

Confidence Intervals and Hypothesis Tests: Two Samples

9.6 t-Test, Two Population Means: Independent Samples (Unequal Variances)

1. The U.S. census bureau released earnings data for year-round full-time workers by age and educational attainment in 2007. The results showed that male workers who were 25 -34 years old with a bachelor's degree earned more than males in the same age group with just a high school diploma. A new study selected a random sample of 20 males (aged 25 – 34) with a bachelor's degree and found they had an average salary of \$66,825 with a standard deviation of \$6,684.5, and a random sample of 22 males with only a high school diploma had a mean of \$35,995 and a standard deviation of \$6,245.1. Use the data provided and a 1% significance level to test the claim that males with a bachelor's degree earn on average more money than males with just a high school diploma (assume unequal variances).
2. Sensa is a product designed to help its users exercise portion control. It uses something called tastant crystals. A user sprinkles these tastant crystals onto their food prior to eating. In an independent, double-blind, placebo-controlled study 29 subjects used Sensa for six months, and 27 subjects used a placebo for the same period. The dieters did not make any other changes to their lifestyle. The Sensa group lost an average of 27.58 pounds with a standard deviation of 9.7 pounds while the placebo group lost 1.10 pounds with a standard deviation of 1.9 pounds. Use the data provided and a 1% significance level to test the claim that the average weight loss from Sensa and placebo over six months of use is the same (assume unequal variances).
3. The 2011 In-House Counsel Compensation Survey (a survey of in-house attorneys) found that there was a difference between the salaries of male and female attorneys working as in-house counsel. Use the following data and a 2% significance level to test the claim that there is a difference between the salaries of male and female in-house counsels (assume unequal variances).

Males		Females	
n	29	n	29
\bar{x}	\$218,423	\bar{x}	\$179,450
s	\$75,833	s	\$64,167

Answers:

1. Based on the sample data, it seems very clear that males in this age group earn a significant amount more when they have a bachelor's degree as compared to having just a high school diploma.

$$\text{Claim: } \mu_{bach} > \mu_{h.s.}$$

$$H_0: \mu_{bach} - \mu_{h.s.} \leq 0$$

$$H_a: \mu_{bach} - \mu_{h.s.} > 0$$

$$\text{Test Stat: } 15.402$$

$$d.f. = 38.93556 = 38$$

$$\text{Critical Value(s): } 2.429$$

Initial Conclusion: Reject the null, support the alternative

Final Conclusion: The sample data supports the claim...

2. Based on the sample data, it seems very clear that Sensa produces a greater amount of weight loss than placebo.

$$\text{Claim: } \mu_{Sensa} = \mu_{placebo}$$

$$H_0: \mu_{Sensa} - \mu_{placebo} = 0$$

$$H_a: \mu_{Sensa} - \mu_{placebo} \neq 0$$

$$\text{Test Stat: } 14.407$$

$$d.f. = 30.29987144 = 30$$

$$\text{Critical Value(s): } \pm 2.75$$

Initial Conclusion: Reject the null, support the alternative

Final Conclusion: The sample data warrants rejection of the claim...

3. The data is not strong enough to support the claim here at a 2% significance level, but if we had used a 5% significance level it would have been. It is close, but we cannot support the claim with this data. Also, note that we use the simpler formula to calculate the degrees of freedom here since the sample sizes are the same.

$$\text{Claim: } \mu_{male} \neq \mu_{female}$$

$$H_0: \mu_{male} - \mu_{female} = 0$$

$$H_a: \mu_{male} - \mu_{female} \neq 0$$

$$\text{Test Stat: } 2.113$$

$$d.f. = 29 + 29 - 2 = 56$$

$$\text{Critical Value(s): } \pm 2.396$$

Initial Conclusion: Do not reject the null, do not support the alternative

Final Conclusion: The sample data does not support the claim...