

1. (6 pts) A sample of 25 pieces of laminate used in the manufacture of circuit boards was selected and the amount of warpage (measured in inches) under particular conditions was determined for each piece, resulting in a sample mean warpage of 0.0635 in and a sample standard deviation of 0.0065 in.
 - (a) Calculate a 95% confidence interval for the true mean warpage. Then include a sentence interpreting your interval.

 - (b) Without actually computing it, explain how the confidence interval would change if you were to increase the confidence level to 99%.

2. (8 pts) There are two statistics classes, each with 30 students. On the midterm exam, the average score for the first class is 84% with a standard deviation of 9%. The second class has an average score of 90% with a standard deviation of 6%. Does the evidence support the claim that the two classes have significantly different mean scores? Conduct an appropriate hypothesis test at the $\alpha = 0.05$ level. Use the rejection region approach to make your decision. Make sure to show all of your work!

3. (12 pts) A sample of 300 urban adult residents of a particular state revealed 63 who favored increasing the highway speed limit from 55 to 65 mph, whereas a sample of 180 rural residents yielded 75 who favored the increase.
- (a) Check that all necessary assumptions for constructing a confidence interval or conducting a hypothesis test are met.
 - (b) Construct a 90% confidence interval for the true difference in proportions of residents who favor increasing the highway speed limit (urban minus rural).
 - (c) Does this data indicate that the sentiment for increasing the speed limit is different for the two groups of residents? Conduct an appropriate hypothesis test at the $\alpha = .05$ level. Use the p -value approach to make your decision. Make sure to show all of your work!
4. (4 pts) Let Z be a standard normal random variable. Determine the value of c that makes the probability statement correct:
- (a) $P(0 \leq Z \leq c) = 0.291$
 - (b) $P(-c \leq Z \leq c) = 0.668$

5. (8 pts) In an experiment designed to study the effects of illumination level on task performance, subjects were required to insert a fine-tipped probe into the eyeholes of ten needles in rapid succession both for a low light level with a black background and a higher level with a white background. Each data value is the time (in seconds) required to complete the task.

Subject	1	2	3	4	5	6	7	8	9
Black	25.85	28.84	32.05	25.74	20.89	41.05	25.01	24.96	27.47
White	18.23	20.84	22.96	19.68	19.50	24.98	16.61	16.07	24.59

Does the data indicate that the higher level of illumination yields a decrease of more than 5 seconds in true average task completion time? Test the appropriate hypotheses using the rejection region approach at the $\alpha = .01$ level. Make sure to show all of your work!

6. (6 pts) Time for R!

- What would be the output of the R command `qt(.025, 12)`?
- What R command would you use if you wanted to find the rejection region cutoff value for a two-sided difference of proportions test at the $\alpha = 0.10$ level?
- What would be the output of the R command `dbinom(1,3,0.5)`?

7. (6 pts) A medical insurance company wants to know whether the proportion of its customers requiring a hospital stay during a year will decrease if it provides coverage for certain types of alternative medicine. The company conducts a 1-year study in which it gives insurance coverage for alternative medicine to 5000 randomly selected customers. Using the data from this study, the company tests the following hypotheses about the effect of offering the alternative medicine coverage to its customers:

H_0 : proportion requiring a hospital stay will remain the same

H_a : proportion requiring a hospital stay will decrease

If the null hypothesis is rejected, the company will offer this coverage to all of its customers in the future.

(a) Explain what a Type I error would be *in the context of the situation*.

(b) Explain what a Type II error would be *in the context of the situation*.

(c) Which error would be more serious for the customers? Why?

8. (6 pts) Suppose a state has 10 universities, 25 four-year colleges, and 50 community colleges, each of which offer multiple sections of an introductory statistics class each year. Researchers want to conduct a survey of students taking introductory stats in the state. Explain a method for collecting each of the following types of samples *in the context of the problem*. Be descriptive!

(a) A stratified sample.

(b) A cluster sample.

(c) A simple random sample.

9. (4 pts) For each of the following scenarios, choose the type of graphical summary that would best represent the data. (Hint: You should use each option once.)

Scatterplot Pie chart Side-by-side boxplots Histogram

- (a) You have data on weights (in lbs) for two populations: males and females. _____
- (b) You collect heights (in inches) of children and their mothers: _____
- (c) You calculate the percentage of students who major in humanities versus those who major in natural sciences: _____
- (d) You measure the amount of waste (in lbs) from the dining hall each day for 100 days: _____
10. (10 pts) A kindergarten class has three left-handed children and seven right-handed children. Two children are selected at random without replacement for a shoe-tying lesson. Let the random variable X represent the number of left-handed children in the two-person sample.
- (a) What are the possible values of X ?
- (b) Find the probability density function for X ; that is, determine the probability associated with each of the possible values of X .
- (c) What is the expected number of left-handed children in the sample?
- (d) What is the variance of X ?

CONGRATULATIONS! You have finished MA186! It's been a pleasure working with you all, and I hope you all have a wonderful holiday season.