

## Homework #3

due Friday, October 18, by noon

**Instructions:** Complete all problems and turn in a set of answers either to me, in my mailbox, or under my door (office 335L) by the assigned due date. Do ask me questions via email or in my office hours. Do work together. Do not copy answers from another student or turn in answers that are substantively identical. To clarify, if you work with another student, I would expect that your numerical answers would be quite close, but that your verbal explanations would be similar, but not identical, reflecting that you wrote up your answers independently. Show your work, and write out explanations for your answers. If you use Excel or a similar tool, write “According to Excel, ...” in your answer.

**Problem 1** A sample of  $n = 64$  observations is drawn from a population with  $\mu = 100$  and  $\sigma = 16$ . Find the following:

- a.  $P(\bar{X} \geq 104)$
- b.  $P(\bar{X} \leq 94)$
- c.  $P(\bar{X} \geq 110)$

**Problem 2** A statistics practitioner took a random sample of 50 observations from a population with a standard deviation of 25 and computed the sample mean to be 100.

- a. Use an interval estimate to estimate the population mean with 90% confidence.
- b. Repeat part a. using a 95% confidence level.
- c. Repeat part a. using a 99% confidence level.
- d. Describe the effect on the confidence interval of increasing the confidence level.

**Problem 3** The mean of a sample of 25 was calculated as  $\bar{x} = 500$ . The sample was randomly drawn from a population with a standard deviation of 15.

- a. Estimate the population mean with 99% confidence.
- b. Repeat part a. changing the population standard deviation to 30.
- c. Repeat part a. changing the population standard deviation to 60.
- d. Describe the effect on the confidence interval of increasing the population standard deviation.

**Problem 4** A medical statistician wants to estimate the average weight loss of people who are on a new diet plan. In a preliminary study, he guesses that the standard deviation of the population of weight losses is about 10 pounds. How large a sample should he take to estimate the mean weight loss to within 2 pounds, with 90% confidence?

**Problem 5** The label on a three-quart container of orange juice claims that the orange juice contains an average of one gram of fat or less. Answer the following question for a hypothesis test that could be used to test the claim on the label.

- a. Develop appropriate null and alternative hypotheses.
- b. What is a Type I error in this situation? What are the consequences of making this error?
- c. What is a Type II error in this situation? What are the consequences of making this error?

**Problem 6** The manager of an automobile dealership is considering a new bonus plan designed to increase sales volume. Currently, the mean sales volume is 14 automobiles per month. The manager wants to conduct a research study to see whether the new bonus plan increases sales volume. To collect data on the plan, a sample of sales personnel will be allowed to sell under the new bonus plan for a one-month period.

- a. Develop the null and alternative hypotheses that are most appropriate for this research situation (hint: be careful! Read pages 391-392. Is a one- or two-tailed test more appropriate?)
- b. Suppose a limited test is conducted among 25 randomly chosen salespeople, who sell an average of 14.7 cars under the bonus plan. Suppose the standard deviation for cars sold is 3. Test the hypotheses you identify in part a. with  $\alpha = .1$ , and interpret your conclusion.

**Problem 7** Fightmaster and Associates Real Estate, Inc. advertises that the mean selling time of a residential home is 40 days or less. A sample of 50 recently sold residential homes shows a sample mean selling time of 34 days and a standard deviation of 20 days. Using  $\alpha = .02$ , test the validity of the company's claim.