Lab 12b: Hypothesis Tests for Means

Stat 131A, Fall 2018

Learning Objectives:

- Hypothesis tests for means

Problem 1

Which of the following research questions asks us to test a claim about a population mean?

a. A bond measure takes a 2/3 majority to pass. Do more than 67% of the voters support the measure?

b. What proportion of community college students transfer to a four-year college or university?

c. Is the average course load for a community college student greater than 12 units?

Problem 2

Which of the following situations calls for a hypothesis test about a population mean?

a. According to the Center for Disease Control (CDC), roughly 21.5% of all U.S. high-school seniors in 2002 have used marijuana. A sociologist suspects that the rate among African-American high school seniors is lower.

b. A recent study estimated that 20% of all college students in the United States smoke. The head of Health Services at Goodheart University suspects that the proportion of smokers may be lower there.

c. A certain prescription allergy medicine is suppose to contain an average of 245 parts per million (ppm) of active ingredient. The manufacturer wants to check whether the mean concentration in a large shipment of pills is 245 ppm or not.

d. A report on the College Board website stated that in 2003 males scored generally higher than females on the SAT exam. An educational researcher wants to check whether this is true in her school district.

Problem 3

For the following scenarios, give the null and alternative hypotheses and state in words what μ (population average) represents in your hypotheses. A good definition of μ describes both the variable and the population.

a. The National Assessment of Educational Progress (NAEP) is administered annually to 4th, 8th, and 12th graders in the United States. On the math assessment, a score above 275 is considered an indication that a student has the skills to balance a checkbook. In a random sample of 500 young men between the ages of 18 and 20, the mean NAEP math score is 272. Do we have evidence to support the claim that young men nationwide have a mean score below 275?

b. The National Center for Health Statistics reports that the systolic blood pressure for males 35 to 44 years of age has a mean of 128. In a study of business executives, a random sample of 100 executives has a mean systolic blood pressure of 134. Do the data suggest that the mean systolic blood pressure for business executives is higher than 128?

c. An analytical chemistry lab is conducting quality control tests on a drug. A single dosage of the drug should contain 8 mg of active ingredient. Of course, there will be a small amount of variability due to imperfections in the production process, but the mean of all dosages produced should be 8 mg. In 20 random dosages, the mean amount of active ingredient is 7.7 mg. Do the data suggest that the mean amount of active ingredient in all dosages produced is different from 8 mg?

Problem 4

Find the z-values:

a. We would reject the null hypothesis at the 5% level if the absolute value of the z-value was more than _____.

b. We would reject the null hypothesis at the 1% level if the absolute value of the z-value was more than _____.

Problem 5

The census data states that one city has 52% women, 48% men, an average income of $45,000 with an SD of $30,000, and an average weight of 150 lbs, with an SD of 10. Test all hypotheses at the 5% significance level.

a. You wish to test if the income is correct, against the alternate that the average is actually larger. You take a simple random sample of 100 people, which has an average $50,000 with an SD of $20,000.

b. You wish to test if the weight is correct, against the alternate that the average is actually smaller. You take a simple random sample of 100 people, which has an average weight of 140 lbs, with an SD of 15.

c. You want to know if a district in the city has a larger average income. You take a simple random sample of 100 people, which has an average $50,000 with an SD of $20,000.

Problem 6

Melanie read an advertisement from the Cell Phone Giants (CPG, for short) that she thinks is too good to be true. The CPG ad states that customers in Los Angeles get average data download speeds of 4 Mbps. With this speed, the ad claims, it takes, on average, only 12 seconds to download a typical 3-minute song from iTunes (give or take 3.2 seconds).

Melanie has her doubts about this claim, so she gathers data to test it. She asks a friend who uses the CPG plan to download a song, and it takes 13 seconds to download a 3-minute song using the CPG network. Melanie collects a random sample of 45 downloads by using her friend's phone to download her song from iTunes according to randomly selected days, times, and locations. She gets a mean download time of 13.5 seconds for her sample of downloads.

What can Melanie conclude? Her sample has a mean download time that is greater than 12 seconds. Isn't this evidence that the CPG claim is wrong? Perform a hypothesis test at the 1% significance level.

Problem 7

Based on information in *Statistical Abstract of the United States*, the average annual miles driven per vehicle in the US is 11.1 thousand miles. Suppose that a simple random sample of 36 vehicles owned by residents of California showed that the average mileage driven last year 10.8 thousand miles, with SD = 600 miles. Does this indicate that the average miles driven per vehicle in California is lower than the national average? Use a 0.05 level of significance.

Problem 8

GPAs of all UC Berkeley students were collected, and were found to have an average of 2.6 with an SD of 1.3. A simple random sample was collected of 100 students who go to tutoring sessions and they were found to have an average GPA of 2.9 with an SD of 1.5. We wish to test whether the tutoring helps raise the GPA of students. Say whether each of the following are true or false:

a) We cannot use this data, because it is not a simple random sample of all students.

b) Our null hypothesis should be that students who go to tutoring have the same GPAs as those who do not, and the measured difference was only due to random chance.

c) The average of the box should be 2.9.

d) The SD of the box should be 1.3

e) We should reject the null hypothesis at the 5% level.

f) The p-value represents the chance that the null hypothesis is true, based on our observed results