Section 7-6 Testing a Claim about a Standard Deviation or Variance

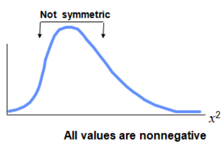
1) The sample is a simple random sample.

2) The population has values that are normally distributed (a strict requirement).

Test Statistic

$$X^2 = \frac{(n-1)s^2}{\sigma^2}$$

Properties of the Chi-Square Distribution



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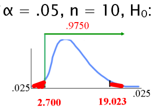
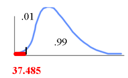
Ex1) Finding Critical Values for X^2.

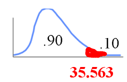
a) if $\alpha = .05$, $n = 10$, H_0: $\sigma = 2.47$



b) if $\alpha = .01$, $n = 62$, H_1: $\sigma < .71$



c) if $\alpha = .10$, $n = 27$, H_1: $\sigma > .06$



If in the shaded region, reject the null hypothesis.

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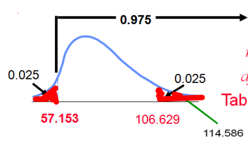
Example: Aircraft altimeters have measuring errors with a standard deviation of 43.7 ft. With new production equipment, 81 altimeters measure errors with a standard deviation of 52.3 ft. Use the 0.05 significance level to test the claim that the new altimeters have a standard deviation different from the old value of 43.7 ft.

1. H_0: $\sigma = 43.7$
   H_1: $\sigma \neq 43.7$ *original claim

2. Test statistics:

$$X^2 = \frac{(n-1)s^2}{\sigma^2} = \frac{(81-1)(52.3)^2}{43.7^2} \approx 114.586$$

3. X^2 values:



$n = 81$
$df = 80$
Table A-4

4. Reject H_0

The new production method appears to be worse than the old method. The data supports that there is more variation in the error readings than before.

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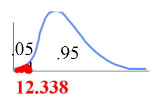
Ex2b) An instructor wishes to see whether the scores of her class of 23 has less variability on their AP exam that the national scores. The standard deviation for the class is 14.07 and the national standard deviation is 25. Use $\alpha = .05$ to test the claim.

1. H_0: $\sigma \geq 25$ H_1: $\sigma < 25$

2. Test statistic:

$$\frac{(23-1)14.07^2}{25^2} = 6.97$$

3. Critical Value:



4. Conclusion:
Reject H_0: There is sufficient evidence to support $\sigma < 25$. The instructors class is more consistent compared to the national scores.

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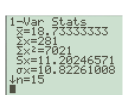
Ex2c) A hospital administrator believes that the standard deviation of the number of out patients surgeries per day is greater than 8. A random sample of 15 days is selected. Use $\alpha = .10$. Is there evidence to support the administrator's claim? The data is shown below:

25	30	5	15	18
42	16	9	10	12
12	38	8	14	27

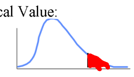
1. H_o: $\sigma \leq 8$ H_1: $\sigma > 8$

2. test statistic:

$$\frac{(15-1)11.2025^2}{8^2} = 27.45$$



3. Critical Value:



4. reject H_0: There is sufficient evidence to support $\sigma > 8$. The administrator is correct.

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