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**HW 3**

**Q1 - Show that the following relationship on the simple linear regression class notebook is true:**

**Text

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**Answer:**

Let’s expand for RHS

Hence proved.

**Q2 - We showed that in a simple linear regression, the MLE estimates for 𝛽1 and 𝛽0 are the same as the OLS**

**estimates.**

**Answer:**

Log likelihood function for the simple linear reaeration can be written as bellow,

Now differentiate LL with respect to ,

Now let’s do MLE for . Which can be done by setting derivation to 0.

Hence proved.

**Q3 - In a simple linear regression, show that the OLS regression line always passes through the mean**

**(average) of both 𝑥 and 𝑦.**

**Answer:**

We know that

And this is true for all the values of I (1, 2, 3, ….. ,n)

So, lets write individual formula

. . . .

. . . .

. . . .

. . . .

Now sum up all the equation

+ + + …….. + = () + + ………… + ()

Which is equivalent to

Dividing equation by n

And here andis just a mean of X and Y ()

Hence proved that OLS regression line always passes through the mean (average) of both 𝑥 and 𝑦

**Q4 -**

**Text

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**Answer:**

1. Generally, in most of the workplaces, schools, collages etc. Sunday is considered as a holiday and in our model, we already have holiday as one independent variable. Hence there is no need to consider Sunday as a separate independent variable. Or one other view can be that when value of all the dummy variable is then it automatically means that it is Sunday.
2. Here intercept is 458.5 which represents the avg munities of sleep an average person get no matter what the day is. And if we convert this intercept into hours then it is 7.6 hours. According to many scientific studies an average person takes a sleep of 7 to 8 hours of sleep. So, this intercept dose makes sense.

**Q5 –**

**Diagram

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**Answer:**

𝛽0 will be positive no matter male is 0 or 1 as it is an intercept.

𝛽1 will be positive as we can clearly infer from the graph that as exp increases wage of a person increases.

𝛽2 will be positive as we can clearly observe from the graph that if person is male his wage rises.

𝛽3 will also be positive as graph clearly tells us that if person is male with more experience than his wage will be higher.