


Stat 104: Quantitative Methods for Economics

Homework 7: Due Monday, October 30

Homework policy: *Homework is due by 8:00AM (EST) on the due date.* Homework is to be handed in via the course website in pdf format. You do not need to type the homework; there are many ways (scanner in the library or phone apps) to convert written homework into a pdf file. Ask the teaching staff if you need assistance.

Late homework will not be accepted. You are encouraged to discuss homework problems with other students (and with the instructor and TFs, of course), but you must write your final answer in your own words. Solutions prepared “in committee” or by copying someone else’s paper are not acceptable.

- Please submit your homework in pdf format; this can be done in Word, or OpenOffice or via cellphone apps that will scan and turn into pdf.
- Please make your homework solutions legible by **bolding** or using  to identify your solution.
- Since we are not printing out anything, use lots of s p a c e for your solutions, and put each answer on a different page if it makes the solution easier to read.
- Please make sure your submitted solutions are in numerical order [problem 1, problem 2 and so on].
- Please keep your computer output to a minimum and focus on the required answer. The easiest way to put your computer output into your homework is to cut and paste it into a Word file and use the font “courier new”.
- Please keep in mind the course rules on Academic Honesty and Collaboration

Hypothesis Test for a Population Mean

- 1) A production line produces rulers that are supposed to be 12 inches long. A sample of 49 of the rulers had a mean of 12.1 and a standard deviation of .5 inches. The quality control specialist responsible for the production line decides to do a two-sided hypothesis test to determine whether the production line is really producing rulers that are 12 inches long or not.
 - a) What is the null hypothesis?
 - b) What is the alternative hypothesis
 - c) Using whatever method you want, clearly run and summarize the result of the hypothesis test. What does this mean in terms of the problem situation?
- 2) Snack bags of popcorn are supposed to weigh 5.5 ounces on average. A random sample of 64 bags of popcorn weighed, on average, 5.23 ounces with a standard deviation of 0.24 ounces. Test using whatever method you want $H_o : \mu = 5.5$ $H_a : \mu < 5.5$. Be sure to clearly state your conclusion.
- 3) A particular brand of tires claims that its deluxe tire averages more than 50,000 miles before it needs to be replaced. A survey of owners of that tire design is conducted. From the 30 tires surveyed, the mean lifespan was 46,500 miles with a standard deviation of 9800 miles. Do the data support the claim at the 5% level? Test using whatever method you want $H_o : \mu = 50000$ $H_a : \mu > 50000$. Be sure to clearly state your conclusion.
- 4) A recent study stated that if a person smoked, the average of the number of cigarettes he or she smoked was 14 per day. A researcher wanted to test the claim that the mean number was actually different from 14. A random sample of 40 smokers was obtained and found that the mean number of cigarettes smoked per day was 18. The standard deviation of the sample was 6. Using whatever hypothesis testing method you want, can you conclude that the mean number of cigarettes a person smokes per day actually different from 14?
- 5) In this exercise we show the relationship between sample size and sample evidence. Suppose the nationwide average for the math SAT test is 480 but we think UCLA students are smarter than the average. We want to test $H_o : \mu = 480$ $H_a : \mu > 480$.
 - a) Using R what is the p-value for this test if $n = 100, \bar{x} = 483, s = 100$
 - b) Using R what is the p-value for this test if $n = 1000, \bar{x} = 483, s = 100$
 - c) Using R what is the p-value for this test if $n = 10000, \bar{x} = 483, s = 100$
 - d) What happens to the p-value as the sample size increases?

- 6) Suppose the same set up as above with the same hypothesis to test.
 - a) Test $H_o : \mu = 480$ $H_a : \mu > 480$ assuming $n = 100, \bar{x} = 496.4, s = 100$
 - b) Test $H_o : \mu = 480$ $H_a : \mu > 480$ assuming $n = 100, \bar{x} = 496.7, s = 100$
 - c) In practical terms should there be a difference between (a) and (b)? Discuss briefly.

Hypothesis Test for a population proportion

- 7) A survey of 4000 people in the US finds that 2856 of them believe that daily weather reports are totally useless because meteorology is not really a science. Given this data perform a hypothesis test to see if more than half of the people in the US believe that weather reports are useless.
 - d) What is the null hypothesis?
 - e) What is the alternative hypothesis
 - f) Using whatever method you want, clearly run and summarize the result of the hypothesis test. What does this mean in terms of the problem situation?
- 8) Your statistics instructor claims that 60 percent of the students who take her Elementary Statistics class go through life feeling more enriched. For some reason that she can't quite figure out, most people don't believe her. You decide to check this out on your own. You randomly survey 64 of her past Elementary Statistics students and find that 34 feel more enriched as a result of her class. Now, what do you think?
- 9) A poll done for Newsweek found that 13% of Americans have seen or sensed the presence of an angel. A contingent doubts that the percent is really that high. It conducts its own survey. Out of 76 Americans surveyed, only 2 had seen or sensed the presence of an angel. As a result of the contingent's survey, would you agree with the Newsweek poll?
- 10) According to the 2010 Census, 58.5% of women worked. A county commissioner feels that more women work in his county, so he conducts a survey of 1000 randomly selected women and finds that 622 work. Is he correct?

Confidence Intervals and Hypothesis Tests for Two Samples

- 11) Two groups of students are given a problem-solving test, and the results are compared. Find and interpret the 95% confidence interval of the true difference in means. Feel free to use R.

Mathematics majors	Computer science majors
$\bar{X}_1 = 83.6$	$\bar{X}_2 = 79.2$
$s_1 = 4.3$	$s_2 = 3.8$
$n_1 = 36$	$n_2 = 36$

- 12) Many doctors believe that early prenatal care is very important to the health of a baby and its mother. Efforts have recently been focused on teen mothers. A random sample of 52 teenagers who gave birth revealed that 32 of them began prenatal care in the first trimester of their pregnancy. A random sample of 209 women in their twenties who gave birth revealed that 163 of them began prenatal care in the first trimester of their pregnancy.
- Construct a 95% confidence interval for the difference between the proportion of teen mothers who get early prenatal care and the proportion of mothers in their twenties who get early prenatal care. (you may do this using R).
 - Briefly interpret the confidence interval.
- 13) In a sample of 80 Americans, 55% wished that they were rich. In a sample of 90 Europeans, 45% wished that they were rich. Run a two sided hypothesis test to see if there is a difference in the proportions against the null that they are equal.
- 14) Suppose in a survey of college students, 1630 out of 7180 men responded Yes to being frequent binge drinkers and 1684 out of 9916 women responded yes. Find a 95% confidence interval for the difference between the proportions of men and women who are frequent binge drinkers. Interpret the interval.

- 15) In an effort to increase production of an automobile part, the factory manager decides to play music in the manufacturing area. Eight workers are selected, and the number of items each produced for a specific day is recorded. After one week of music, the same workers are monitored again. The data are given below. Can the manager conclude that the music has increased?

Worker	1	2	3	4	5	6	7	8
Before	6	8	10	9	5	12	9	7
After	10	12	9	12	8	13	8	10