

STATISTICS FOR MANAGEMENT (IDS 570)

HOMEWORK 8

DUE DATE: FRIDAY, NOVEMBER 14 AT 11:59 PM

Problem 1. In the following items, indicate whether the analysis involves a statistical test or not and explain your reason. If it does involve a statistical test, state the null hypotheses.

For example: Suppose you are told “Poll 1000 people in a large community to determine the average number of hours a day people watch television”. This analysis does not involve a test because there is no claim of interest. We would likely use a confidence interval to estimate the average.

However, if you are told “there is a difference in the proportion who receive CPR based on whether the patients race is white or black”, then we define p_w to be the proportion of white ICU patients who receive CPR and p_b to be the proportion of black ICU patients who receive CPR. Then the hypotheses are:

$$H_0 : p_w = p_b$$

$$H_a : p_w \neq p_b.$$

- (a) [5 pts] There is evidence that mean heart rate is higher in male ICU patients than in female ICU patients.
- (b) [5 pts] Utilize the census of a community, which includes information about all residents of the community, to determine if there is evidence for the claim that the percentage of people in the community living in a mobile home is greater than 10%.
- (c) [5 pts] The average age of ICU patients at Chicago hospital is greater than 50?
- (d) [5 pts] There is a positive linear association (correlation) between systolic blood pressure and heart rate?
- (e) [5 pts] Use the complete voting record of a county to see if there is evidence that more than 50% of the eligible voters in the county voted in the last election.

Please solve the following exercises using R. One simple way to present your solutions is to copy all of your code and results into a Word document or a LATEX file.

Problem 2. A certain chemical pollutant in the Ghicago River has been constant for several years with mean $\mu = 34$ ppm (parts per million) and standard deviation $\sigma = 8$ ppm. A group of factory representatives whose companies discharge liquids into the river is now claiming that they have lowered the average with improved filtration devices. A group of environmentalists ask you to test if this is true at the 4% level of significance. To check this claim, you collect a sample of size 50 that has mean of 32.5 ppm. . Perform a hypothesis test and state your decision. In particular,

- (a) [5 pts] What are H_0 and H_a for this test?
- (b) [10 pts] Execute a test. Write the R code and results you get.

- (c) [5 pts] What is your conclusion regarding “Reject H_0 ” versus “Not reject H_0 ” and why?
- (d) [5 pts] What would you tell to environmentalists regarding your decision.

Problem 3. A manufacturing process produces ball bearings with diameters that have a normal distribution with known standard deviation of 0.04 centimeters. Ball bearings with diameters that are too small or too large are undesirable. The manufacturer claims that the average diameter of ball bearings is $\mu = 0.5$ centimeters. Perform a hypothesis test at the 5% level of significance to check this claim. Assume that a random sample of 25 gave a mean diameter of 0.51 centimeters.

- (a) [5 pts] What are H_0 and H_a for this test?
- (b) [10 pts] Execute a test. Write the R code and results you get.
- (c) [5 pts] What is your conclusion regarding “Reject H_0 ” versus “Not reject H_0 ” and why?
- (d) [5 pts] What would you tell to manufacturer regarding their claim.

Problem 4. A pharmaceutical company makes tranquilizers. It is assumed that the distribution for the length of time they last is approximately normal. Researchers in a hospital used the drug on a random sample of 9 patients. The effective period of the tranquilizer for each patient (in hours) was as follows: 2.7, 2.8, 3.0, 2.3, 2.3, 2.2, 2.8, 2.1, and 2.4.

Define X as the time the tranquilizer is effective for a given patient.

- (a) [5 pts] Find \bar{x} , and s_x ?
- (b) [15 pts] Construct a 95% confidence interval for the population mean length of time. State the confidence interval and compute the sampling error m .
- (c) [5 pts] What does it mean to be “95% confident” in this problem?