Review for Final Exam

Tables Provided: Z table (Table III from the book), t table (Table V from the book), Studentized Range Distribution (Tukey q values) (Table VIII from the book)

New Material:

Chapter 12

- 1. Be able to determine which are the explanatory variable and the response variable.
- 2. Be able to interpret a scatterplot in terms of pattern, direction, strength, outliers, constant variance.
- 3. Be able to state the model for linear regression defining all of the terms and the assumptions for $\boldsymbol{\epsilon}$

 $Y = \beta_0 + \beta_1 X + \varepsilon$

- Be able to state the four assumptions for linear regression
 a) Given the appropriate graphs, determine if the assumptions are met (you will need to determine which graphs are appropriate)
- 5. Be able to calculate least squares regression line,

$$\hat{\beta}_1 = b_1 = \frac{S_{XY}}{S_{XX}}, \hat{\beta}_0 = b_0 = \bar{y} - b_1 \bar{x}$$

- 6. Be able to make a point prediction using the regression line.
- 7. Be able to calculate the residual, $e_i = y_i \hat{y}_i$
- Be able to calculate the ANOVA table for linear regression via hand (fill in the boxes and know equations) Remember no summations need to be performed. See note for the ANOVA table for ANOVA for more details.

Source	df	SS (Sum of Squares)	MS (Mean Square)
Regression	1	$\sum_{i=1}^{n} (\hat{y}_i - \bar{y})^2$	$\frac{SSR}{dfr}$
Error	n - 2	$\sum_{i=1}^{n} (y_i - \hat{y}_i)^2$	SSE dfe
Total	n - 1	$\sum_{i=1}^{n} (y_i - \bar{y})^2$	

a) SST = S_{YY}

b) SSR = $b_1 S_{XY}$

c) SST = SSR + SSE

b) dft = dfr + dfe

9. Be able to calculate and interpret the standard deviation about the least squares line (point estimate)

 $\hat{\sigma}=s=\sqrt{MSE}$

10. Be able to calculate the coefficient of determination and know how the question is asked $r^2 = \frac{SSR}{r^2}$

$$r^2 = \frac{1}{SST}$$

- 11. Be able to interpret R² including what it doesn't tell you.
 - a) linearity
 - b) outliers

c) good prediction

12. Be able to perform hypothesis test for association (model utility test) with a test statistic of $\frac{MSR}{E} = \frac{MSR}{E}$

$$F_{ts} = \overline{MSE}$$

13. Be able to calculate and interpret the confidence interval for β_1

$$b_1 \pm t_{\alpha/2,df} SE_{b1} = b_1 \pm t_{\alpha/2,df} \sqrt{\frac{MSE}{S_{XX}}}$$

df = dfe = n - 2

14. Be able to perform hypothesis tests for β_1 with a test statistic of

$$t = \frac{b_1 - \beta_{10}}{SE_{b1}}, SE_{b1} = \sqrt{\frac{MSE}{S_{XX}}}$$

- 15. Be able to state the similarities and differences between objectives 12, 13, and 14.
- 16. Be able to calculate the sample correlation

$$a) r = \frac{S_{xy}}{\sqrt{S_{xx}S_{yy}}}$$

- b) from the ANOVA table and the sign of the slope.
- 17. Be able to interpret r
 - a) What happens when you switch X and Y
 - b) Sign of r
 - c) What is meant by uncorrelated (r = 0)
 - d) How r relates to the association of X and Y
 - e) Correlation doesn't provide information on form.
- 18. Be able to determine and explain when you cannot use linear regression because of extrapolation or other reasons.
- 19. Be able to state if there is causality in linear regression.

20. Be able to calculate the confidence interval for the mean value at $x = x^*$. a) The estimated value is the \hat{y}_{x^*}

b)
$$SE_{\hat{\mu}^*} = \sqrt{MSE\left[\frac{1}{n} + \frac{(x^* - \bar{x})^2}{S_{XX}}\right]}$$

c) df = n - 2

21. Be able to calculate the prediction interval at $x = x^*$. a) The estimated value is the \hat{y}_{x^*}

b)
$$SE_{\hat{y}*} = \sqrt{MSE\left[1 + \frac{1}{n} + \frac{(x^* - \bar{x})^2}{S_{XX}}\right]}$$

c) df = n - 2

22. Be able to state the difference between the confidence interval for the mean response at $x = x^*$ and the prediction interval for a particular value and when each would be used.

General Inference Questions

- 23. For a specific scenario, be able to identify best inference method to use.
- 24. There is a possibility that you will have to summarize the information in English sentences for all types of inference.
- 25. Be able to determine how far a specific situation can be generalized and under what conditions.
- 26. Be able to determine the practical consequences of the inference.

Midterms 1 and 2:

See the objectives for Midterms 1 and 2 for a complete list of the objectives. We will be going over specifics in class on Friday.