# MAT 303 Module One Problem Set Report

Multiple Regression

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Note: Replace the bracketed text on page one (the cover page) with your personal information.

## Introduction

*Discuss the statement of the problem with regard to the statistical analyses that are being performed. Address the following questions in your analysis:*

* *What is the data set that you are exploring?*
* *How might your results be used?*
* *What type of analyses will you be running in this problem set?*

Caution sign icon Answer the questions in a paragraph response. Remove all questions and this note before submitting! Do not include R code in your report.

## Data Preparation

*There are some important variables that you have been asked to analyze in this problem set. Identify and explain these variables. Address the following questions in your analysis:*

* *What are the important variables in this data set?*
* *How many rows and columns are present in this data set?*

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## Multiple Regression Model

### Correlation Analysis

*Visualize and describe the relationships between variables in the data set. Address the following questions in your analysis:*

* *Create a scatterplot of fuel efficiency (mpg) against rear axle ratio (drat) and include a copy in this report. What can you say about the relationship between these two variables?*
* *Create a scatterplot of fuel efficiency (mpg) against horsepower (hp) and include a copy in this report. What can you say about the relationship between these two variables?*
* *Calculate Pearson Correlation Coefficients between fuel efficiency and rear axle ratio and between fuel efficiency and horsepower. Comment on the strength and direction of these correlation coefficients.*

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### Reporting Results

*Report the results of the regression model. Address the following questions in your analysis:*

* *Write the general form and the prediction equation of multiple regression model for fuel efficiency (mpg) as the response variable and rear axle ratio (drat) and horsepower (hp) as predictors.*
* *Create a multiple regression model for fuel efficiency (mpg) as the response variable and rear axle ratio (drat) and horsepower (hp) as predictors. Write the prediction model equation using outputs obtained from your R script.*
* *What are the values of R-Squared(R-squared) and Adjusted R-Squared (Adjusted R-squared) for the model? Provide your interpretation of these statistics.*
* *Interpret the beta estimates for rear axle ratio and horsepower.*
* *What is a fitted value and what is a residual?*
* *Obtain fitted values and residuals for the data set and create the following plots:* 
  + *Residuals against Fitted Values*
  + *Normal Q-Q plot*
* *Based on these plots, what can you say about the assumptions of homoscedasticity and normality of the residuals? Be detailed in your response.*

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### Evaluating Model Significance

*Evaluate model significance for the regression model. Address the following questions in your analysis:*

* *Is the model significant at a 5% level of significance? Carry out the overall F-test by identifying the null hypothesis, the alternative hypothesis, the P-value, and the conclusion of the test.*
* *Are the variables rear axle ratio and horsepower significant at a 5% level of significance? Carry out individual beta tests by identifying the null hypothesis, the alternative hypothesis, the P-value, and the conclusion of the test.*
* *Create a 95% confidence interval for the parameter estimates of rear axle ratio and horsepower. Interpret these intervals.*

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### Making Predictions Using the Model

*Make predictions using the regression model. Address the following questions in your analysis:*

* *What is the predicted fuel efficiency (miles per gallon) for a car that has a rear axle ratio of 3.15 and a horsepower of 120? Suppose that this car achieves an average of 20.5 miles per gallon. What is the residual for this observation?*
* *What is the 95% prediction interval for the car identified in the previous question? Interpret this interval.*
* *What is the 95% confidence interval for the car identified in the previous question? Interpret this interval.*
* *Why is the prediction interval wider than the confidence interval?*

Caution sign icon Answer the questions in a paragraph response. Remove all questions and this note before submitting! Do not include R code in your report.

## Conclusion

*Describe the results of the statistical analyses and address the following questions:*

* *Based on the analysis that you have performed and assuming that the sample size is sufficiently large, would you recommend using this model? Why or why not?*
* *Fully describe what these results mean in your scenario using proper statistical terms and concepts.*
* *What is the practical importance of the analyses that were performed?*

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## Citations

*You are not required to use external resources for this report. If none were used, remove this entire section. However, if you used any resources to help you with your interpretation, you must cite them. Use proper APA format for citations.*

*Insert references here in the following format:*

Author's Last Name, First Initial. Middle Initial. (Year of Publication). Title of book: Subtitle of book, edition. Place of Publication: Publisher.