

## STAT 511: Assignment #5

Spring 2021

Due at the beginning of class on Monday, March 29

### Instructions:

- Submit R code and any relevant R output, including figures, tables, tests, etc. If you have any handwritten answers, take pictures and compile into one file before submission.
- Upload a **maximum of two files** to CANVAS.
- This is an individual assignment. Collaboration is encouraged, but each person must write up their own solution.

Refer to the “Brand Preference” dataset (Brand.txt), answer Questions 1-4.

Column 1: Degree of brand liking ( $Y$ )

Column 2: Moisture content of the product ( $X_1$ )

Column 3: Sweetness of the product ( $X_2$ )

1. (a). Fit a multiple regression model to this dataset. Write down the estimated regression function.  
(b). Interpret the regression coefficients  $\hat{\beta}_0, \hat{\beta}_1, \hat{\beta}_2$  in words.  
(c). Test if **each of the two predictors** (partial slopes) in this regression are significant. Write down the null and alternative hypotheses, decision rule, and conclusion.  
(d). Find the 95% confidence intervals of the regression model coefficients  $\hat{\beta}_1, \hat{\beta}_2$ .

2. (a). Obtain the ANOVA table for your multiple regression model in Question 1.
- (b). Compute the  $R^2$  and adjusted  $R^2$  using the ANOVA table.
- (c). Interpret the adjusted  $R^2$  you computed in Part (b).
- (d). Conduct an F-test for overall model significance using the ANOVA table. Write down the null and alternative hypotheses, decision rule, and conclusion. The F-distribution critical value at 5%  $F_{0.05,2,13} = 3.8056$ .
3. (a). What is the fitted value of the degree of brand liking when moisture content is at 5 and sweetness is at 4?
- (b). Obtain a 95% interval estimate of the average degree of brand liking when moisture content is at 5 and sweetness is at 4. Interpret this interval.
- (c). Obtain a 95% interval estimate of a future degree of brand liking when moisture content is at 5 and sweetness is at 4. Interpret this interval.
4. Analyze the residuals from the MLR in Question 1
- (a). Use the “Component Plus Residual” (CPR) plots to conclude on linearity assumption.
- (b). Draw boxplot and histogram of residuals to conclude on normality assumption.
- (c). Conduct the Breusch-Pagan test to check if the equal variance assumption is satisfied.