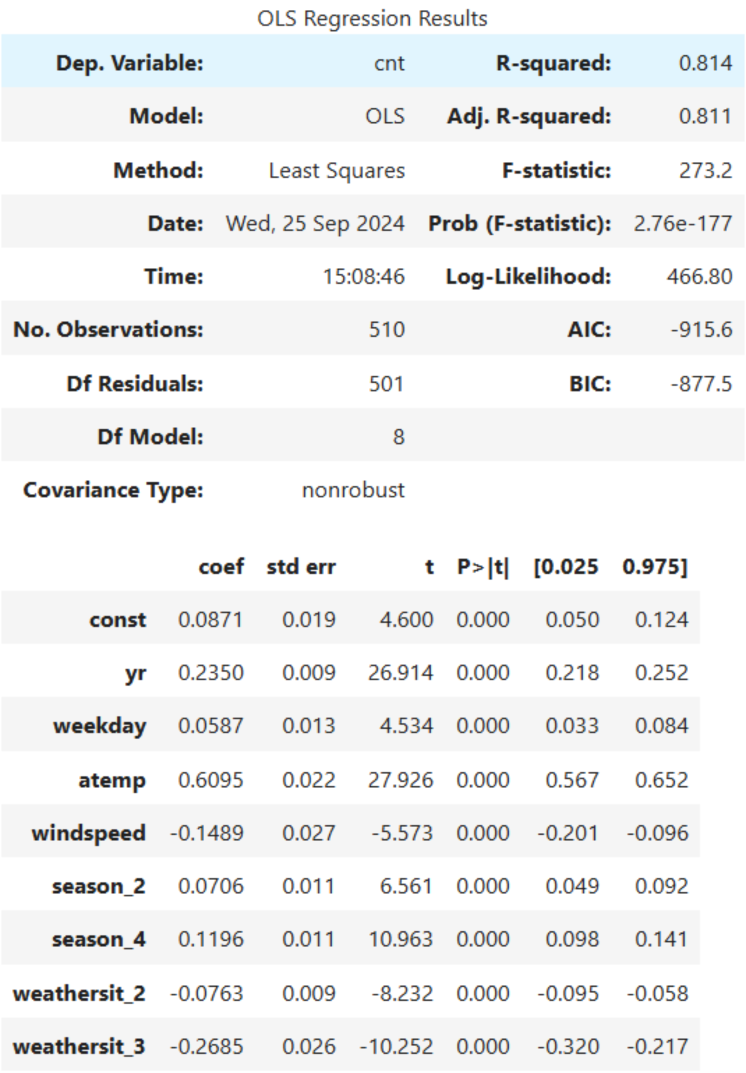
Assignment-based Subjective Questions

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

Ans: Based on the linear regression analysis done on the data set I can see that for the training data adjusted R-square comes to be .811 which means that the model is able to explain 81.1% variance in target variable cnt.

Using the same model for the test data set the adjusted R-square comes out to be .787 which is very close to .811 hence there is no overfitting present in the model.

Final model details including coefficients of all the features present in the final model is shown below.



OLS Regression Results

Dep. Variable:	cnt	**R-squared:**	0.814
Model:	OLS	**Adj. R-squared:**	0.811
Method:	Least Squares	**F-statistic:**	273.2
Date:	Wed, 25 Sep 2024	**Prob (F-statistic):**	2.76e-177
Time:	15:08:46	**Log-Likelihood:**	466.80
No. Observations:	510	**AIC:**	-915.6
Df Residuals:	501	**BIC:**	-877.5
Df Model:	8		
Covariance Type:	nonrobust		

	coef	**std err**	**t**	**P>|t|**	**[0.025**	**0.975]**
const	0.0871	0.019	4.600	0.000	0.050	0.124
yr	0.2350	0.009	26.914	0.000	0.218	0.252
weekday	0.0587	0.013	4.534	0.000	0.033	0.084
atemp	0.6095	0.022	27.926	0.000	0.567	0.652
windspeed	-0.1489	0.027	-5.573	0.000	-0.201	-0.096
season_2	0.0706	0.011	6.561	0.000	0.049	0.092
season_4	0.1196	0.011	10.963	0.000	0.098	0.141
weathersit_2	-0.0763	0.009	-8.232	0.000	-0.095	-0.058
weathersit_3	-0.2685	0.026	-10.252	0.000	-0.320	-0.217

2. Why is it important to use **drop_first=True** during dummy variable creation?

Ans: It's important to drop 1 column while creating dummy variables as the same amount of information can be stored in n-1 variables if there are n unique values for a categorical variable.

If we don't use drop_first=true, then n dummy variables will be created for the categorical variable which is more than the required number by 1 and hence **the adjusted R-square of the model might decrease**.

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

Ans: Looking the pair-plot among the numerical variables ***atemp*** variable seems to have highest correlation with the target variable.

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

Ans: I validated the assumptions of linear regression after building the model by calculating the error values on the training data set and then plotting a histogram for these values.
Based on the histogram I can see the following things about the error distribution:

- Is a normal distribution.
- It has a mean of 0.

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

Ans: Looking at the coefficients of features selected in the final model I can see that these are the top 3 features contributing the most towards explaining the demand of shared bikes.

1. ***atemp*** – Demand goes up as the feels like temperature goes up.
2. ***Year*** – The demand is increasing with time.
3. ***Weather Situation*** – There is negative correlation between demand and weather indicating that if the weather is bad (e.g. Heavy Rain, Ice Pallets, etc.) the demand goes down.

General Subjective Questions

1. Explain the linear regression algorithm in detail.

Ans: Linear regression algorithm is used to identify a linear relation ship between a dependent variable and a set of independent variables.

Using this algorithm a dependent variable can be represented as a linear equation shown below.

Target-variable = beta-0 + beta-1 X var1 + beta-2 X var2 +…+ beta-n X varn

Generally gradient descent method is used to calculate these coefficients.

2. Explain the Anscombe's quartet in detail.

3. What is Pearson's R?

4. What is scaling? Why is scaling performed? What is the difference between normalized scaling and standardized scaling?

Ans: Scaling is the process of bringing the values of variables in a certain range by dividing the original values with a certain constant.

Features are scaled before they used for creating the linear regression so that they are processed in a comparable scale. This helps with interpretation of the variables. Also, this leads to faster conversions for gradient descent methods.

There are 2 methods of performing scaling:

- Standardization – It brings all the data into a standard normal distribution with mean zero and standard deviation one.
  - This is done by subtracting the mean of data set with each value and then dividing by standard deviation of the data set.

- Min-Max Scaling – This process brings all the data in the range of 0 and 1.
  - This is done by subtracting the minimum value of data set with each value and then dividing by the difference between the maximum and minimum values.

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

Ans: If a variable is completely correlated by other variables in the data set, then the R-square value for this variable will be 1 considering the formula of VIF which is, 1/(1-R^2) the VIF would become 1/0 which is infinite.

This essentially means that this variable is completely redundant and can be fully covered by other variables in the data set. It should be dropped before the model is generated.

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