

Hypothesis Test Example for Population Mean (μ)

Exercise 8.19 on page 341 in *Statistics, 5th Edition* by James T. McClave and Frank H. Dietrich, II:

"The University of Minnesota uses thousands of fluorescent light bulb each year. The brand of bulb it currently uses has a mean life of 900 hours. A manufacturer claims that its new brand of bulbs, which cost the same as the brand the university currently uses, has a mean life of more than 900 hours. The university has decided to purchase the new brand if, when tested, the test evidence supports the manufacturer's claim at the .05 significance level. Suppose 64 bulbs were tested with the following results:

$$\bar{x} = 920 \text{ hours} \quad s = 80 \text{ hours}$$

Will the University of Minnesota purchase the new brand of fluorescent bulbs?"

H_a : The new brand of light bulbs has a mean life of more than 900 hours.
($\mu > 900$)

H_0 : The new brand of light bulbs has a mean life of no more than 900 hours. ($\mu \leq 900$)

Assumptions: Since $n = 64$, the sampling distribution of \bar{x} is approximately normal.

Test Statistic: $z = \frac{\bar{x} - \mu_0}{\frac{\sigma}{\sqrt{n}}}$, Use s if σ is not known.

$$\alpha = .05$$

$$\text{RR: } z > 1.645$$

Calculations:

$$\bar{x}=920, \quad s=80, \quad \text{and} \quad z = \frac{920-900}{\frac{80}{\sqrt{64}}} = 2$$

Decision: Reject H_0 .

Conclusion: There is enough evidence to indicate that the new brand of light bulbs has a mean life of more than 900 hours.

The University of Minnesota should buy them.

Find the P-Value of the test statistic.

Since the alternative hypothesis is $\mu > 900$, the P-Value of the test statistic is $P(z > 2.00) = .5 - .4772 = .0228$.

If the light bulbs have a mean life of 900 hours, then the probability of a value of the sample mean at least as large as 920 occurring in random sampling is .0228. Hence, anyone willing to work at a significance level of .0228 or larger will reject the null hypothesis and conclude that the data indicates that the light bulbs have a mean life of more than 900 hours.