EXAMPLE:

A sample of 40 speedometers of a particular brand is checked for accuracy at 55 mph. The resulting sample average and sample standard deviation are 53.8 and 1.3 respectively. Let μ denote the true average speedometer reading when the actual speed is 55 mph. Compute a P-value and use it and a significance level of .01 to decide whether the sample evidence strongly suggests μ is not 55.

ANSWER

A. True average speedometer reading when actual speed is 55mph

B. $H_0: \mu = 55$

C. $H_A: \mu \neq 55$

D. $z = \dfrac{\bar{x} - 55}{s / \sqrt{n}}$

E. $z = \dfrac{53.8 - 55}{1.3 / \sqrt{40}} = -5.84$

F. P-value is less than .001 and so the Null Hypothesis would be rejected at significance level .01. The sample evidence suggests quite strongly that the true average reading is not 55 mph when the actual speed is 55 mph.

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1) The national mean cholesterol level is approximately 210. 100 people with high cholesterol levels (over 265) participated in a drug study and were treated with a new drug Cholestyramine. After treatment the sample mean was 228 and the sample standard deviation was 12. One question of interest is whether people taking this drug still have a mean cholesterol level that exceeds the national average. Compute the P-value for this data. If a .05 significance level is chosen what conclusion would you draw?

2) A neurologist wants to test the effects of a particular drug on the nervous system. She conducts a test to measure the drug's effect on the response rates of rats. She knows that the mean response time for rats which are not injected with this drug is 1.2 seconds. She injects 100 rats with the drug and finds that the mean response rate for these rats is 1.05 seconds with a standard deviation of 0.5 seconds. The neurologist now wants to test whether the mean response time for the drug-injected rats differs from 1.2 seconds using a significance level $\alpha = 0.05$

3) The Environmental Protection Agency (EPA) sets limits on the maximum allowable concentration of certain chemicals in water. For the substance PCB the level has been set at 5 ppm. A random sample of 36 water specimens from a reservoir results in a sample mean concentration of 4.82 and a standard deviation of 0.6. Is there sufficient evidence to substantiate a claim that the reservoir water is safe? Use a 0.01 level of significance. Would you recommend using a significance level greater than 0.01? Why or why not?

4) The college bookstore tells prospective students that the average cost of its textbooks is $52 with a standard deviation of $4.50. A group of smart statistics students thinks that the average cost is higher. In order to test the bookstore's claim against their alternative, the students will select a random sample of size 100. Assume that the mean from their random sample is $52.80. Perform a hypothesis test (6 step procedure outlined in class) at the 5% level of significance and state your decision.

5) A certain chemical pollutant in the Genesee River has been constant for several years with mean μ = 34 ppm (parts per million) and standard deviation σ = 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 will test to see if this is true at the 4% level of significance. Assume that their sample of size 50 gives a mean of 32.5 ppm. . Perform a hypothesis test (6 step procedure outlined in class) at the 4% level of significance and state your decision.

6) A manufacturing process produces ball bearings with diameters that have a normal distribution with known standard deviation of .04 centimeters. Ball bearings with diameters that are too small or too large are undesirable. In order to test the claim that μ = 0.50 centimeters, perform a two-tailed hypothesis test at the 5% level of significance. Assume that a random sample of 25 gave a mean diameter of 0.51 centimeters. Perform a hypothesis test (6 step procedure outlined in class) and state your decision.