



## MATH232 Week 06 Assignment

### Confidence Intervals and Hypothesis Testing for One Population Mean and Proportion

#### Guidelines

- Your work must be organized neatly and typed
- Clearly indicate your name and the assignment number in the file name
- Electronic copies of your work can be submitted as an attachment to the drop box
- You need to hand in individual work. You may talk with each other about the problems
- However, everything in the assignment must be your own work. You are not allowed to use classmate's Minitab Express output. Using Minitab Express output that is not your own is a violation of academic integrity
- No late assignments will be accepted

#### Instructions

The key steps to tests of significance are to state  $H_0$  and  $H_A$ , calculate the **test statistic**, compute the  **$p$ -value**, and make a conclusion based on the given significance level. If you input  $H_0$ ,  $H_A$ , and the summary statistics into Minitab Express, Minitab Express will output the  $p$ -value and you will not have to make any complex calculations. Keep in mind that the results obtained from software are not meaningful unless the correct null and alternative hypotheses are determined.

Here is an example of what you will need to do for the hypothesis testing problems in this assignment: Testing the Population Mean or Proportion

Example 1: You measure the weights of a random sample of 24 male runners 18 to 24 years old. The sample mean is 60kg and sample standard deviation is 5kg. A local gym advertises that the mean weight for this group of men is 62kg. Does this sample give enough evidence to suggest that the mean weight is actually less than the gym is advertising? (Use a 5% significance level.)

#### WORK YOU NEED TO SUBMIT:

Solution Question 1:

Step 1:  $H_0: \mu = 62$

$H_A: \mu < 62$

Step 2:  $t = -1.96$

Step 3:  $p\text{-value} = 0.03114$

Step 4: Reject  $H_0$  at the 5% level. There is enough evidence to suggest that the mean weight of male runners 18 to 24 years old is actually less than the gym's advertised value of 62kg.

Example 2: A noted psychic was tested for ESP. The psychic was presented with 200 cards face down



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and asked to determine if the card was one of five symbols: a star, cross, circle, square, or three wavy lines. The psychic correctly identified 50 cards. If the psychic is truly guessing the shape on the cards, the proportion of correct guesses would be  $1/5 = 0.20$ . Does this experiment give enough evidence to suggest that the psychic has ESP? (Use a 1% significance level.)

#### WORK YOU NEED TO SUBMIT:

Solution:

Step 1:  $H_0: p = 0.2$

$H_A: p > 0.2$

Step 2:  $z = 1.77$

Step 3:  $p\text{-value} = 0.039$

Step 4: Do not reject  $H_0$  at the 1% level. There is not enough evidence to suggest that the psychic has ESP.

If the question requires a test of significance, your solution should clearly show the four steps to the test. In addition, you should show that you have checked that the conditions for inference are met.

Step 1: State the null and alternative hypothesis. (Use “mu” for the symbol  $\mu$ .)

Step 2: Calculate the test statistic.

Step 3: Find the  $p$ -value.

Step 4: State your conclusion. (Do not just say “Reject  $H_0$ ” or “Do not reject  $H_0$ .” State the conclusion in the context of the problem.)

- (4 points) Suppose that the mean time to relief for a standard drug for treating migraines is 2.8 hours. A new drug is proposed to help treat migraines. In a controlled study, 60 patients who suffer from migraines are given the new drug upon the start of their next migraine attack and the mean time to relief was 2.63 hours with standard deviation of 0.9 hours. Does this indicate at the 5% significance level that the new drug reduces the mean time to relief for treating migraines?
- (4 points) **E. coli in swimming areas.** To investigate water quality, the *Columbus Dispatch* took water samples at 16 Ohio State Park swimming areas in central Ohio. These samples were taken to laboratories and tested for *E. coli*, which are bacteria that can cause serious gastrointestinal problems. If a 100-milliliter sample (about 3.3 ounces) of water contains more than 130 *E. coli* bacteria, it is considered unsafe. The Minitab Express data file contains the *E. coli* levels found by the laboratories at these 16 sites.\*  
Take these water samples as a SRS of the water in all swimming areas in central Ohio.
  - Are these data good evidence that on the average the *E. coli* levels in these swimming areas were unsafe?
  - Make a [histogram] of the data. How would you describe the distribution of the data?
  - Another method that gives  $p$ -values without assuming any specific shape for the



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distribution gives a p-value of 0.9997 for the question in part a.) How does the one-sample  $t$  test compare with this? Should the  $t$  procedures be used with these data?

3. (4 points) A company hopes to improve customer satisfaction, setting a goal of less than 5% negative comments. A random survey of 850 customers found only 34 with complaints. Does this provide evidence at the 10% significance level that the company has reached its goal of decreasing the percentage of complaints?
4. (4 points) The Pew Internet and American Life Project reported Wednesday, April 18th that two-thirds (67%) of young adults with profiles on social-networking sites have restricted access to their profiles by requiring passwords or making them available only to friends on an approved list ("Study: Teens protecting their profiles" POSTED: 10:54 a.m. EDT, April 19, 2007 on CNN.com). A researcher believes that military personnel are more careful with keeping themselves safe online and surveys a random sample of 100 enlisted military personnel students and finds that 78 students restrict access to their profiles. Does this indicate at the 5% significance level that a larger proportion of military personnel protect their profiles on social-networking sites?
5. (4 points) A journal article reports that 34% of fathers take no responsibility for child care. A group of fathers believes that this estimate is too high. In a random sample of 80 fathers, it was found that 23 of those fathers take no responsibility for child care. Is there significant evidence at the 1% significance level that less than 34% of fathers take no responsibility for child care?
6. (4 points) **Fuel Economy for Midsize Cars.** The Department of Energy provides fuel economy ratings for all cars and light trucks sold in the United States. The Minitab Express file for this problem contains the estimated miles per gallon for city and highway driving for a sample of 40 cars classified as midsize in 2016. Use this data set to test the claim that midsize cars get more than 30 miles per gallon for highway driving at the 5% significance level.