

Name _____ Student ID _____

The exam is closed book. You may use a calculator, and one $8\frac{1}{2}$ by 11 sheet of paper with formulas (or anything else) on it, but no other notes. Put all of your work on this test form (use the back if necessary). Show your work or give an explanation of your answer. No credit for numbers with no indication of where they came from.

The points for the questions total to 100. There are 3 pages and 7 problems. Check to see that you have all 3 pages. You also need the normal table and the two t tables, which are separate handouts.

1. [15 pts.] Suppose heights of adult American women are normally distributed with mean 63.5 inches and standard deviation 2.5 inches. Find the approximate probability that a randomly chosen woman from this population is taller than 70 inches.
2. [15 pts.] Suppose that Jones is a candidate for mayor and the true population proportion of voters favoring Jones is 0.52. Suppose a random sample of 500 voters is selected. What is the probability that the sample proportion will be less than 0.50?
3. [15 pts.] Three assays of the amount of iron in a geological specimen had mean 253 parts per million and standard deviation 123 parts per million. Assume these three measurements are a sample from a normally distributed population and calculate a 95% confidence interval for the true mean value.
4. [15 pts.] Suppose I have taken a random sample of size 100 of ears of corn from a field. My sample has mean ear length of 6.13 inches and standard deviation 1.44 inches. This gives me a 95% confidence interval for the true mean ear length all the corn in the field of 6.13 ± 0.28 inches.

Suppose I want a more accurate 95% confidence interval with a half-width (plus-or-minus) of 0.10 inches. What sample size do I need to get that?

5. [10 pts.] A group of doctors are studying a new treatment for colon cancer. The standard treatment has a 47% five-year survival rate for treated patients. When the study of the new treatment is finished, the doctors will report the five-year survival rate among patients given the new treatment. They also want to do a hypothesis test of whether the new treatment is a “statistically significant” improvement over the standard treatment. What should the null and alternative hypotheses be for this test?
6. [10 pts.] A parapsychologist studying telepathy (mind reading) ran an experiment in which 100 subjects tried call each card in a special deck of 20 cards without being able to see the cards, the idea being that more correct calls than one would expect by chance indicates ability to read the mind of the experimenter (who could see the cards). The deck used was a special ESP deck having only 4 different kinds of cards, each kind appearing 5 times. So just blind guessing would get 25% correct calls on average.

The experimenter’s write-up contained the following language

The subjects called 26.8% of the cards correctly. This gives a P -value $P = 0.0315$ for a one-tailed z test of the null hypothesis of random guessing.

You may assume that the experimenter’s arithmetic is correct and $P = 0.0315$ is the correct one-tailed P -value.

- (a) Using the significance level $\alpha = 0.05$, what does this P -value say about accepting or rejecting the null hypothesis? What does this decision say about whether any ESP occurred in the experiment?
- (b) Suppose you think the experimenter should have done a two-tailed test. What would the appropriate P -value be for that test?
- (c) Again using the significance level $\alpha = 0.05$, what does this two-tailed P -value say about accepting or rejecting the null hypothesis, and what does this decision say about whether any ESP occurred in the experiment?
7. [20 pts.] A tire manufacturer advertises that one of its tire models lasts 50,000 miles. A testing organization fits 40 cars with these tires and drives

them until the tires wear out, recording the mileage at that point, call it the wear-out mileage. The average wear-out mileage for the 40 cars was 46,300 miles. The standard deviation of the wear-out mileages for the 40 cars was 11,100 miles. Calculate a P -value for a lower-tailed test having the null hypothesis that wear-out mileage is in fact 50,000 miles as the manufacturer claims.