

Bright Motor Company Data Analysis

SUMMER BOOTCAMP PROJECT - 2024

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Problem Statement

Bright Motor Company want to analyze the data to get a fair idea about the demand of customers which will help them in enhancing their customer experience. Suppose you are a Data Scientist at the company and the Data Science team has shared some of the key questions that need to be answered. Perform the data analysis to find answers to these questions that will help the company to improve the business.

Data Dictionary

- **Age:** The age of the individual in years.
- **Gender:** The gender of the individual, categorized as male or female.
- **Profession:** The occupation or profession of the individual.

- **Marital_status:** The marital status of the individual, such as married & single
- **Education:** The educational qualification of the individual Graduate and Post Graduate
- **No_of_Dependents:** The number of dependents (e.g., children, elderly parents) that the individual supports financially.
- **Personal_loan:** A binary variable indicating whether the individual has taken a personal loan "Yes" or "No"
- **House_loan:** A binary variable indicating whether the individual has taken a housing loan "Yes" or "No"
- **Partner_working:** A binary variable indicating whether the individual's partner is employed "Yes" or "No"
- **Salary:** The individual's salary or income.
- **Partner_salary:** The salary or income of the individual's partner, if applicable.
- **Total_salary:** The total combined salary of the individual and their partner (if applicable).
- **Price:** The price of a product or service.
- **Make:** The type of automobile.

Importing the necessary Libraries

Loading the Dataset

Basic Exploration

1. - Displaying the top 5 rows

[7]:

	0	1	2	3	4
Age	53	53	53	53	53
Gender	Male	Femal	Female	Female	Male
Profession	Business	Salaried	Salaried	Salaried	NaN
Marital_status	Married	Married	Married	Married	Married
Education	Post Graduate	Post Graduate	Post Graduate	Graduate	Post Graduate
No_of_Dependents	4	4	3	?	3
Personal_loan	No	Yes	No	Yes	No
House_loan	No	No	No	No	No
Partner_working	Yes	Yes	Yes	Yes	Yes
Salary	99300.0	95500.0	97300.0	72500.0	79700.0
Partner_salary	70700.0	70300.0	60700.0	70300.0	60200.0
Total_salary	170000	165800	158000	142800	139900
Price	61000	61000	57000	61000	57000
Make	SUV	SUV	SUV	?	SUV

- Table 1: Top 5 rows

Observations

From the head we can infer that:

- "No_of_Dependents", "Make" columns might be having wrong entries like "?"
- There are null values in the dataset

2. - Displaying the last 5 Rows

	1576	1577	1578	1579	1580
Age	22	22	22	22	22
Gender	Male	Male	Male	Male	Male
Profession	Salaried	Business	Business	Business	Salaried
Marital_status	Single	Married	Single	Married	Married
Education	Graduate	Graduate	Graduate	Graduate	Graduate
No_of_Dependents	2	4	2	3	4
Personal_loan	No	No	No	Yes	No
House_loan	Yes	No	Yes	Yes	No
Partner_working	No	No	No	No	No
Salary	33300.0	32000.0	32900.0	32200.0	31600.0
Partner_salary	0.0	NaN	0.0	NaN	0.0
Total_salary	33300	32000	32900	32200	31600
Price	27000	31000	30000	24000	31000
Make	Hatchback	Hatchback	Hatchback	Hatchback	Hatchback

- Table 2: Bottom 5 Rows

3. - Getting the shape of the dataset i.e to get the number of rows and columns

Observations

We can see that in our dataset:

- There are 1581 rows.
- There are 14 columns.

4. - Check the datatypes of each feature.

```

<class 'pandas.core.frame.DataFrame'>
RangeIndex: 1581 entries, 0 to 1580
Data columns (total 14 columns):
 #   Column                Non-Null Count  Dtype  
---  -
 0   Age                   1581 non-null  int64  
 1   Gender                1528 non-null  object  
 2   Profession            1575 non-null  object  
 3   Marital_status       1581 non-null  object  
 4   Education             1581 non-null  object  
 5   No_of_Dependents     1581 non-null  object  
 6   Personal_loan        1581 non-null  object  
 7   House_loan           1581 non-null  object  
 8   Partner_working      1581 non-null  object  
 9   Salary               1568 non-null  float64 
10   Partner_salary       1475 non-null  float64 
11   Total_salary         1581 non-null  int64  
12   Price                1581 non-null  int64  
13   Make                 1581 non-null  object  
dtypes: float64(2), int64(3), object(9)
memory usage: 173.1+ KB

```

- Figure 1: displaying the datatypes of columns

Observations

We can see that in our dataset we have:

- 3 columns which are of Int datatype.
- 2 columns of float datatype.
- Remaining 9 columns are of object datatype.type.
- No_of_Dependents column should be numerical datatype but a as object type data which is incorrect and needs to be corrected.ppearing as object

5. - Check the Statistical summary

	Age	Salary	Partner_salary	Total_salary	Price
count	1581.000000	1568.000000	1475.000000	1581.000000	1581.000000
mean	31.952562	60276.913265	20225.559322	79625.996205	35948.170778
std	8.712549	14636.200199	19573.149277	25545.857768	21175.212108
min	14.000000	30000.000000	0.000000	30000.000000	58.000000
25%	25.000000	51900.000000	0.000000	60500.000000	25000.000000
50%	29.000000	59450.000000	25600.000000	78000.000000	31000.000000
75%	38.000000	71700.000000	38300.000000	95900.000000	47000.000000
max	120.000000	99300.000000	80500.000000	171000.000000	680000.000000

- Table 3: Displaying statistical summary

Observations

- The maximum age is given as 120
- the minimum age is given as 14 this needed to be checked as a 14 year cannot drive a car

Data cleaning

6. - Check the null values

```

Age          0
Gender       53
Profession   6
Marital_status  0
Education    0
No_of_Dependents  0
Personal_loan  0
House_loan   0
Partner_working  0
Salary       13
Partner_salary 106
Total_salary  0
Price        0
Make         0

```

- Table 4: Displaying the null values

Observations

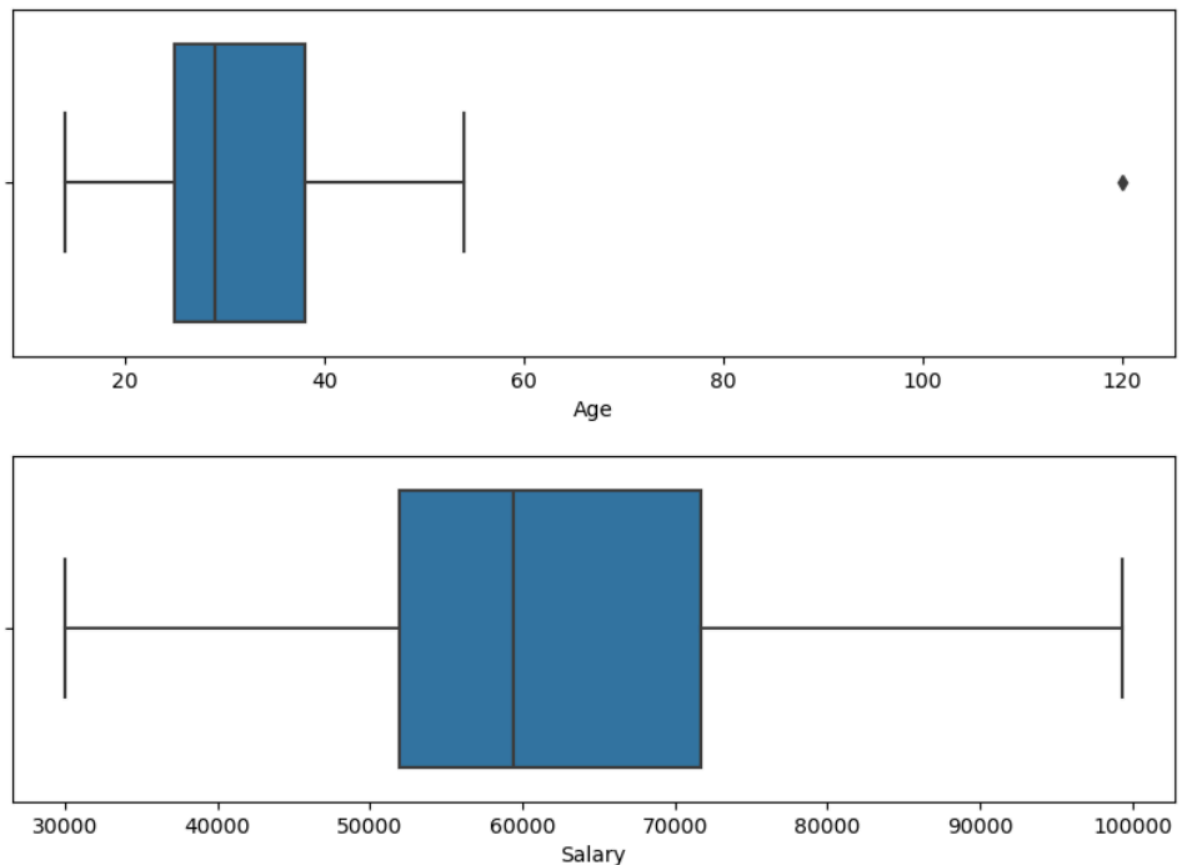
We can see that in our dataset:

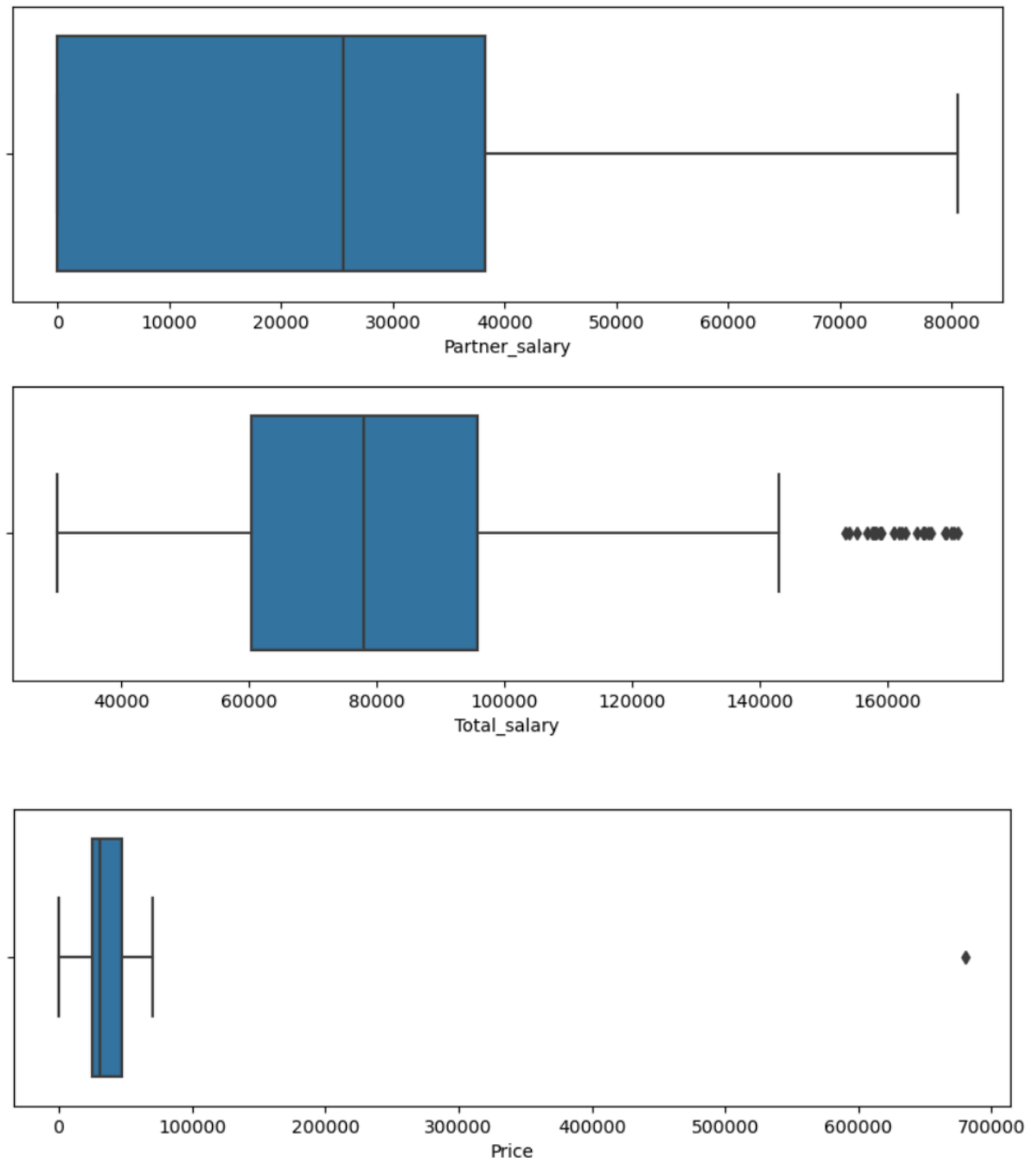
- only 4 columns (Gender, Profession, Salary, Partner_salary) have null values.
- Gender have 53 null values.
- Profession have 6 null values.
- Salary have 13 null values.
- Partner_salary have 106 null values.

7. - Check the duplicate values

We can see that all the rows are unique and we have no duplicated rows

8. - Check the outliers and their authenticity.





- Figure 2: Displaying the outliers

Observations

we can see that:

- Column 'Age', 'Total Salary' and 'Price' has outliers which needed to be seen

we can see that in the Total_salary column we have outliers but they are correct and genuine values as the outliers are showing when the total salary includes the partner working as 'Yes', so when the partner work the total salary will be more than when partner is not working or they need not to be replaced

9. - Removing Anomalies

Observation:

In 2 columns we have anomalies as they contain invalid values:

- In No_of_Dependents we have '?' as some value which are wrong and needed to be replaced
 - The '?' values replaced with nan value are then replaced with the median of the column.
- In Make column we have '?' as some value which are wrong and needed to be replaced.
 - The '?' values replaced with nan values which are replaced with the mode of column.

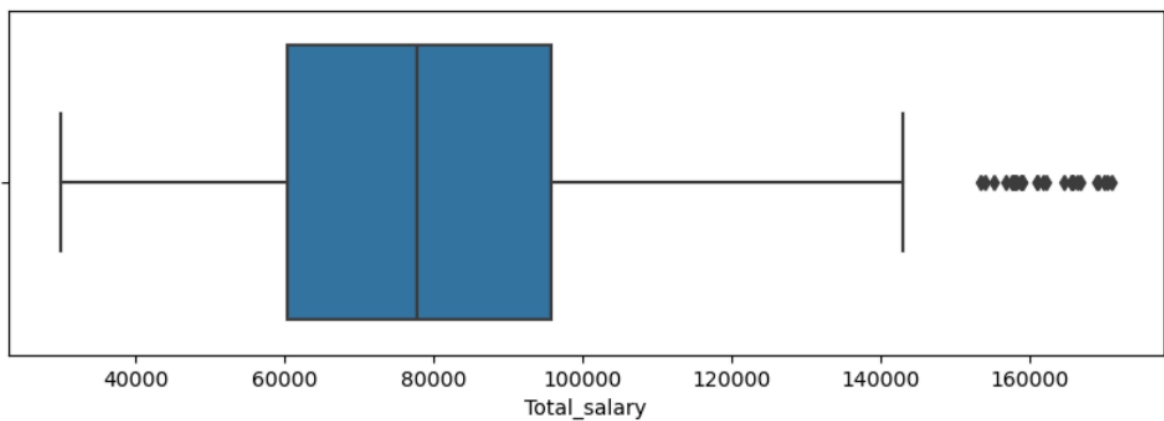
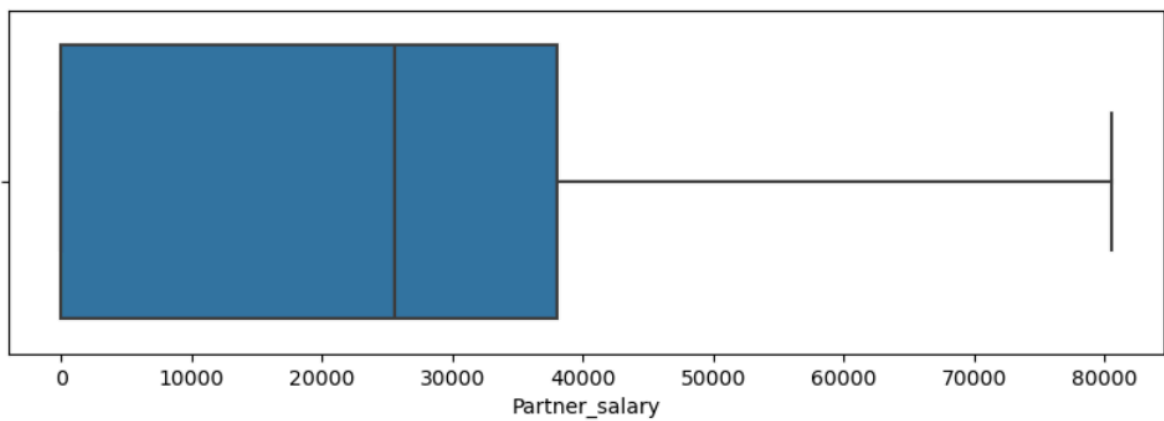
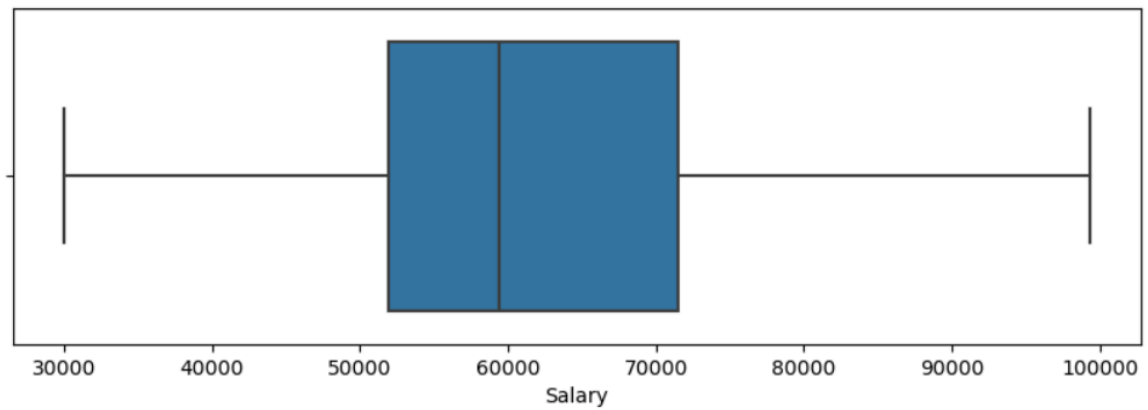
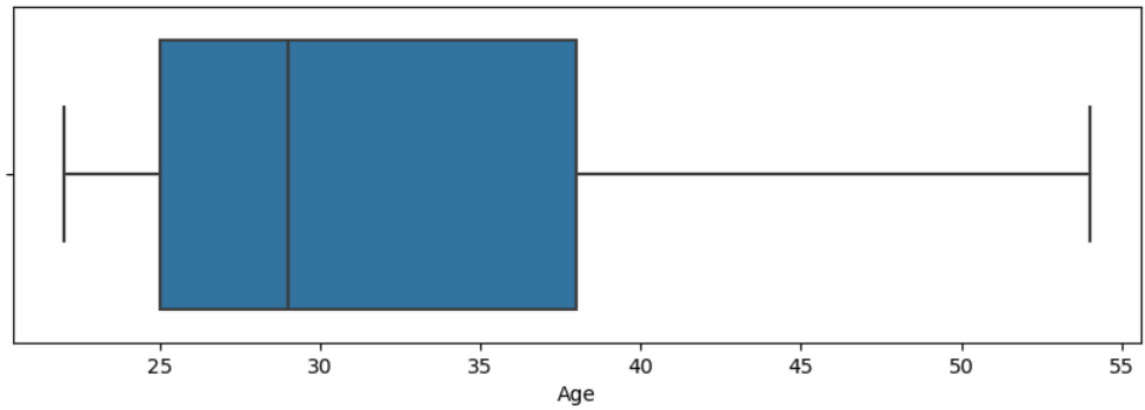
Removing the data where age is 14 as it is an incorrect value as a 14 year old cannot use an automobile.

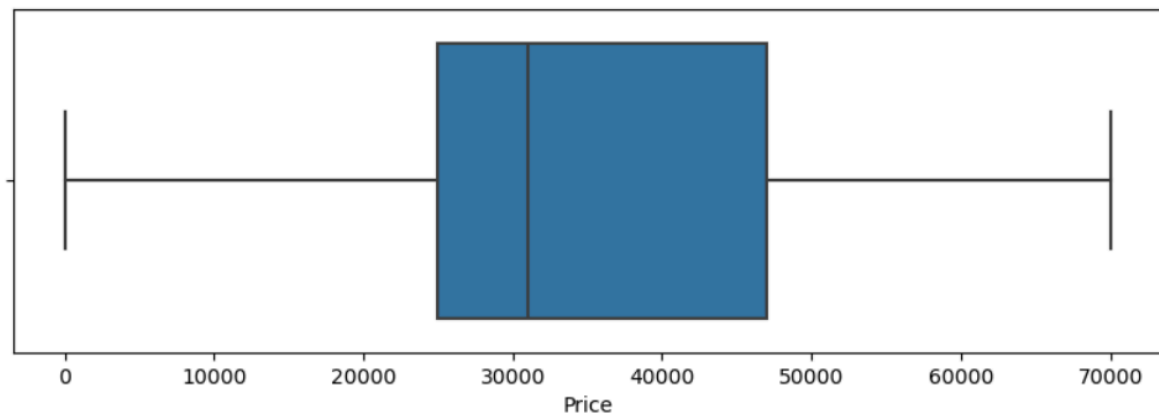
Removing the data where age is 120 as it appears to be a anomaly.

10. - Null value imputation and outlier correction

Age	0
Gender	0
Profession	0
Marital_status	0
Education	0
No_of_Dependents	0
Personal_loan	0
House_loan	0
Partner_working	0
Salary	0
Partner_salary	0
Total_salary	0
Price	0
Make	0

- Table 5: New table displaying no null value





- Figure 3: Figure displaying no outliers present

Observations

All the Null values are now removed.

We can see that now all the Outliers have been removed

Questions

1. Descriptive Statistics:

- What are the mean, median, and standard deviation of the ages of individuals in the dataset?

Observation

We can infer that:

- Mean Age is: 31.9 years
- Median Age is: 29 years
- Standard Deviation of Age is: 8.4 years

2. Data Distribution:

- What is the distribution of gender in the dataset? Represent it using a pie chart.

Obseravtion

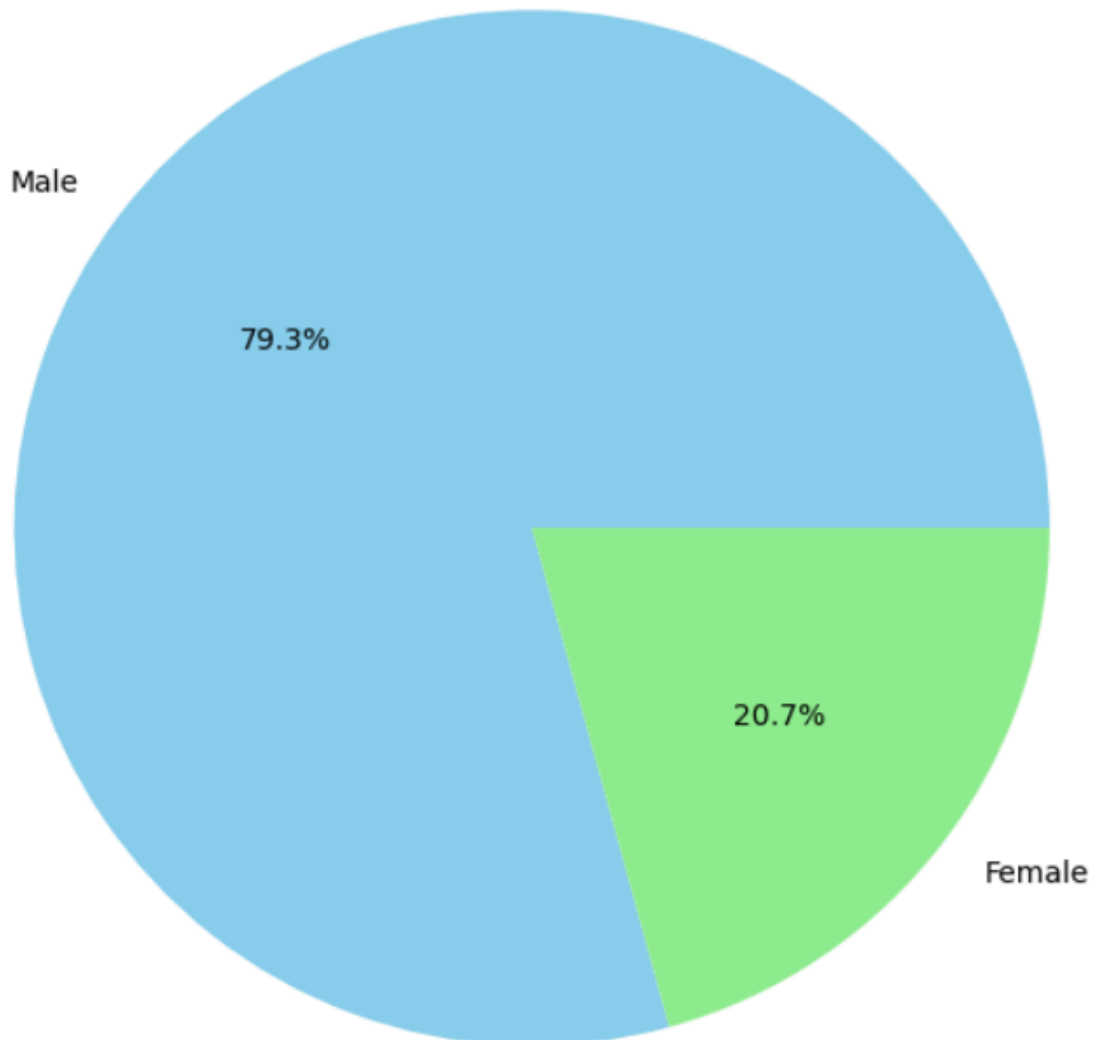
We can see that we have 2 enteries as:

- Femal

- Femle

These are wrong entries and needed to be corrected

Distribution of Gender in the Dataset



- Figure 4: Distribution of Gender

Observation

From the Pie Chart we can infer that:

- There are 79.2% Male.
- There are 20.8% Female.

3. Correlation Analysis:

- Is there a correlation between age and salary? Provide the correlation coefficient and interpret the result.

Correlation coefficient between Age and Salary: 0.6007704272305254
There is a positive linear relationship between Age and Salary.

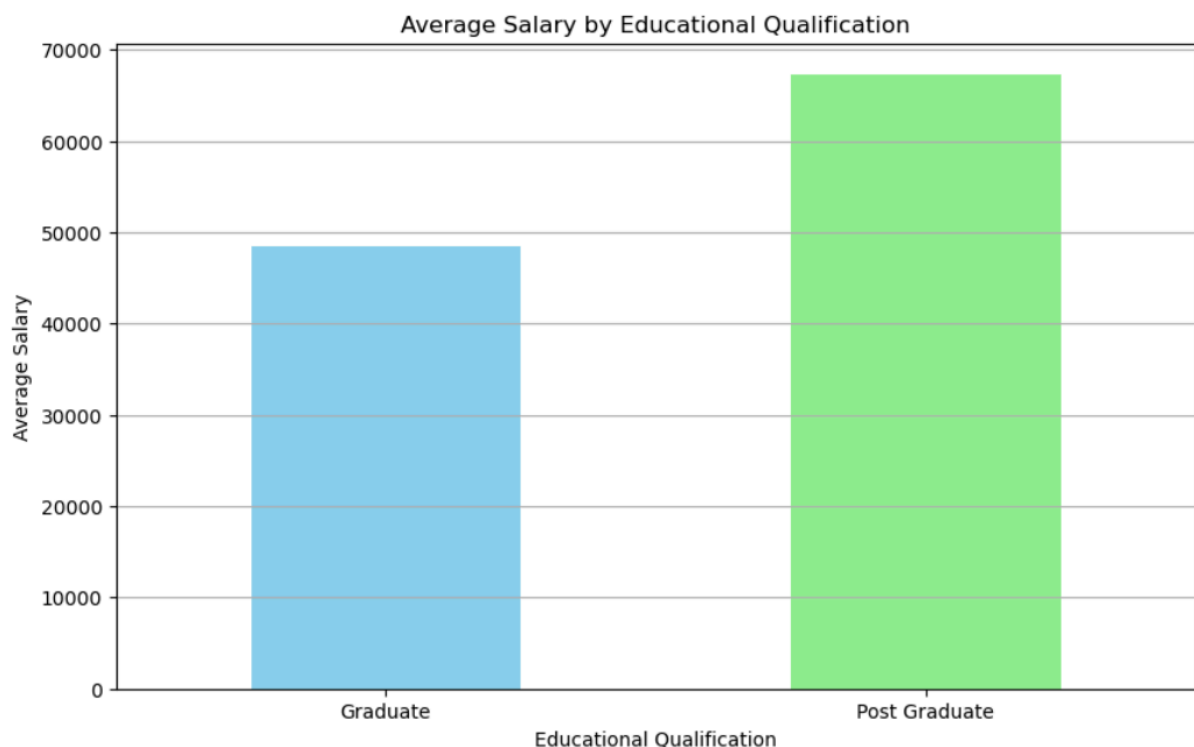
Observation

From the data we can infer that:

- The correlation between Age and Salary is coming out to be - 0.591
- There is a strong positive correlation, meaning as age increases, salary tends to increase.

4. Salary Analysis:

- What is the average salary for individuals based on their educational qualifications (Graduate vs. Post Graduate)?



- Figure 5: Average salary by education qualification

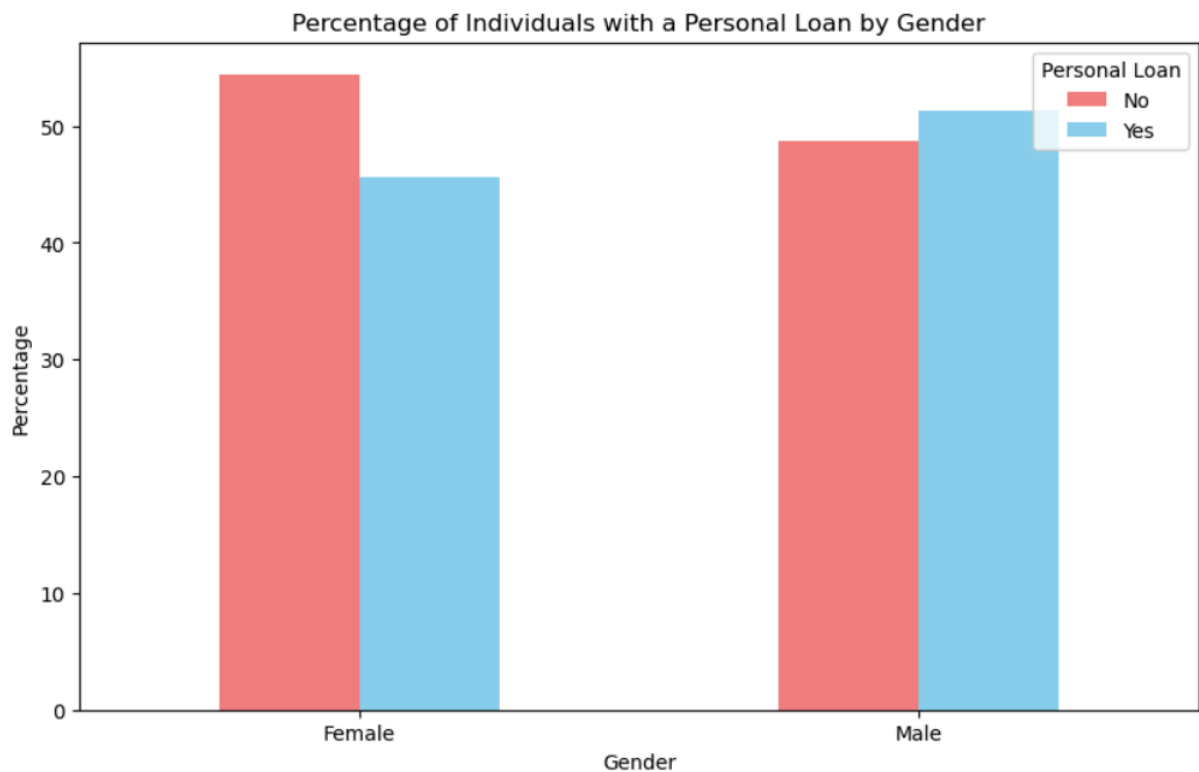
Obseravtion

From this we can infer that:

- Average Salary for Graduate person is: Rs 48514.59
- Average Salary for Post Graduate person is: Rs 67383.09
- The person with Post Graduate qualification have more average salary as compared to to the person with Graduate qualification

5. Loan Status:

- What percentage of individuals have taken a personal loan?
How does this compare between males and females?



- Figure 6: percentage of individuals with personal loan by gender

Observation

We can infer that The percentage of population with a personal is approx 50%

In case of Male and Female :

- 45% of Females have a personal loan
- 51% of Men have a personal loan

6. Marital Status and Dependents:

- What is the average number of dependents for married individuals versus single individuals?

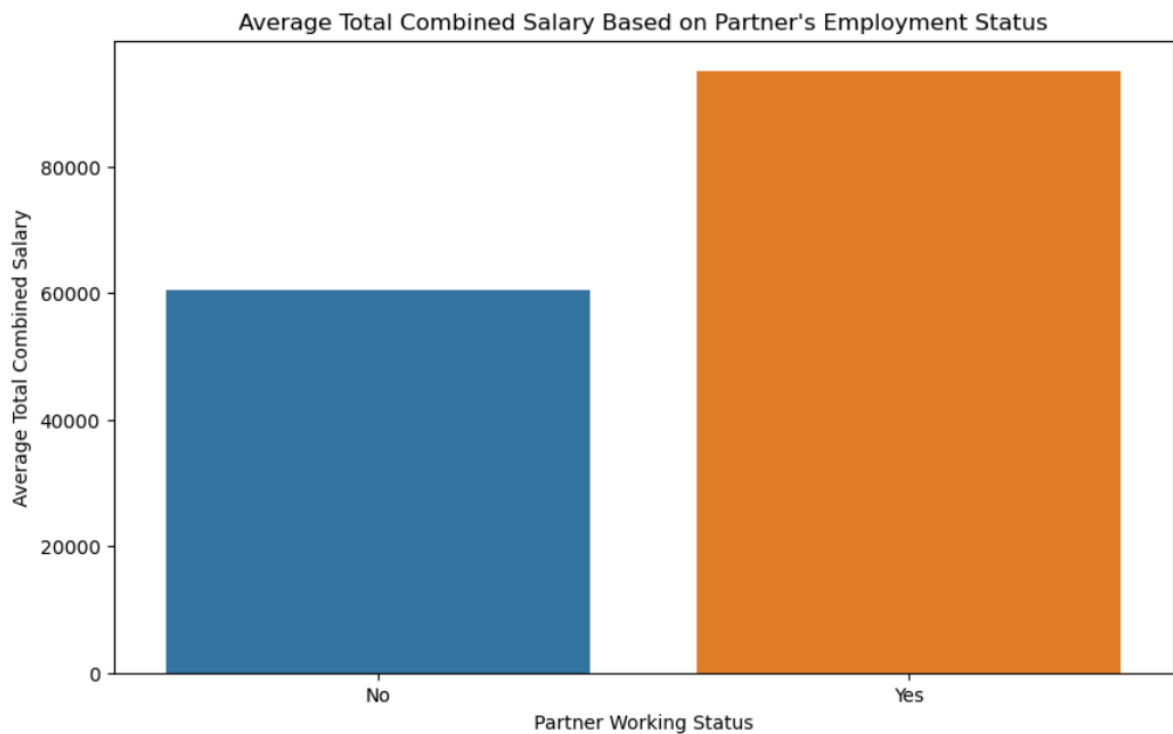
Observation

we can see that the average number of dependents:

- for married dependents - 3
- for single individuals - 2

7. Partner Employment:

- How does the employment status of a partner affect the total combined salary?



- Figure 7: Average total combined salary based on partner employment

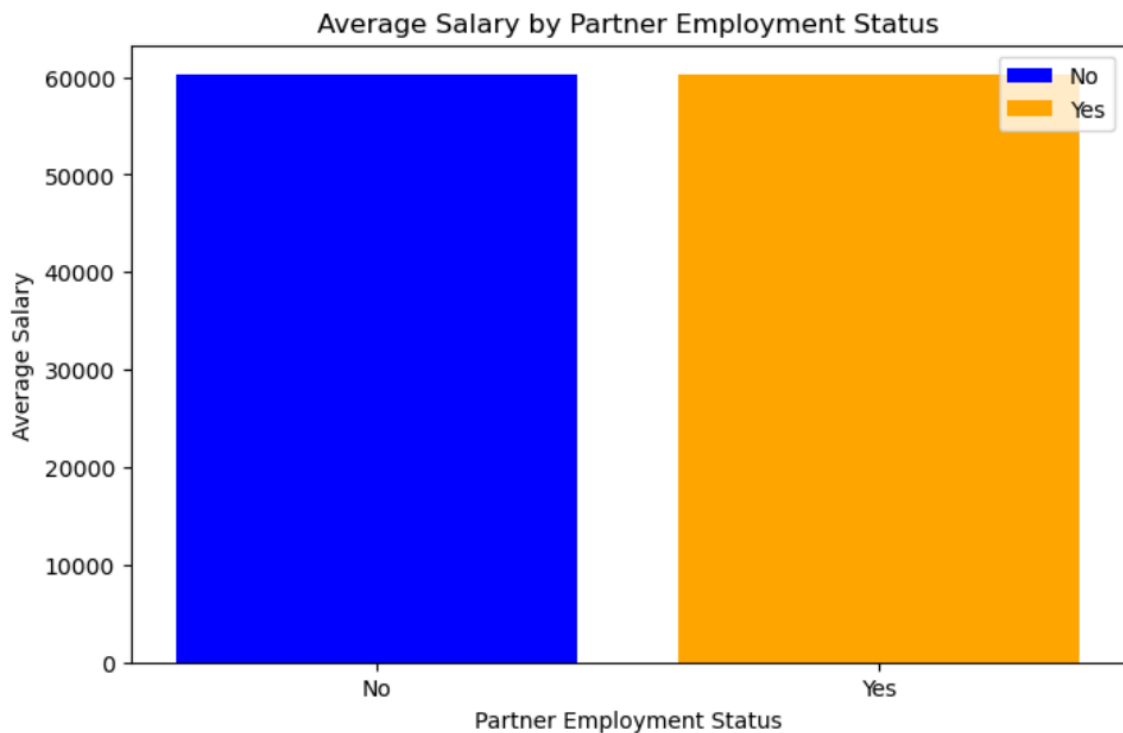
Observation

We can infer that the average total combined salary on the basis of partner employment status is:

- for those whose partner are not working: Rs 60527.20
- for those whose partner are working: Rs 95314.28
- This means that if both the partners are working the average combined salary is more

8. Salary Comparison:

- Compare the average salary of individuals whose partners are working versus those whose partners are not working.



- Figure 8: Average salary by partner employment

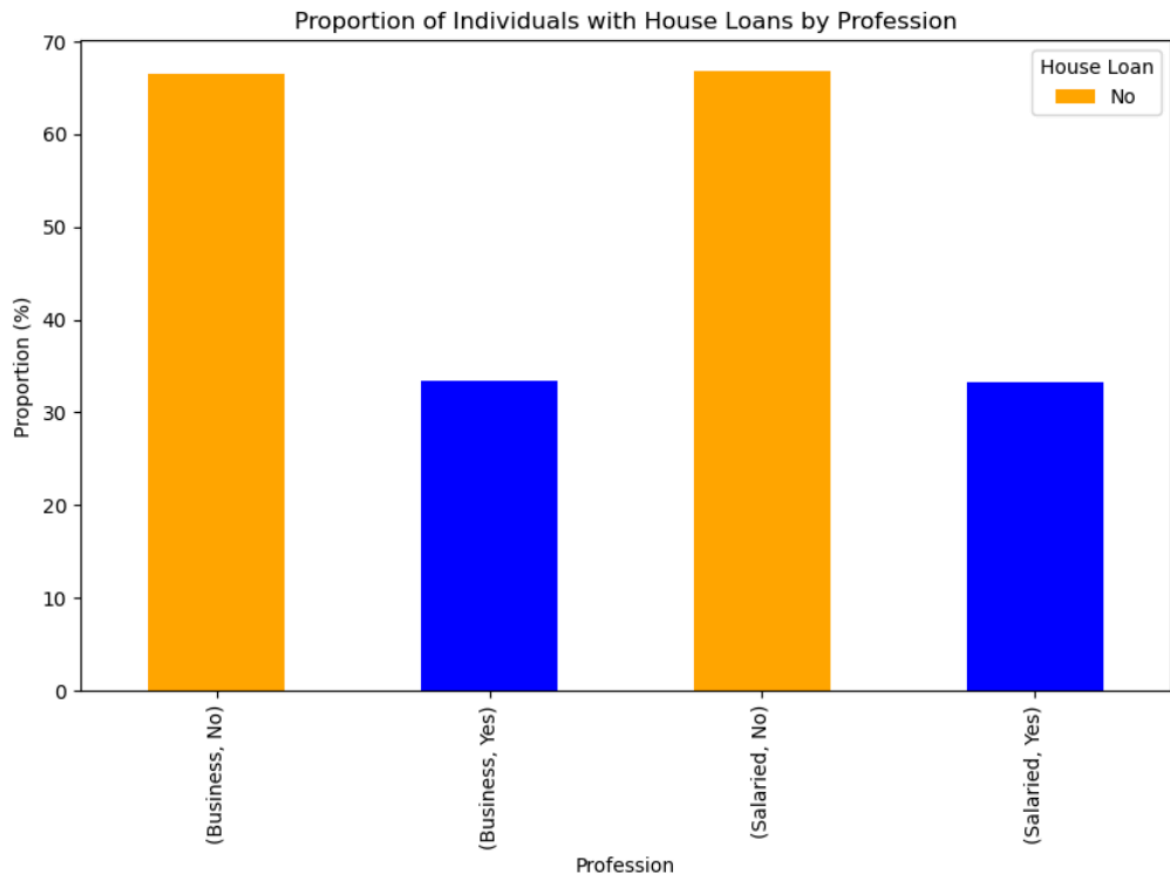
Observation

- Average salary when:
 - when partner works is Rs. 60195.49
 - when partner does not work is Rs. 60255.53

This shows that there is not much difference in the average salary on the basis of partner employment status.

9. House Loan Analysis:

- What is the proportion of individuals with house loans based on their profession?



- Figure 9: House Loan proportion by profession

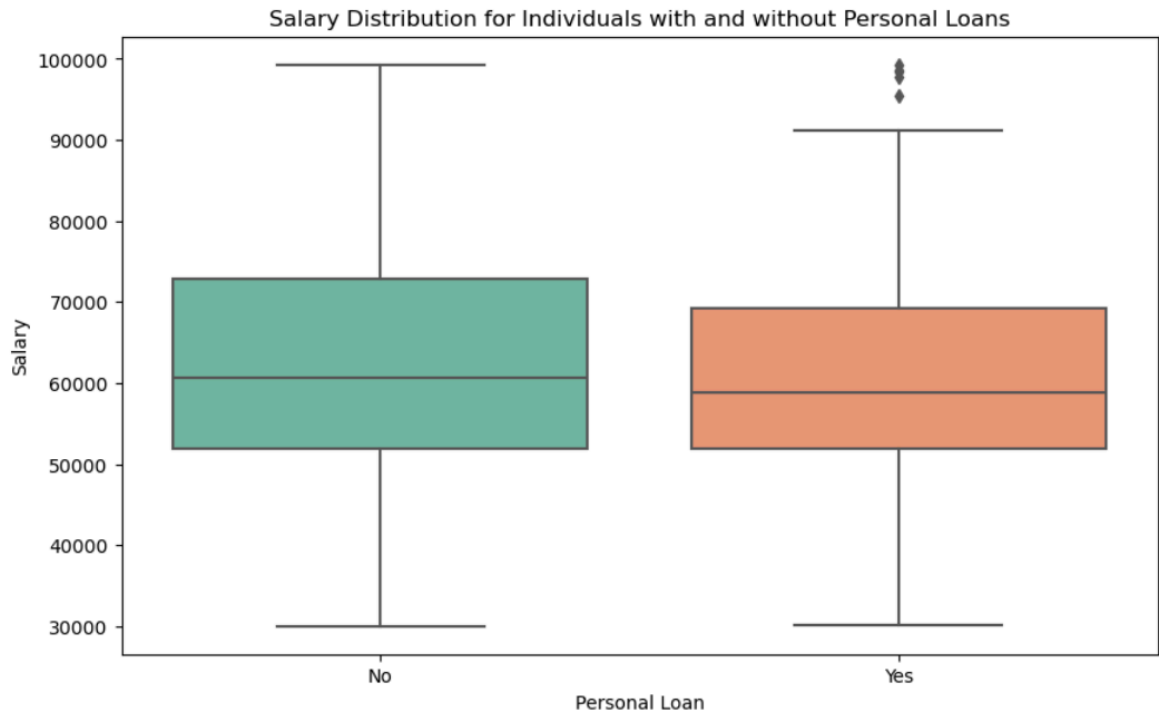
Observation

We can infer that:

- There are 33.43% people with Business as their profession who have house loans.
- There are 33.25% people with Salaried as their profession who have house loans.

10. Salary Distribution:

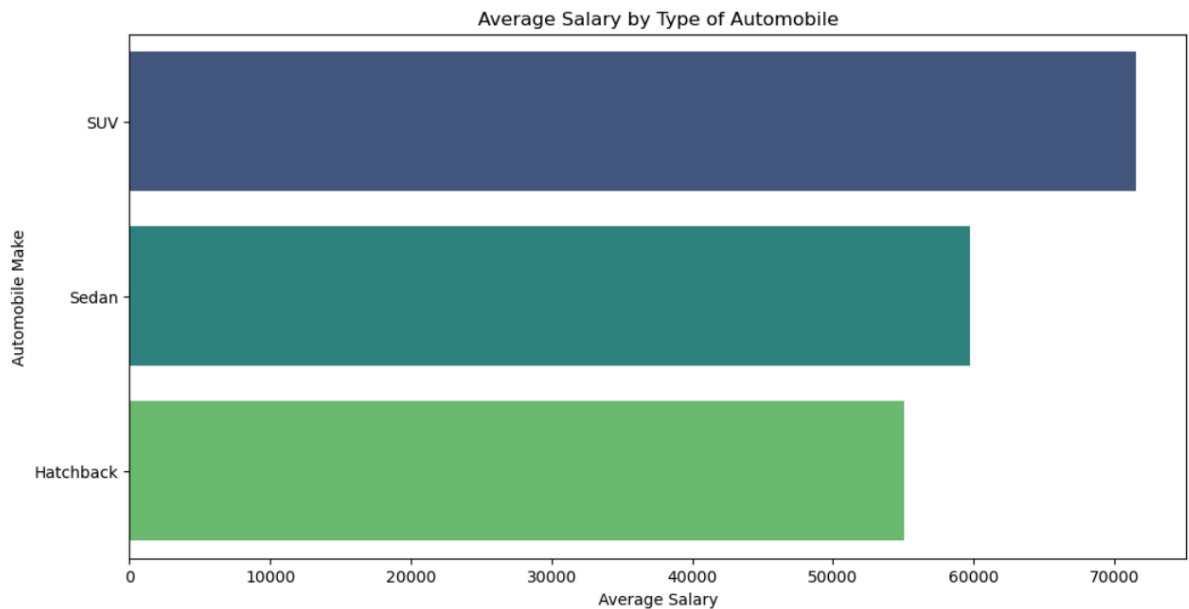
- What is the distribution of salaries for individuals with personal loans versus those without personal loans? Represent it using a box plot.



- Figure 10: Salary distribution by personal loans

11. Automobile Make Analysis:

How does the type of automobile relate to the salary of the individuals? Provide insights based on the make of the automobile.



- Figure 11: Average salary by Automobile make

Observation

We can see that:

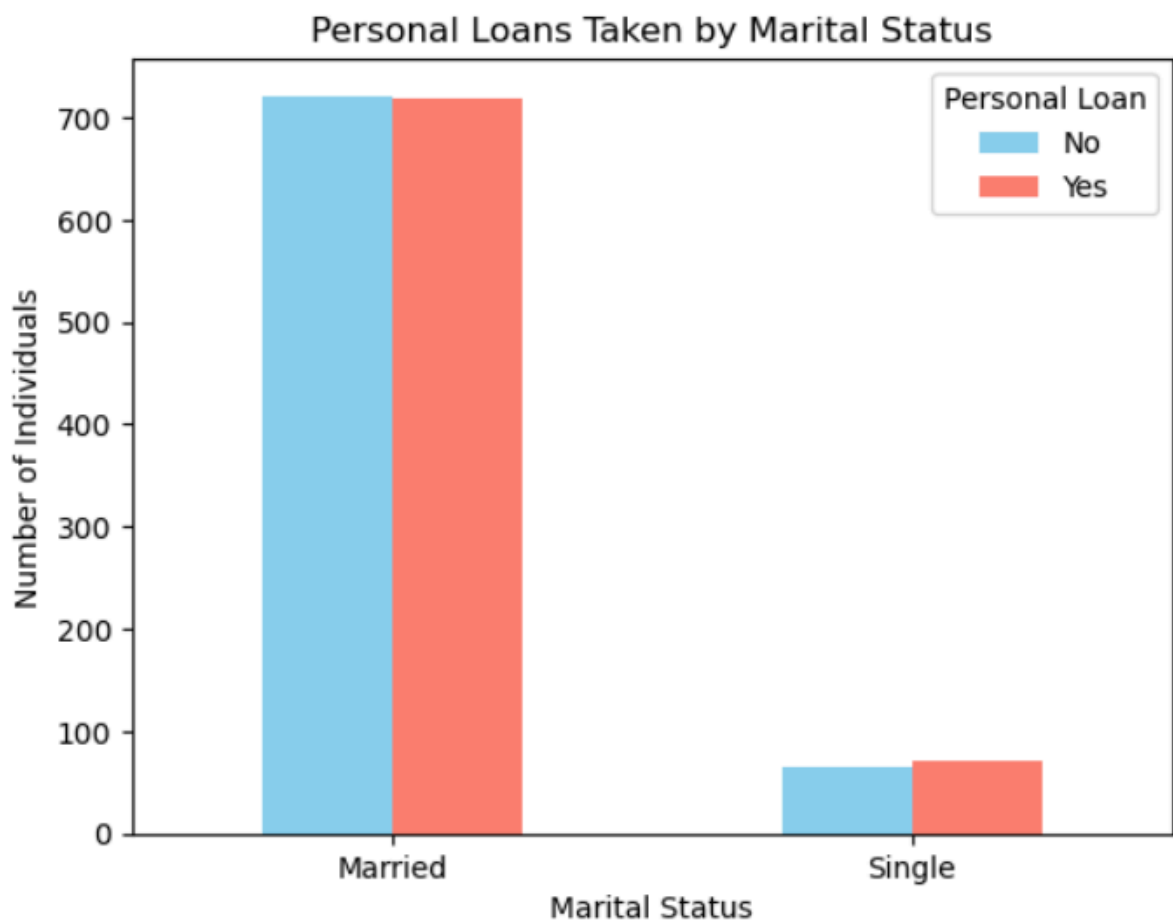
- The make of the Automobile is 'SUV' when the average salary is Rs. 71533.76
- The make of the Automobile is 'SEDAN' when the average salary is Rs. 59762.87
- The make of the Automobile is 'HATCHBACK' when the average salary is Rs. 55083.50

When the average salary is larger the automobile make is also the costlier one

As the salary decreases the make of automobile becomes the cheaper one

12. Marital Status and Loans:

Is there a significant difference in the number of personal loans taken by married individuals compared to single individuals?



- Figure 12: Personal loan by marital status

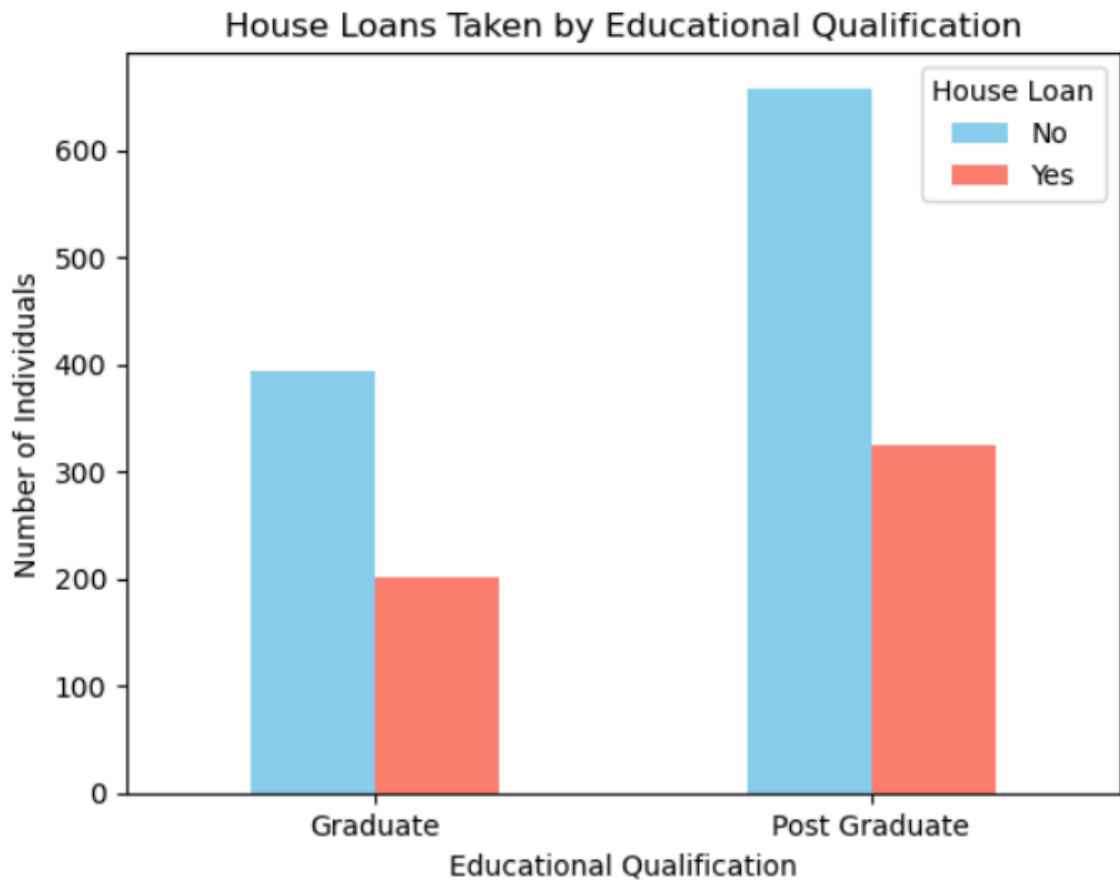
Observation

We can infer that:

- In case of married status there are 720 individuals who have personal loan and 723 individuals who do not have personal loan.
- In case of single status there are 72 individuals who have personal loan and 66 individuals who do not have personal loan.

13. Educational Qualification Impact:

How does educational qualification impact the likelihood of taking a house loan?



- Figure 13: House Loan by Educational qualification

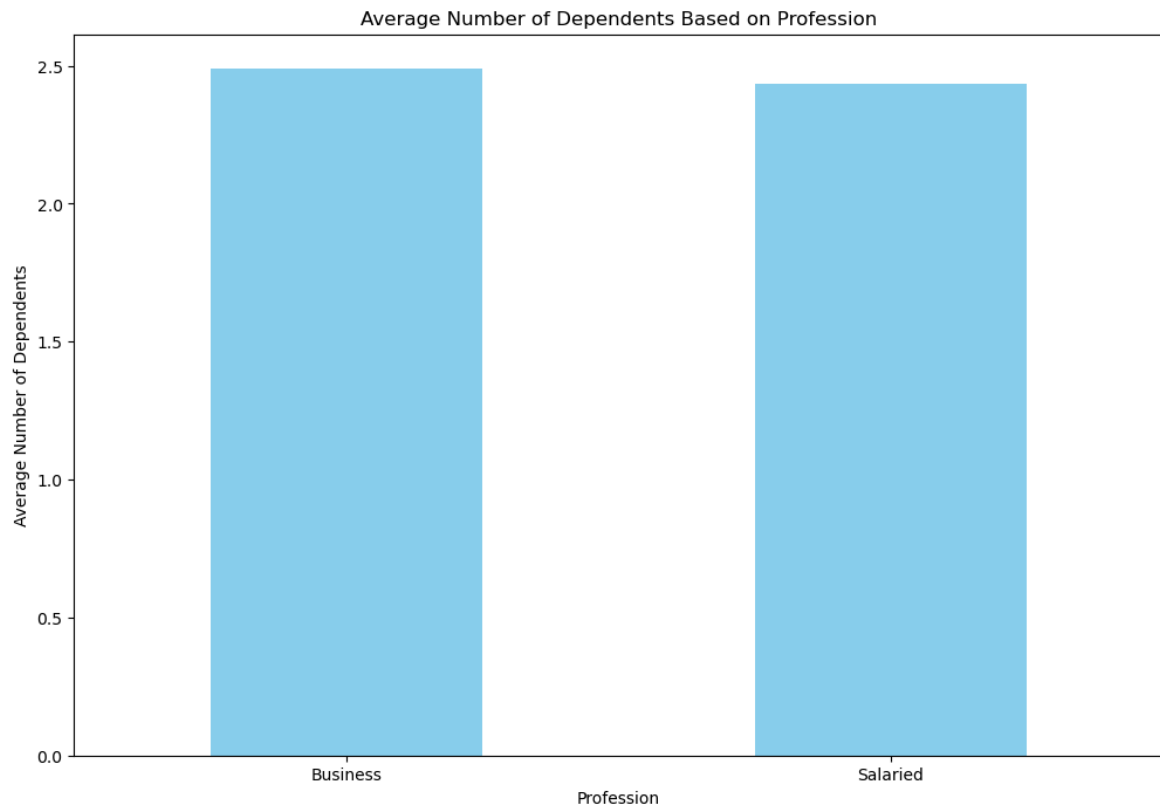
Obseravtion

From this we can infer that:

- In case of Graduate qualification the individuals with house loan are 202
- In case of Post Graduate qualification the individuals with house loan are 324
- This shows that individuals with Post Graduate Education take more house loan as compared to the individuals with Graduate education qualification

14. Dependent Count Analysis:

Analyze the number of dependents based on the profession of the individual. Which profession has the highest average number of dependents?



- Figure 14: Average dependents by profession

Observation

Individuals with Business profession has the highest number of dependents

15. Gender and Salary:

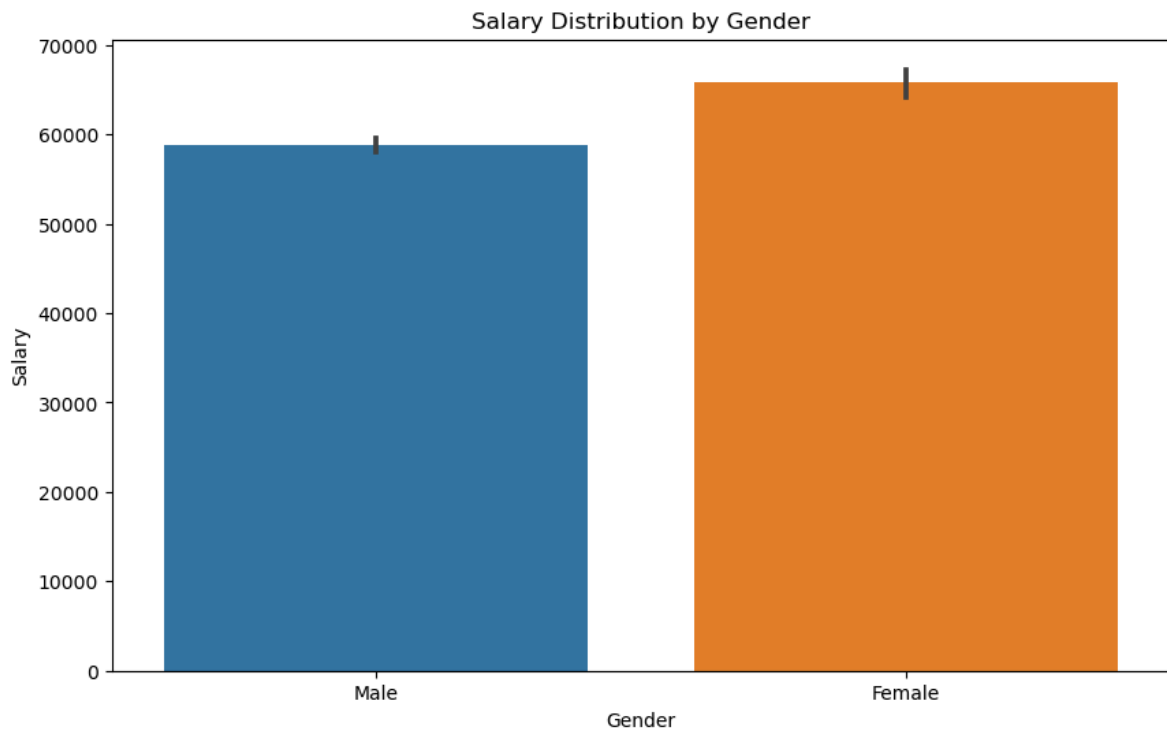
Is there a significant difference in salaries between males and females? Provide statistical evidence.

```

Descriptive statistics of salaries based on gender:
      count      mean      std      min      25%      50% \
Gender
Female   327.0  65816.513761  14380.357985  34800.0  56700.0  63900.0
Male   1251.0  58760.431655  14239.046917  30000.0  51200.0  58500.0

      75%      max
Gender
Female  77300.0  99300.0
Male   68950.0  99300.0

```



- Figure 15: Salary distribution by gender

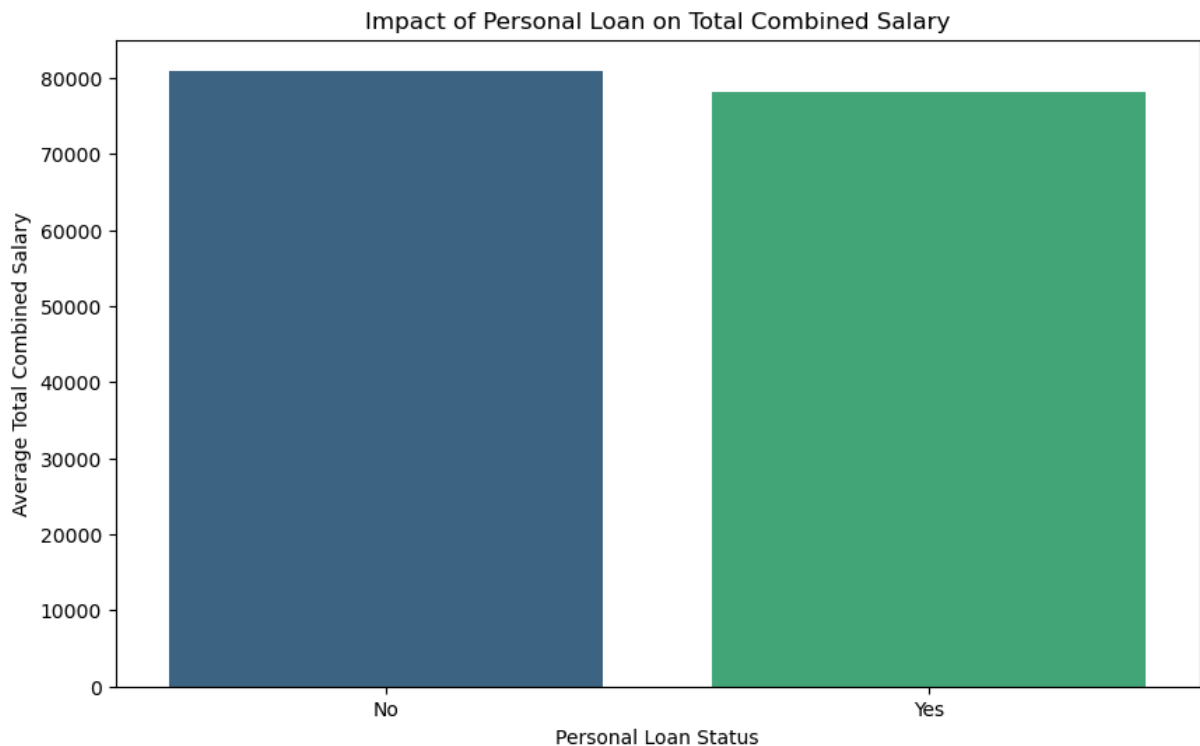
Observation

According to the statistical analysis:

- count of Male is 1251, whereas for Female is 327
- Mean salary for male is Rs. 58760.43, whereas for Female it is Rs. 65816.51
- Minimum salary for Male is Rs. 30000, whereas for Female it is Rs. 34800
- Maximum salary for both Male and Female is Rs. 99300

16. Loan Status Impact:

- How does having a personal loan affect the total combined salary of the individual and their partner?



- Figure 16: personal loan impact by total combined salary

Observation

Having a personal Loan does not much affect the total combined salary of the individual and their partners

17. Partner's Salary Contribution:

What is the average partner's salary for individuals with and without house loans?

```
Average partner's salary for individuals with house loans: 19661.216730038024  
Average partner's salary for individuals without house loans: 20975.190114068442
```

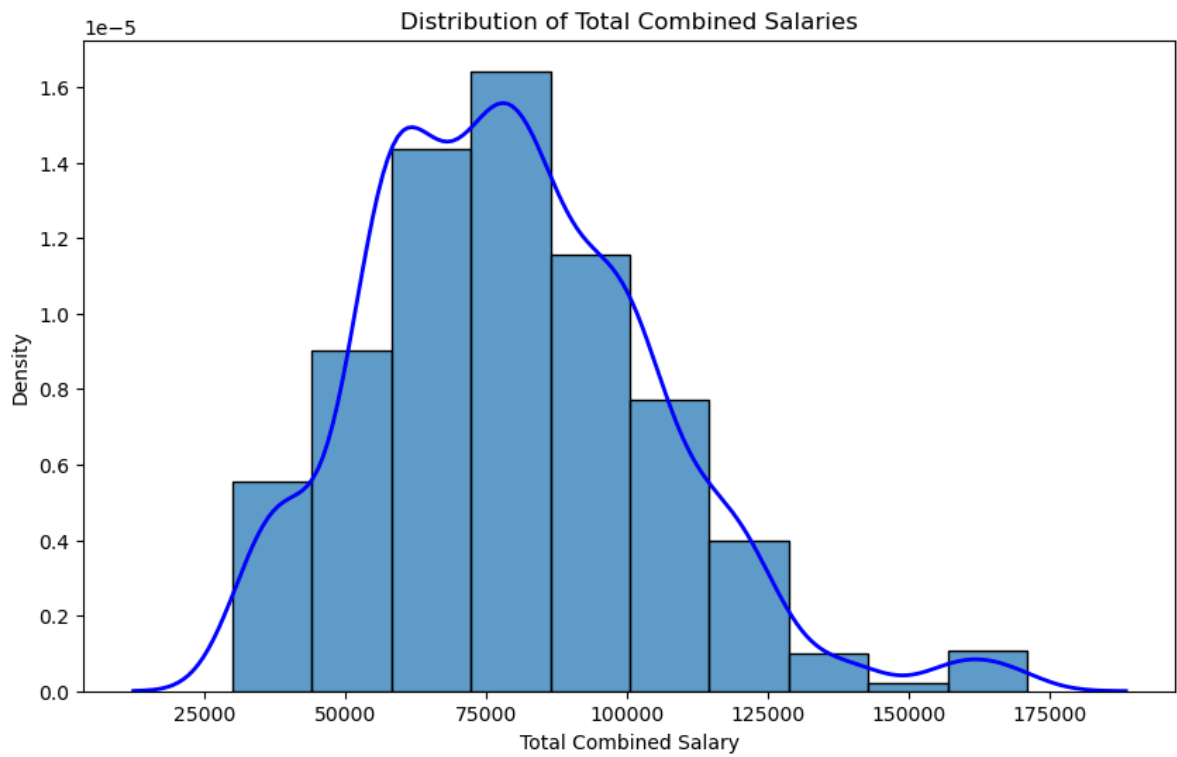
Observation

Average salary of partner for individuals with house loan are: Rs 19661.21

Average salary of partner for individuals without house loan are: Rs 20975.19

18. Total Salary Distribution:

Create a histogram showing the distribution of total combined salaries. Identify and discuss any skewness or outliers in the data.



- Figure 17: Distribution of total combined salary

THANK YOU

In []: