

Homework #20

Stat 202

6.50 What's wrong? Here are several situations where there is an incorrect application of the ideas presented in this section. Write a short paragraph explaining what is wrong in each situation and why it is wrong.

(a) A researcher tests the following null hypothesis:
 $H_0: \bar{x} = 23$.

(b) A random sample of size 30 is taken from a population that is assumed to have a standard deviation of 5. The standard deviation of the sample mean is $5/30$.

(c) A study with $\bar{x} = 45$ reports statistical significance for $H_a: \mu > 50$.

(d) A researcher tests the hypothesis $H_0: \mu = 350$ and concludes that the population mean is equal to 350.

6.51 What's wrong? Here are several situations where there is an incorrect application of the ideas presented in this section. Write a short paragraph explaining what is wrong in each situation and why it is wrong.

(a) A significance test rejected the null hypothesis that the sample mean is equal to 500.

(b) A test preparation company wants to test that the average score of their students on the ACT is better than the national average score of 21.2. They state their null hypothesis to be $H_0: \mu > 21.2$.

(c) A study summary says that the results are statistically significant and the P -value is 0.98.

(d) The z statistic is equal to 0.018. Because this is less than $\alpha = 0.05$, the null hypothesis was rejected.

6.52 Determining hypotheses. State the appropriate null hypothesis H_0 and alternative hypothesis H_a in each of the following cases.

(a) A 2008 study reported that 88% of students owned a cell phone. You plan to take an SRS of students to see if the percentage has increased.

(b) The examinations in a large freshman chemistry class are scaled after grading so that the mean score is 75. The professor thinks that students who attend early morning recitation sections will have a higher mean score than the class as a whole. Her students this semester can be considered a sample from the population of all students she might teach, so she compares their mean score with 75.

(c) The student newspaper at your college recently changed the format of their opinion page. You take a random sample of students and select those who regularly read the newspaper. They are asked to indicate their opinions on the changes using a five-point scale: -2 if the new format is much worse than the old, -1 if the new format is somewhat worse than the old, 0 if the new format is the same as the old, $+1$ if the new format is somewhat better than the old, and $+2$ if the new format is much better than the old.

6.53 More on determining hypotheses. State the null hypothesis H_0 and the alternative hypothesis H_a in each case. Be sure to identify the parameters that you use to state the hypotheses.

(a) A university gives credit in first-year calculus to students who pass a placement test. The mathematics department wants to know if students who get credit in this way differ in their success with second-year calculus. Scores in second-year calculus are scaled so the average each year is equivalent to a 77. This year 21 students who took second-year calculus passed the placement test.

(b) Experiments on learning in animals sometimes measure how long it takes a mouse to find its way through a maze. The mean time is 20 seconds for one particular maze. A researcher thinks that playing rap music will cause the mice to complete the maze slower. She measures how long each of 12 mice takes with the rap music as a stimulus.

(c) The average square footage of one-bedroom apartments in a new student-housing development is advertised to be 880 square feet. A student group thinks that the apartments are smaller than advertised. They hire an engineer to measure a sample of apartments to test their suspicion.

Solutions

6.50. (a) The null hypothesis should be a statement about μ , not \bar{x} . (b) The standard deviation of the sample mean is $5/\sqrt{30}$. (c) $\bar{x} = 45$ would not make us inclined to believe that $\mu > 50$ over the (presumed) null hypothesis $\mu = 50$. (d) Even if we fail to reject H_0 , we are not sure that it is true.

Note: That is, “not rejecting H_0 ” is different from “knowing that H_0 is true.” This is the same distinction we make about a jury’s verdict in a criminal trial: If the jury finds the defendant “not guilty,” that does not necessarily mean that they are sure he/she is innocent. It simply means that they were not sufficiently convinced of his/her guilt.

6.51. (a) Hypotheses should be stated in terms of the population mean, not the sample mean. (b) The null hypothesis H_0 should be that there is no change ($\mu = 21.2$). (c) A small P -value is needed for significance; $P = 0.98$ gives no reason to reject H_0 . (d) We compare the P -value, not the z -statistic, to α . (In this case, such a small value of z would have a very large P -value—close to 0.5 for a one-sided alternative, or close to 1 for a two-sided alternative.)

6.52. (a) We are checking to see if the proportion p increased, so we test $H_0: p = 0.88$ versus $H_a: p > 0.88$. (b) The professor believes that the mean μ for the morning class will be higher, so we test $H_0: \mu = 75$ versus $H_a: \mu > 75$. (c) Let μ be the mean response (for the population of all students who read the newspaper). We are trying to determine if students are neutral about the change, or if they have an opinion about it, with no preconceived idea about the direction of that opinion, so we test $H_0: \mu = 0$ versus $H_a: \mu \neq 0$.

6.53. (a) If μ is the mean score for the population of placement-test students, then we test $H_0: \mu = 77$ versus $H_a: \mu \neq 77$ because we have no prior belief about whether placement-test students will do better or worse. (b) If μ is the mean time to complete the maze with rap music playing, then we test $H_0: \mu = 20$ seconds versus $H_a: \mu > 20$ seconds because we believe rap music will make the mice finish more slowly. (c) If μ is the mean area of the apartments, we test $H_0: \mu = 880 \text{ ft}^2$ versus $H_a: \mu < 880 \text{ ft}^2$, because we suspect the apartments are smaller than advertised.