

## Assignment-based Subjective Questions

1. From your analysis of the categorical variables from the dataset, what could you infer about their effect on the dependent variable? (3 marks)

Ans. There were 6 categorical variables in the dataset.

We used Box plot (refer the fig above) to study their effect on the dependent variable ('cnt').

The inference that We could derive were:

- **season:** Almost 32% of the bike booking were happening in season3 with a median of over 5000 booking (for the period of 2 years). This was followed by season2 & season4 with 27% & 25% of total booking. This indicates, season can be a good predictor for the dependent variable.
- **mnth:** Almost 10% of the bike booking were happening in the months 5,6,7,8 & 9 with a median of over 4000 booking per month. This indicates, mnth has some trend for bookings and can be a good predictor for the dependent variable.
- **weathersit:** Almost 67% of the bike booking were happening during 'weathersit1 with a median of close to 5000 booking (for the period of 2 years). This was followed by weathersit2 with 30% of total booking. This indicates, weathersit does show some trend towards the bike bookings can be a good predictor for the dependent variable.
- **holiday:** Almost 97.6% of the bike booking were happening when it is not a holiday which means this data is clearly biased. This indicates, holiday CANNOT be a good predictor for the dependent variable.
- **weekday:** weekday variable shows very close trend (between 13.5%-14.8% of total booking on all days of the week) having their independent medians between 4000 to 5000 bookings. This variable can have some or no influence towards the predictor. I will let the model decide if this needs to be added or not.
- **workingday:** Almost 69% of the bike booking were happening in 'workingday' with a median of close to 5000 booking (for the period of 2 years). This indicates, workingday can be a good predictor for the dependent variable

2. Why is it important to use drop\_first=True during dummy variable creation? (2 mark)

Ans. In this case study we have below code which uses drop\_first

```
bike_shr_new = pd.get_dummies(bike_shr_new, drop_first=True)
```

This code does 3 things:

- 1) Create Dummy variable
- 2) Drop original variable for which the dummy was created
- 3) Drop first dummy variable for each set of dummies created.

3. Looking at the pair-plot among the numerical variables, which one has the highest correlation with the target variable? (1 mark)

Ans. Pair-Plot tells us that there is a Linear relation between variables 'atemp' and 'cnt'

Where cnt being target variable.

4. How did you validate the assumptions of Linear Regression after building the model on the training set? (3 marks)

Ans. By using the training model to predict test data also doing hypotheses testing on the final model we prove that our assumptions are true.

5. Based on the final model, which are the top 3 features contributing significantly towards explaining the demand of the shared bikes?

Ans. temp, year, season4

*season4 = Heavy Rain + Ice Pallets + Thunderstorm + Mist, Snow + Fog*

## General Subjective Questions

1. Explain the linear regression algorithm in detail. (4 marks)

Ans. Linear Regression, a foundational algorithm in data science, plays a pivotal role in predicting continuous outcomes. It predicts the relationship between two variables by assuming a linear connection between the independent and dependent variables. It seeks the optimal line that minimizes the sum of squared differences between predicted and actual values.

2. Explain the Anscombe's quartet in detail. (3 marks)

Ans. Anscombe's quartet is a group of datasets (x, y) that have the same mean, standard deviation, and regression line, but which are qualitatively different. It is often used to illustrate the importance of looking at a set of data graphically and not only relying on basic statistic properties.

3. What is Pearson's R? (3 marks)

Ans. The **Pearson correlation coefficient** ( $r$ ) is the most common way of measuring a linear correlation. It is a number between  $-1$  and  $1$  that measures the strength and direction of the relationship between two variables.

Between 0 and 1	Positive correlation	When one variable changes, the other variable changes in the same direction.	Baby length & weight:  The longer the baby, the heavier their weight.
0	No correlation	There is no relationship between the variables.	Car price & width of windshield wipers: The price of a car is not related to the width of its windshield wipers.
Between 0 and -1	Negative correlation	When one variable changes, the other variable changes in the opposite direction.	Elevation & air pressure: The higher the elevation, the lower the air pressure.

4. What is scaling? Why is scaling performed? What is the difference between normalized scaling and standardized scaling? (3 marks)

Ans. Scaling (geometry), a linear transformation that enlarges or diminishes objects. Scale invariance, a feature of objects or laws that do not change if scales of length, energy, or other variables are multiplied by a common factor. Standardization centers data around a mean of zero and a standard deviation of one, while normalization scales data to a set range, often [0, 1], by using the minimum and maximum values.

5. You might have observed that sometimes the value of VIF is infinite. Why does this happen? (3 marks)

Ans. when multicollinearity is perfect then VIF is infinite. A large value of VIF indicates that there is a correlation between the variables. If the VIF is 4, this means that the variance of the model coefficient is inflated by a factor of 4 due to the presence of multicollinearity.

6. What is a Q-Q plot? Explain the use and importance of a Q-Q plot in linear regression. (3 marks)

Ans. The quantile-quantile plot is a graphical method for determining whether two samples of data came from the same population or not. A q-q plot is a plot of the quantiles of the first data set against the quantiles of the second data set. By a quantile, we mean the fraction (or percent) of points below the given value.