Testing a Claim About the Population Standard Deviation
Examples

Example 1 (One Tail Right Tail Test)

The Folsom City Housing Office reports that the average rent for a two bedroom apartment in Folsom has an average cost of \$ 1200 with a standard deviation of \$ 250. An advocate for renters claims that the standard deviation is much larger than the \$ 250 that the Housing Office reported. The city decides to conduct a review of rents in Folsom. They take **a random sample of 51** two bedroom apartments and find that the **average rent is \$1225** with a **standard deviation of \$ 315.** Test the claim at a **.01 significance level** that the standard deviation in the rent of two bedroom apartments is **more than \$ 250.** Assume that **the population is normal.**

H_0: $\sigma = 250$

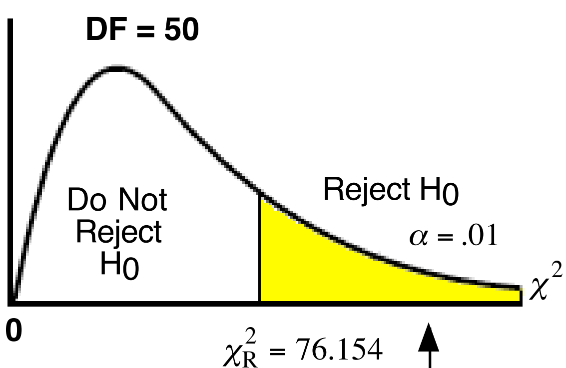
H_1: $\sigma > 250$ (One Tail Test, Right Tail)

Sample Standard Deviation: $s_x = 315$

Population Standard Deviation: $\sigma = 250$

n = 51 $\alpha = .01$ (all .01 in the right tail)

Graph of Critical information:



Test Statistic:

$$\chi^2 = \frac{(n-1)s_x^2}{\sigma^2}$$

$$\chi^2 = \frac{(51-1)315^2}{250^2}$$

$$\chi^2 = 79.38$$

Conclusion based on H_0 **:** **Reject H0**

Conclusion based on the problem:

There is sufficient evidence at the $\alpha = .01$ level **to support the claim** that the standard deviation in the rent of two bedroom apartments is **more than \$ 250.**

Chi-Square Distribution: Critical Values										
	Area in the Right Tail									
D of F	0.995	0.99	0.975	0.95	0.9	0.10	0.05	0.025	0.01	0.005
50	27.991	29.707	32.357	34.764	37.689	63.167	67.505	71.420	76.154	79.490

Testing a Claim About the Population Standard Deviation
Example 2 (One Tail Left Tail Test)

The Film Producers Guild reports that the average length of motion pictures is 105 minutes with a standard deviation of 10 minutes. A film studies class refutes that and claims that the standard deviation is less then 10 minutes. They **select 81 movies at random** and find that the **average length is 103** minutes with a **standard deviation of 9 minutes.** Test the claim at a **.05 significance level** that the standard deviation in the length of movies is **less than 10 minutes.** Assume that **the population is normal.**

H_0: $\sigma = 10$

H_1: $\sigma < 10$ (One Tail Test, Left Tail)

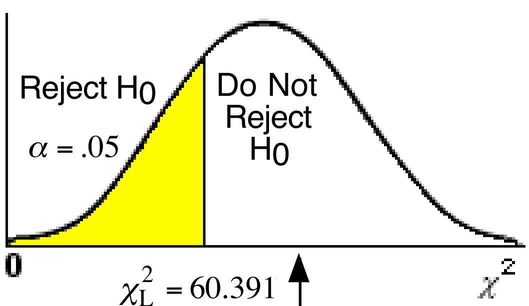
Sample Standard deviation: $s_x = 9$

Population Standard deviation: $\sigma = 10$

n = 81 $\alpha = .05$ (all .05 in the left tail)

Graph of Critical information:

DF = 80



Test Statistic:

$$\chi^2 = \frac{(n-1)s_x^2}{\sigma^2}$$

$$\chi^2 = \frac{(81-1)9^2}{10^2}$$

$$\chi^2 = 64.8$$

Conclusion based on H_0 **: Do Not Reject H0**

Conclusion based on the problem:

There is **not sufficient evidence** at the $\alpha = .05$ level **to reject** the hypothesis that the standard deviation in the length of movies is **equal to 10 minutes.**

or

There is **not sufficient evidence** at the $\alpha = .05$ level t**o support** the claim that the standard deviation in the length of movies is **less than 10 minutes.**

Chi-Square Distribution: Critical Values										
	Area in the Right Tail									
D of F	0.995	0.99	0.975	0.95	0.9	0.10	0.05	0.025	0.01	0.005
80	51.172	53.540	57.153	60.391	64.278	96.578	101.879	106.629	112.329	116.321

Testing a Claim About the Population Standard Deviation
Example 3 (Two Tail Test)

A local high school student feels that the 20 ounce Sprite bottles vary a lot from the listed 20 ounces. The local Sprite distributor tells the students that the average volume for these bottles is 20.3 ounces with a standard deviation of 1.5 ounces based on information from the parent company Coca Cola. The student **selects 41** 20 ounces bottles of Sprite at random from a local grocery store. The student finds that the **average volume of the 41 samples is 20.1** with **a standard deviation of 1.3** ounces. Test the claim at a **.05 significance level** that **the standard deviation of 20 ounces of sprite is not equal to 1.5 ounces.** Assume that **the population is normal.**

H_0: $\sigma = 1.5$

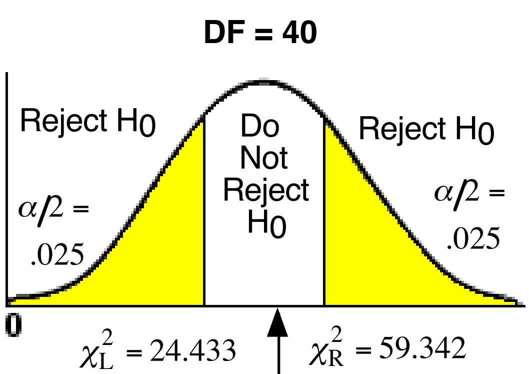
H_1: $\sigma \neq 1.5$ (Two Tail Test)

Sample Standard deviation: $s_x = 1.3$

Population Standard deviation: $\sigma = 1.5$

n = 41 $\alpha = .05$ ($\alpha/2 = .025$ in each tail)

Graph of Critical information:



Test Statistic:

$$\chi^2 = \frac{(n-1)s_x^2}{\sigma^2}$$

$$\chi^2 = \frac{(41-1)1.3^2}{1.5^2}$$

$$\chi^2 = 30.04$$

Conclusion based on H_0 : **Do not Reject H0**

Conclusion based on the problem:

There is **not sufficient evidence** at the $\alpha = .05$ level **to reject the hypothesis** that the standard deviation of 20 ounces of sprite is **equal to 1.5 ounces.**

or

There is **not sufficient evidence** at the $\alpha = .05$ level **to support** the claim that the standard deviation of 20 ounces of sprite is **not equal to 1.5 ounces.**

Chi-Square Distribution: Critical Values										
		Area in the Right Tail								
D of F	0.995	0.99	0.975	0.95	0.9	0.10	0.05	0.025	0.01	0.005
40	20.707	21.164	24.433	26.509	29.051	51.805	55.758	59.342	63.691	66.766

