

Homework 7

Problem 1

A researcher wants to compare the starting salaries of college graduates who majored in chemical engineering and computer science. She randomly selects a sample of 50 graduates from each major, and records their starting salaries. The table below contains the means and standard deviations of each sample.

Major	Mean	SD
Chemical Engineering	\$53,659	\$2,225
Computer Science	\$51,042	\$2,375

Do the data provide sufficient evidence to indicate a difference in average starting salaries between the majors?

- (a) Perform a hypothesis test at significance level $\alpha = 0.05$. Check the appropriate conditions. State the hypotheses, the value of the test statistic, the p-value, and your conclusion.
- (b) What would a Type I error be in the context of this problem?

Problem 2

Refer to the information in problem 1.

- (a) Construct a 95% confidence interval for the true difference in average starting salaries.
- (b) Interpret the interval.
- (c) Compare your interval to the conclusion in Problem 1. Are they consistent?

Problem 3

Independent random samples were selected from two normal populations. The results are summarized below.

	Population 1	Population 2
Sample Size	64	24
Sample Mean	2.9	5.1
Sample Variance	0.83	1.67

- (a) Construct a 90% confidence interval for the difference of the population means. Be sure to check the appropriate conditions.
- (b) Interpret the interval from (a). What does “90% confident mean?”

Problem 4

Refer to the information in problem 3. Perform a hypothesis test at significance level $\alpha = 0.05$ to test the claim that the mean of population 2 is larger than the mean of population 1. Check the appropriate conditions. State the hypotheses, the value of the test statistic, the p-value, and your conclusion.

Problem 5

An analyst wants to gauge the support of the President's recent decision among members of both parties. She randomly selects a sample of 45 registered Democrats and 57 registered Republicans. It turns out that 21 of the Democrats and 33 of the Republicans support the President's decision. Is there sufficient evidence to conclude that there is a greater proportion of supporters among Republicans than Democrats?

- (a) Check that the conditions for a hypothesis test for a difference of two proportions are satisfied.
- (b) State the hypotheses.
- (c) Compute the value of the test statistic.
- (d) Compute the p-value.
- (e) State your conclusion at significance level $\alpha = 0.01$.
- (f) What would a Type II error be in this case?

Problem 6

Refer to the information in problem 5.

- (a) Construct a 99% confidence interval for the true difference in proportions of supporters.
- (b) Interpret the interval.

Problem 7

In order to construct a 95% confidence interval for the difference of two proportions, a researcher will obtain random samples of the same size n from two populations. She wants the margin of error to be no more than ± 0.03 . How big should the sample size n be?

HINT: Since the sample proportions (\hat{p}_1 and \hat{p}_2) are unknown, use $\hat{p}_1 = \hat{p}_2 = 0.5$. This will produce the largest possible SE and ME (i.e. worst case scenario). If your value of n works for this case, it will work for all other cases.

Problem 8

A study was conducted to compare the effects of two pain relievers. A random sample of $n_1 = 200$ subjects took the first medicine, and 93% of them found it effective. A random sample of $n_2 = 450$ individuals took the second medicine, and 96% of them found it effective.

- (a) Construct a 99% confidence interval for the difference in the proportions of subjects experiencing relief from the two medicines.
- (b) Based on (a), is there sufficient evidence to indicate a difference in the true proportions?

Problem 9

The midterm and final exam scores of a class of 48 students were recorded. The differences (final score - midterm score) produced the following statistics: $\bar{x}_d = 4.3$, $s_d = 1.8$. Is there evidence that the students performed better on the final than on the midterm on average? Perform a hypothesis test.

- (a) Check that the appropriate conditions are satisfied.
- (b) State the hypotheses.
- (c) Compute the value of the test statistic.
- (d) Compute the p-value.
- (e) State your conclusion at significance level $\alpha = 0.1$

Textbook Problems

Lecture 19: 7.1, 7.2, 7.3, 7.4, 7.5, 7.6, 7.8, 7.33, 7.35

Lecture 20: 7.52, 7.54, 8.4, 8.6, 8.24