted marketing campaigns focusing on high-priced vehicles.
- Moderate Correlations:

- Recognise that Salary directly influences expenditure on automobiles. Campaigns should emphasize value and luxury features.
- Weak Correlations:
- Understand that Partner Salary alone does not strongly influence the Price. However, Total Salary still holds significant, though moderate, insight when considered with other factors.

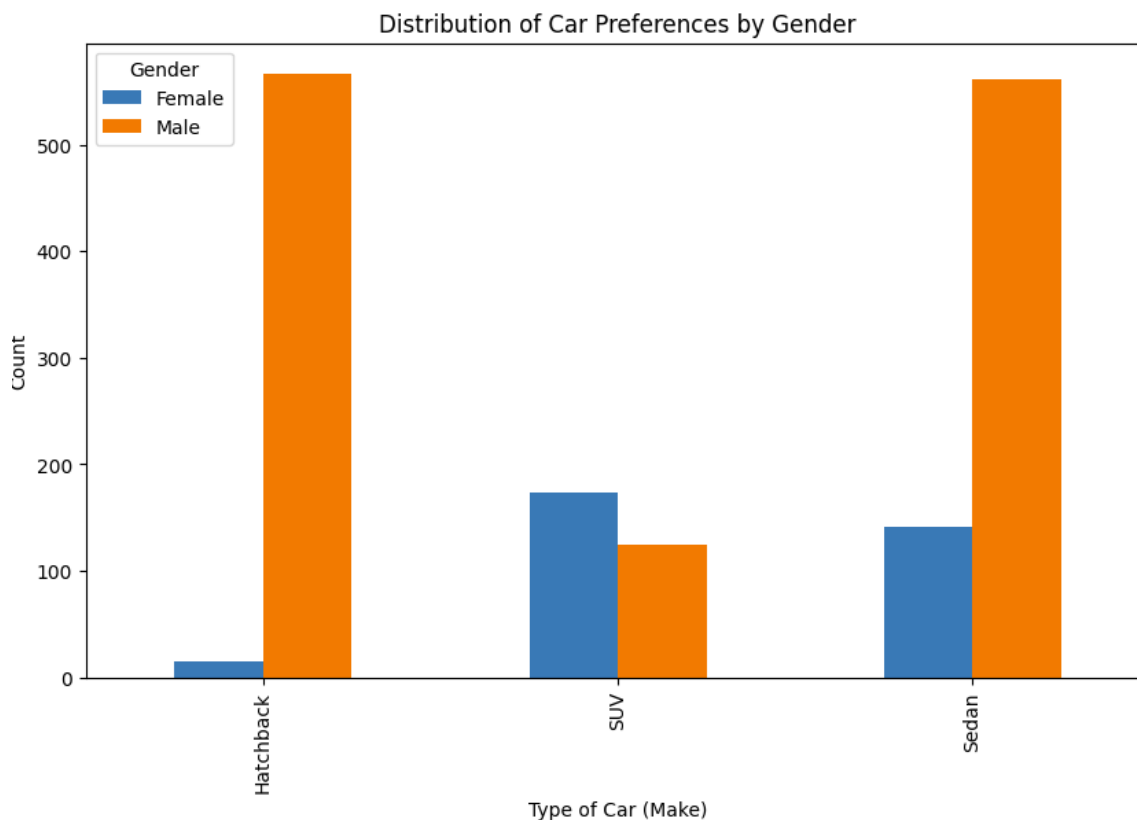


## 5 . key Question analysis:

### 1 . Do men tend to prefer SUVs more compared to women?

- analysed the distribution of SUV preferences among males and females using a bar plot to visualize the counts for each gender.
- on plotting the data, we observed the following counts:
  - 1.Men: 124
  - 2.Women: 173

The bar plot clearly illustrates that women tend to prefer SUVs more than men



From the bar plot, it is evident that a higher count of females prefer SUVs compared to males. The analysis shows that 173 females prefer SUVs, whereas 124 males tend to do so. Therefore, we conclude that women show a significantly higher preference for SUVs than men.

## 2. What is the likelihood of a salaried person buying a Sedan?

- We filtered the dataset to include only individuals who are categorized as "salaried" in the profession column. The following steps were taken:
- We filtered out the salaried individuals from the "Profession" column, resulting in a count of 896 salaried individuals.
- Next, we identified the number of salaried individuals who purchased a Sedan, which is 396.
- Finally, we calculated the percentage of salaried individuals who bought a Sedan.

### Analysis

5 Total Salaried Individuals: 896

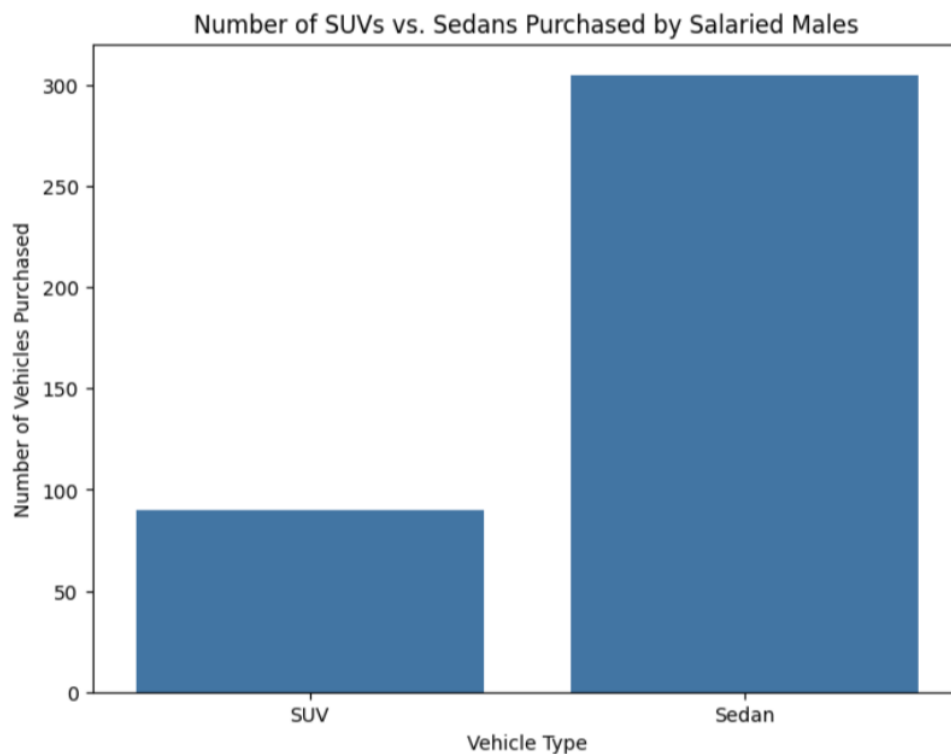
6 Salaried Individuals Buying Sedan: 396

7 Percentage Calculation:  $\text{proportion} = (\text{sedan}/\text{total\_salaried\_person}) * 100$ : 44.19%

Approximately **44.19%** of salaried individuals are likely to buy a Sedan. This indicates a significant portion of the salaried demographic shows a preference for Sedans.

## 3. What evidence or data supports Sheldon Cooper's claim that a salaried male is an easier target for a SUV sale over a Sedan sale?

To evaluate Sheldon Cooper's claim that a salaried male is an easier target for an SUV sale compared to a Sedan sale we have plotted a bar graph and also made the filtration of data



- Extracted data for salaried males.
- Segmented the data to identify the counts of salaried males who purchased SUVs and Sedans.
- Total Number of Salaried Males: 672
- Number of Salaried Males Who Purchased SUVs: 90
- Number of Salaried Males Who Purchased Sedans: 305
- Percentage Calculation:  
 $\text{suv\_proportion} = \text{suv\_count} / \text{total\_salaried\_males} * 100 = 13.39\%$   
 $\text{sedan\_proportion} = \text{sedan\_count} / \text{total\_salaried\_males} * 100 = 45.39\%$   
Based on the analysis:
- 13.39% of salaried males bought SUVs.
- 45.39% of salaried males bought Sedans.

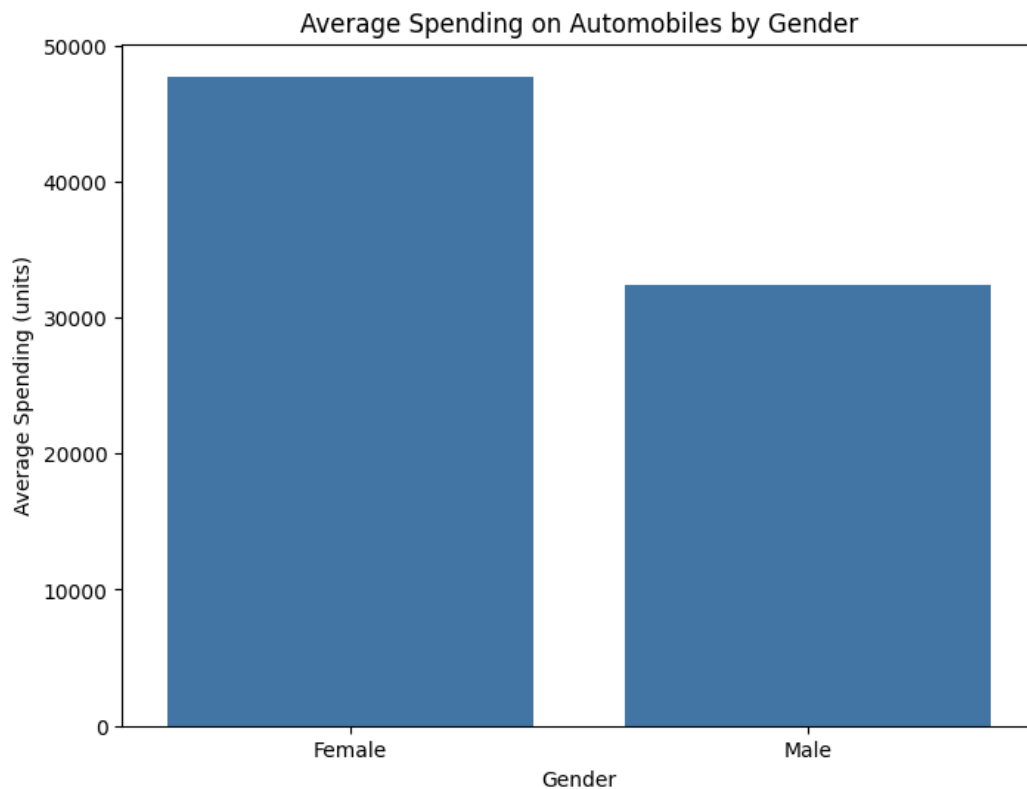
The data clearly demonstrates that a significantly higher proportion of salaried males prefer Sedans over SUVs. Therefore, Sheldon Cooper's claim that salaried males are easier targets for SUV sales compared to Sedan sales is incorrect.

#### 4. How does the the amount spent on purchasing automobiles vary by gender?

- The data was grouped by the 'Gender' column to calculate the average amount spent on automobiles for each gender using the mean of the 'Price' column.
- Average Spending by Females: \$ 47,705.17
- Average Spending by Males: \$32,416.13

Females tend to spend significantly more on automobiles compared to their male which is very clear by the barplot.

#### Visualization



5. How much money was spent on purchasing automobiles by individuals who took a personal loan?

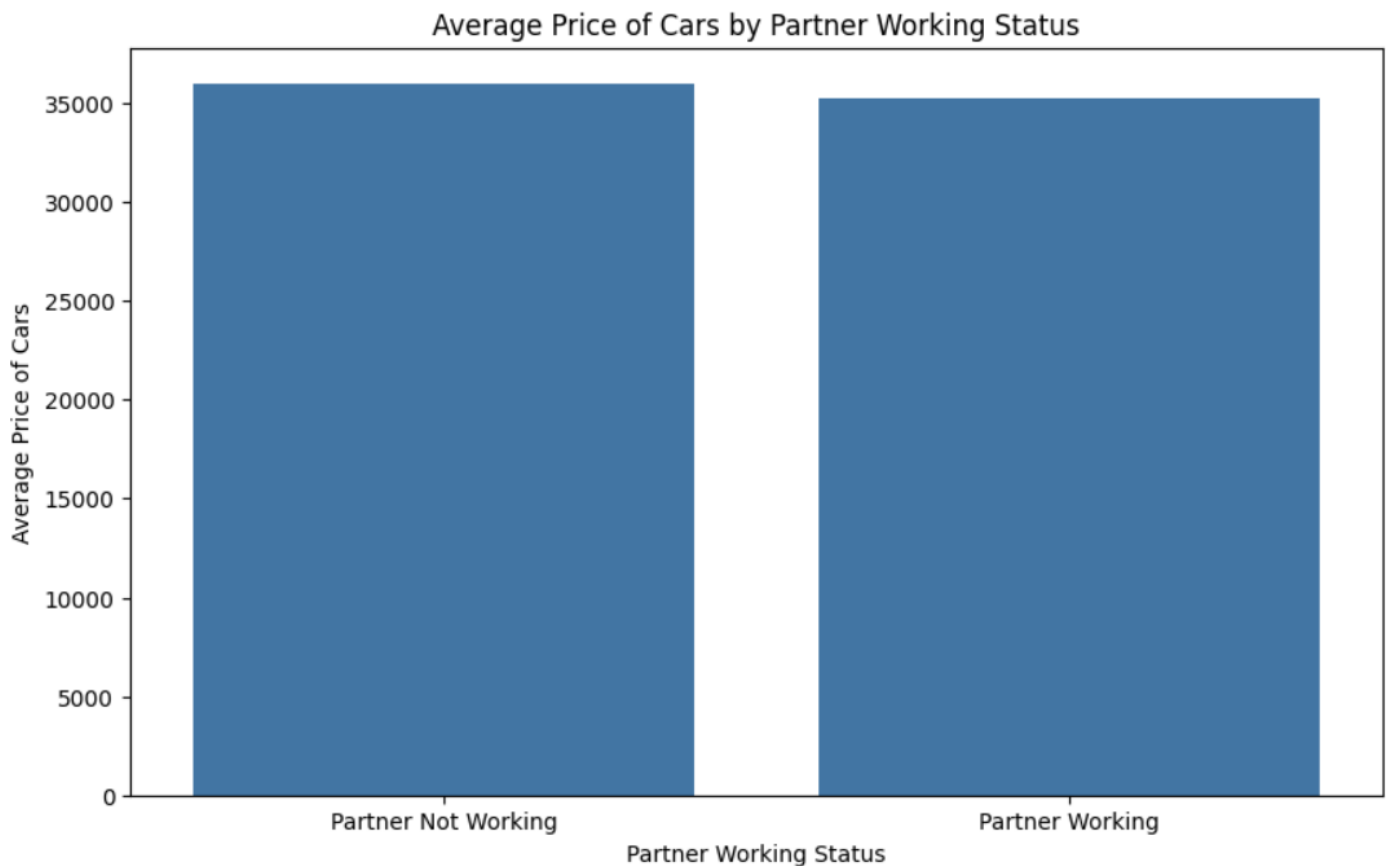
To determine how much money was spent on purchasing automobiles by individuals who took a personal loan.

- Extracted data for individuals who reported taking a personal loan.
- This was done by filtering the dataset where the 'Personal\_loan' column is 'Yes'.
- Applied an aggregate function to calculate the total amount spent by these individuals on purchasing automobiles.
- Specifically, summed the 'Price' column for the filtered dataset
- Total Amount Spent by Individuals with Personal Loans: \$27,290,000

6. how does having a working partner influence the purchase of higher-priced cars?

- Converted the 'Partner\_working' column to binary values (1 for 'Yes', 0 for 'No') for easier analysis
- Created a bar plot to visualize the average price of cars based on the partner's working status





- Average Price of Cars Purchased by Individuals with Working Partners: Approximately 33,000
- Average Price of Cars Purchased by Individuals with Non-Working Partners: Approximately 35,000
- The bar graph shows that individuals with non-working partners spend slightly more on average on car purchases compared to those with working partners.
- Contrary to what might be expected, individuals with working partners tend to spend less on automobiles compared to those whose partners are not working.
- This suggests that the partner's working status does not significantly influence the purchase of higher-priced cars

## 6.Actionable Insights and Recommendations

### Actionable insights:

- Females spend significantly more on automobiles than males (\$47,705.17 vs \$ 32,416.13 ),This indicates that females may prefer higher-end or more feature-rich vehicles compared to males.
- A higher proportion of females prefer SUVs, whereas males show a greater preference for Sedans and Hatchbacks.
- Approximately 44.19% of salaried individuals are likely to buy a Sedan, Sedans have a significant market share among salaried customers.
- Individuals who took personal loans spent a total of \$27,290,000 on automobiles.
- Individuals with non-working partners spend slightly more on cars \$35,000 compared to those with working partners \$33,000 , The partner's working status does not significantly influence the

purchase of higher-priced cars, suggesting other factors play a more critical role in purchasing decisions.

**Recommendations:**

- Develop advertisements and promotions that appeal to female buyers' preferences, potentially increasing sales.
- Salaried males prefer Sedans (45.39%). Focus marketing on this group to take advantage of their preference.