

## Homework 7

(Due Friday, March 31, by 4:00 p.m.)

Please submit your assignment *on paper*, following the Guidelines for Homework Write-Ups and Submissions. Please include your name (with your last name underlined), and your NetID at the top of the first page.

1. For this problem, you are not to use R / R Studio or any other software to solve, unless explicitly told to do so in part (d). A Calculator is allowed.

Let's revisit the study in Homework 6 for comparing average GPA for the members of three activity clubs at a university. Four students were randomly chosen from each club, and they were also separated by college. The results are given in the following table:

Club	College				$\bar{y}_{i\bullet}$
	Engineering	Education	Law	Business	
Drama	1.8	0.9	1.5	2.4	1.65
Writing	2.4	3.3	3.9	3.6	3.30
Statistics	2.1	2.4	3.0	3.9	2.85
$\bar{y}_{\bullet j}$	2.1	2.2	2.8	3.3	2.6

- (a) Construct an ANOVA table. Do NOT use a computer. Show your work.
- (b) Test whether or not there is a significant difference between clubs at the 5% level of significance. State the hypotheses, the test statistic, the critical value(s), a decision, and your interpretation of the result.
- (c) Test whether or not there is a significant difference between colleges at the 5% level of significance. State the hypothesis, the test statistic, the critical value(s), a decision, and your interpretation of the result.
- (d) Repeat parts (a) through (c) using R / R Studio. Include a printout of relevant code and tables.

2. For this problem, you are not to use R / R Studio or any other software to solve, unless explicitly told to do so in part (e). A Calculator is allowed.

In order to compare the average GPA for the members of three activity clubs at a university, eight students were randomly chosen from each club, and they were also separated by college. The results are given in the following table:

College	Club						$\bar{y}_{i\bullet\bullet}$
	Writing		Drama		Statistics		
Business	4.0	3.4	3.2	2.5	3.2	2.3	3.1
Education	2.5	3.3	1.5	2.4	2.8	3.7	2.7
Law	3.2	3.7	2.2	3.0	3.2	2.7	3.0
Engineering	1.9	2.8	1.5	2.1	3.3	2.8	2.4
$\bar{y}_{\bullet j\bullet}$	3.1		2.3		3.0		2.8

- (a) Construct an ANOVA table. Do NOT use a computer. Show your work.

Hint:  $\sum_{i=1}^4 \sum_{j=1}^3 \sum_{k=1}^2 \left( y_{ijk} - \bar{y}_{ij\bullet} \right)^2 = 3.24.$   $\sum_{i=1}^4 \sum_{j=1}^3 \sum_{k=1}^2 \left( y_{ijk} - \bar{y}_{\bullet\bullet\bullet} \right)^2 = 10.24.$

- (b) Test whether or not there is a significant interaction between clubs and colleges at the 5% level of significance. State the hypotheses, the test statistic, the critical value(s), a decision, and your interpretation of the result.
- (c) Test whether or not there is a significant difference between clubs at the 5% level of significance. State the hypothesis, the test statistic, the critical value(s), a decision, and your interpretation of the result.
- (d) Test whether or not there is a significant difference between colleges at the 5% level of significance. State the hypothesis, the test statistic, the critical value(s), a decision, and your interpretation of the result.
- (e) Repeat parts (a) through (d) using R / R Studio. Include a printout of relevant code and tables.

3. In a study done at University of Illinois, researchers randomly assigned participants to one of four groups designed to compare weight loss programs. One of the four groups is the control group (i.e. not on any diet or none diet). The participants were also instructed to record their weekly average

time spent exercising ( $x$ ) in hours. The response is the amount of weight lost, in pounds, after 8 weeks.

Consider the model below:

$$Y = \beta_0 + \beta_1 v_1 + \beta_2 v_2 + \beta_3 v_3 + \beta_4 x + \varepsilon,$$

where

$v_1 = 1$  if the participant is on the Low Calorie diet, 0 otherwise,

$v_2 = 1$  if the participant is on the Low Fat diet, 0 otherwise,

$v_3 = 1$  if the participant is on the Low Carbohydrate diet, 0 otherwise.

- (a) Give an interpretation (in the context of the problem) to the regression coefficient  $\beta_0$ .
- (b) Give an interpretation (in the context of the problem) to the regression coefficient  $\beta_1$ .
- (c) Give an interpretation (in the context of the problem) to the regression coefficient  $\beta_4$ .

Note: Please Do NOT use mathematical terms such as “slope”, “intercept”, “coefficient”, etc. in your interpretations.