

## Book Homework

These prompts correspond to “Book Homework” portion of the homework on Canvas. You turn in the answers to these questions online.

- Consider the following research topic: The goal is to determine if there is a statistically significant increase in the average weight gain of anorexic patients for a new treatment ( $\mu_N$ ) when compared to a standard treatment ( $\mu_S$ ).
  - State the null hypothesis.
  - State the alternative hypothesis.
  - Interpret a Type I error in terms of the problem.
  - Interpret a Type II error in terms of the problem.
  - If we wanted to **minimize** the probability of a Type I error, what action should we take?
  - If we wanted to **minimize** the probability of a Type II error, what action should we take?
- Answer the following questions with TRUE or FALSE. It is good practice to explain your answers. Assume the p-value for a hypothesis test of  $H_0 : \mu_1 = \mu_2$  is 0.0020
  - Our conclusion at any common value of  $\alpha$  would be to reject  $H_0$ .
  - This means the probability of  $H_0$  being true is 0.0020.
  - The one-sided p-value for this test would then be 0.0010.
  - This means the probability of a Type II error is 0.0020.
- A sociology student wanted to test to see if the GPA's of four sororities were significantly different. They found the following: Let A = group 1, B = group 2, C = group

Sorority	A	B	C	D
$\bar{y}_i$	3.22	3.57	2.87	2.98
$s_i$	0.54	0.35	0.21	0.23
$n_i$	10	10	10	10

3, and D = group 4.

- Calculate  $SSB$ .
  - Calculate  $SSW$
  - Calculate  $d.f\{B\}$ .
  - Calculate  $d.f\{W\}$ .
  - Calculate  $MSB$ .
  - Calculate  $MSW$
  - Calculate the  $F$  test statistic.
- Continue with Problem 3 (the sorority problem). Assume  $\alpha = 0.05$

- State the null and alternative hypothesis mathematically.
  - State the null and alternative hypothesis in terms of the problem.
  - Calculate the range for the p-value.
  - Interpret the p-value in terms of the problem.
  - Do you reject or fail to reject the null hypothesis?
  - Interpret your conclusion in terms of the problem.
  - What 95% confidence interval between two means will certainly not contain zero if we were to create it?
  - What type of error could we have made in this question?
  - Interpret a Type II error in terms of the problem.
- A group of paramedics does not believe that the average number of calls in the morning, afternoon and night shifts are equal. They counted the number of calls over 7 days, and found the following:

	Morning	Afternoon	Night
$\bar{y}_i$	2.57	3.71	4.29
$s_i$	0.98	1.11	1.38
$n_i$	7	7	7

Let Morning = group 1, Afternoon = group 2, and Night = group 3.

- Calculate  $SSB$ .
  - Calculate  $SSW$
  - Calculate  $d.f\{B\}$ .
  - Calculate  $d.f\{W\}$ .
  - Calculate  $MSB$ .
  - Calculate  $MSW$
  - Calculate the  $F$  test statistic.
- Continue with Problem 5 (the paramedic problem). Assume  $\alpha = 0.01$ .
    - State the null and alternative hypothesis mathematically.
    - State the null and alternative hypothesis in terms of the problem.
    - Calculate the range for the p-value.
    - Do you reject or fail to reject the null hypothesis?
    - Interpret your conclusion in terms of the problem.
    - Interpret a Type I error in terms of the problem.

## R Homework

These prompts correspond to “R Portion” of the homeworks on Canvas. You use R to find the answers to the following questions, and submit your answers online.

- I. You will be using the dataset `DRP.csv` (or `DRP.txt`). Results of an experiment to test whether directed reading activities in the classroom help elementary school students improve aspects of their reading ability. A treatment class of 21 third-grade students participated in these activities for eight weeks, and a control class of 23 third-graders followed the same curriculum without the activities. After the eight-week period, students in both classes took a Degree of Reading Power (DRP) test which measures the aspects of reading ability that the treatment is designed to improve. The first column is the group (treatment or control), and the second is the DRP score (the higher the better).
  - (a) Find the lower bound for the 95% confidence interval for the difference in average DRP score.
  - (b) Find the upper bound for the 95% confidence interval for the difference in average DRP score.
  - (c) If the experimenter is interested in if the treatment group has a higher average than the control group, find the test-statistic.
  - (d) If the experimenter is interested in if the treatment group has a higher average than the control group, find the p-value.
  - (e) Do we fail to reject or reject the null hypothesis if  $\alpha = 0.05$ ?
- II. On Canvas under Files you will find a dataset `IQ.csv`. It has two columns, the first of which denotes what major a student is from (A, B, or C). The second is the IQ measured by the Stanford–Binet Intelligence Scales. The goal is to determine if this IQ measures differs on average between majors.
  - (a) Find the value of the F test-statistic.
  - (b) Find the p-value of the test.
  - (c) Do we fail to reject or reject the null hypothesis?
  - (d) State your conclusion in terms of the problem.
  - (e) Plot a normal probability plot of the IQ scores. Does this data appear to be approximately normally distributed?