Review for Exam 1

You are not required to write any SAS code for this exam, however, you will be answering questions based on the SAS output (with certain key values possibly removed). The missing values can be calculated from the values provided. To review, look at the questions that were asked about interpretation of the results on the homework problem sets.

Topic 1

- 1. Be able to write down the linear regression model including the distribution of the error terms given a particular situation.
- 2. Be able to write down the estimated regression equation given the SAS output.
- 3. Be able to state the difference between the linear regression model and the estimated regression equation.
- 4. Given a function of the original explanatory variable, be able to determine the new regression model in terms of the old model.
- 5. Be able to write down the estimated value of σ^2 given the SAS output.
- 6. Be able to calculate and interpret the confidence interval for β_0 and β_1 given b_0 and $s(b_0)$ and/or b_1 and $s(b_1)$ from the SAS output.
 - a. You will need to determine df and t_c by hand.
- 7. Be able to perform a significance test for β_0 and β_1 given b_0 and $s\{b_0\}$ and/or b_1 and $s\{b_1\}$ and appropriate p values from the SAS output. This includes
 - a. the null and alternative hypothesis
 - b. test statistic with degrees of freedom
 - c. p-value and decision
 - d. conclusion in words.
- 8. Be able to state whether it is appropriate to perform a significance test for β_0 and why.
- 9. Be able to calculate a predicted value for the response variable given a particular value of the explanatory variable.
 - a. Given the actual value of the response variable, be able to calculate the residual.
- 10. Be able to calculate and interpret the confidence interval for the estimate of the mean of a particular value of the explanatory variable given $s{\hat{Y}_h}$.
- 11. Be able to calculate and interpret the prediction interval of a particular value of the explanatory variable given s{pred}.
- 12. Be able to state the difference between a confidence interval for the estimate of the mean at a particular value and the prediction interval for the same value and explain the cause of the difference.
- 13. Be able to state why you want to have a confidence band for the entire regression line.
- 14. In the ANOVA table
 - a. Given the number of data points, be able to calculate all of the degrees of freedom.
 - b. Given the appropriate values of SSM, SSE, SST, MSM, MSE and/or F, be able to calculate the rest of them
 - c. Be able to interpret the p-value (you will NOT have to calculate it).
- 15. Be able to perform the F- test using the ANOVA table
 - a. See Objective 7 for details..
- 16. Be able to state the differences and similarities between the F and t-tests.
- 17. Be able to calculate and interpret the coefficient of determination given the ANOVA table.
- 18. Be able to state the limitations of using R^2 .

Topic 2

- 19. Be able to state the assumptions that are required for the linear regression model to be valid and how to check (specific quantities or plots) whether the assumptions are valid or not.
- 20. Given the appropriate plots, be able to determine if the linear regression model is valid or not with an explanation of why or why not.
- 21. Given a problem with the assumptions, describe what methods can be used to possibly correct them.
- 22. Given a scatterplot or residual plot, be able to state which X transformation should be tried.
- 23. Using the output from SAS, determine what Y transformation should be tried.
- 24. Using the Bonferroni correction, be able to calculate the joint confidence interval of β_0 and β_1 given b_0 and $s(b_0)$ and b_1 and $s(b_1)$ from the SAS output. The appropriate value of t_c will be obtainable from the table in the back of the book.

Topic 3

- 25. Be able to write down the following matrices (including their dimensions) for simple linear regression or multiple regression: response vector, design matrix, parameter vector and error vector.
- 26. Be able the write the linear regression model in matrix form including the distribution of the error terms.
- 27. Be able to write down the equation for the **b** matrix.
- 28. Be able to write down the fitted regression equation in matrix form (both versions).
- 29. Be able to write down the model for multiple regression in both the full equation and in matrix form including the distribution of the error terms.
- 30. Be able to write down the estimated value of σ^2 given the SAS output (object 5 for multiple regression)
- 31. Be able to generate the ANOVA table for MLR (objective 14 for SLR).
- 32. Be able to perform the F- test using the ANOVA table including the significance test for MLR (objective 15 for SLR).
- 33. Be able to calculate the adjusted R^2 from the ANOVA table and state why the adjusted R^2 is used.
- 34. Be able to calculate the F value from the coefficient of multiple determination.
- 35. Be able to calculate the confidence intervals for each partial regression coefficient for MLR (objective 6 for SLR).
- 36. Be able to perform a significance test for each partial regression coefficient and interpret the result for MLR (objective 7 for SLR).
- 37. Be able to explain the difference between the F-test and the t-test in multiple regression.
- 38. Be able to calculate and interpret the confidence interval for the estimate of the mean of a particular value of the explanatory variable given s{ \hat{Y}_h } for MLR (objective 10 for SLR).
- 39. Be able to calculate and interpret the prediction interval of a particular value of the explanatory variable given s{pred} for MLR (objective 11 for SLR).
- 40. Be able to do Topic 2 for multiple regression.
 - a. In addition, be able to interpret the scatter plots and the pairwise correlations between the variables.