Solutions Friday Quiz 1

Q8 - Partial Slope Misinterpretation

Question Text: Explain what is wrong with this interpretation: "In Model 3 (mpg ~ wt + hp), the coefficient for hp is -0.03177, which means that increasing hp always increases mpg by this exact amount. Be as detailed as possible."

Ideal Answer: The interpretation is incorrect in two ways:

1. **Incorrect direction** – The coefficient for `hp` is negative (-0.03177), which indicates that as horsepower increases, **mpg decreases**, not increases.
2. **Failure to hold other variables constant** – In multiple linear regression, each coefficient (or partial slope) represents the effect of that variable **while holding all other variables constant**. So the interpretation should state that *for a fixed weight*, increasing `hp` by 1 unit is associated with a **decrease** in `mpg` by approximately 0.03177.
3. **Did not mention on average** – The interpretation should also clarify that this is an average effect, as the relationship may not hold for every individual observation.

Rubric (4 points total):

Points	Criteria
1.5 pts	Correctly identifies that the sign of the slope is negative (i.e., `hp` leads to a **decrease** in `mpg`)
1.5 pts	Correctly explains that the coefficient reflects the effect of `hp` *holding weight constant* (i.e., partial slope interpretation in MLR)
1 pt	Mentions that the coefficient is an average effect (i.e., it may not hold for every individual observation)

Q9 - Prefer Model 2?

Question Text:

> Why might you prefer Model 2 (mpg ~ wt) over Model 1 (mpg ~ hp), even if both are simple linear regressions? Be as detailed as possible.

Ideal Answer: Model 2 is preferred over Model 1 based on several model fit criteria:

- **Higher R^2 and Adjusted R^2**: Model 2 explains more variance in `mpg` than Model 1.
- **Lower RSS**: Model 2 has an RSS of 278.32 vs. 447.67 for Model 1, meaning Model 2 fits the data better.
- **Lower RSE (Residual Standard Error)**: Model 2 has 3.05 vs. 3.86 in Model 1, suggesting less spread in residuals.
- **Lower AIC/BIC**: Model 2 has a better trade-off between fit and complexity.

All these indicators suggest that `wt` is a stronger predictor of `mpg` than `hp`, and Model 2 performs better across multiple metrics.

Rubric (4 points total):

Points	Criteria
1 pt	Mentions lower RSS or lower RSE
1 pt	Mentions higher R^2 or adjusted R^2
2 pt	Correct overall comparison or mentions `wt` is a stronger predictor

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