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**Subject: Project 2**

**Class: DSCI 512**

**Section: 01W**

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1. Use the lm() function to perform a simple linear regression with the response mpg and the predictor hp.

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1. Is there a relationship between the target mpg and predator hp?

**Yes**, the t-test for hp results in a p-value of 2.72e-09, which is significantly low, indicating a strong relationship. Since this is a simple linear regression, the F-test yields the same conclusion:

* t-value = -7.658
* Squaring the t-value: (-7.658)2 = 58.65, which equals the F-value.

Thus, the p-values from both the t-test and F-test are identical in this case.

1. How strong is the relationship between the response and predictor?

The p-value from the t-test is far below the 0.05 threshold, indicating a **strong relationship** between the predictor and the response variable. Additionally, the R2 value suggests that this variable alone explains 60% of the variation in the model. The F-test can also serve as a useful indicator.

1. Is the relationship between mpg and hp positive or negative?

**Negative**, as hp goes up, mpg goes down.

1. What is the predicted mpg associated with a horsepower (hp) of 100? What’s the 95% confidence interval for the predicted mpg?

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* The **predicted mpg** for a car with 100 horsepower is **22.84317 mpg**.
* The **lower bound** of the 95% confidence interval is **21.5279 mpg**.
* The **upper bound** of the 95% confidence interval is **24.15844 mpg**.

1. Plot the response and the predictor and add the regression line using abline().

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1. Perform a multiple linear regression with mpg as the response and the predictors cyl, disp, hp, wt, vs, and gear. Print out the results using summary() function.

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1. Is there a relationship between the predictors and the response?

**Yes**, some predictors show a significant relationship with the response variable, as evidenced by the F-statistic of 30.5 and a p-value of 2.568e-12.

1. Which predictors appear to have a statistically significant relationship to the response?

The variables **wt (weight)** and **hp (gross horsepower)** have p-values of **0.00012** and **0.02061**, respectively, based on their t-tests.

1. Use \* symbols to fit linear regression models with interaction effects between hp and wt. Does this interaction appear to be statistically significant?

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**Yes**, the interaction has a p-value of 0.000362 < alpha = 0.05