

## Tests of Significance Practice Problems

Researchers claim that the average age at which children start walking is 12.5 months. A child psychologist wanted to study if this claim was true. She took a random sample of 18 children and found that the mean age at which these children started walking was 12.9 months with a standard deviation of 0.8 months. If it is known that the ages at which children start walking is approximately normally distributed, does our sample data suggest that the true age at which all children start walking is different from 12.5 months?

Answer this question by conducting a formal test of significance at the  $\alpha = 0.01$  level of significance.

### NULL AND ALTERNATIVE HYPOTHESES

$$H_0: \mu = 12.5$$

$$H_a: \mu \neq 12.5$$

### TEST STATISTIC

$$t = \frac{\bar{x} - \mu}{s/\sqrt{n}} = \frac{12.9 - 12.5}{0.8/\sqrt{18}} = 2.12$$

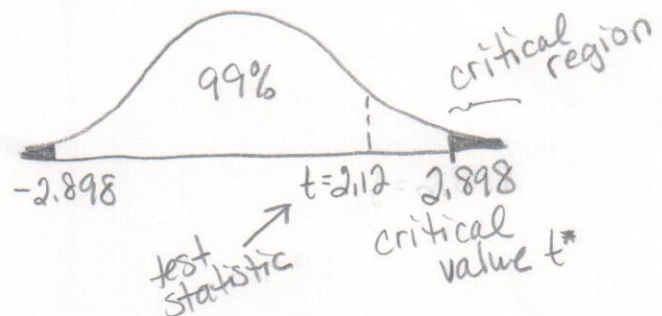
### CRITICAL REGION $\alpha = 0.01$

The test statistic is not in the critical region.

two-tails  $\neq$

$$df = 17$$

$$t^* = 2.898$$



### DECISION AND IN-CONTEXT CONCLUSION

Fail to reject the null hypothesis.

There is not enough evidence from the data to conclude that the mean age at which all children start walking is different from 12.5. The test statistic does not fall in the critical region.

Given that  $\alpha = 0.01$ , construct a 99% confidence interval estimate of the true average age at which all children start walking. Can this information be used for the purpose of hypothesis testing?

$$\bar{x} = 12.9 \quad 12.9 \pm \frac{(2.898)(0.8)}{\sqrt{18}} = 12.9 \pm 0.5465 \quad (12.35, 13.45)$$

$$s = 0.8$$

$$t^* = 2.898$$

We are 99% confident the interval (12.35, 13.45) contains the true mean age at which children start walking. Reject the null b/c the interval contains 12.5. A sample w/ mean 12.9 can be due to random variation.

## Tests of Significance Practice Problems

In a 2011 survey conducted by the National Institute on Alcohol Abuse and Alcoholism, 33% of American adults said that they had never consumed alcohol. Suppose that this result is true for the 2011 population of American adults. In a recent random sample of 2300 adults Americans, 35% said that they have never consumed alcohol. Does the data support that the current percentage of American adults who have never consumed alcohol is significantly greater than 33%?

Answer this question by conducting a formal test of significance at the  $\alpha = 0.05$  level of significance.

### NULL AND ALTERNATIVE HYPOTHESES

$$H_0: p = 0.33$$

$$H_a: p > 0.33$$

### TEST STATISTIC

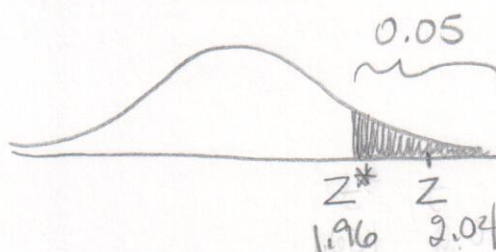
$$Z = \frac{\hat{p} - p}{\sqrt{\frac{p(1-p)}{n}}} = \frac{0.35 - 0.33}{\sqrt{\frac{(0.33)(0.67)}{2300}}} = \frac{0.02}{0.0098} = 2.04$$

### CRITICAL REGION $\alpha = 0.05$

"greater than"

⇒ Right-tailed test

$$Z^* = 1.96$$



### DECISION AND IN-CONTEXT CONCLUSION

Reject the null. The test statistic, 2.04, is more extreme than the critical value, 1.96. There is enough evidence from the data to conclude that the true proportion of adult Americans who have never consumed alcohol is greater than 33%.