7.5

C.I. for Variances and Standard Deviat

7.5

C.I for Variances and Standard Deviations

So far, we've found C.I. for mean and proportions.

To find C.I for σ^2 and σ, we use the Chi-Squared distribution, χ^2.

χ^2 is dependent on d.f. $= n-1$.

To use table

1. find $\alpha = 1 - C.I.$
2. find $\alpha/2$
3. Look $\alpha/2$, d.f. up in table, this is χ^2_{right}
4. find $1-\alpha/2$
5. Look $1-\alpha/2$, d.f. up in table, this is χ^2_{left}

Formula for the C.I. for Variance

$$\frac{(n-1)s^2}{\chi^2_{right}} < \sigma^2 < \frac{(n-1)s^2}{\chi^2_{left}} \qquad d.f. = n-1$$

Formula for C.I. for Standard Deviation

$$\sqrt{\frac{(n-1)s^2}{\chi^2_{right}}} < \sigma < \sqrt{\frac{(n-1)s^2}{\chi^2_{left}}} \qquad d.f. = n-1$$

ex Find 90% C.I. for the σ^2 and σ of an exam if a sample of 30 students has $s=2$

Find χ^2_{right} and χ^2_{left}

1. $\alpha = 1 - .90 = .10$
2. $\alpha/2 = .05$
3. $\chi^2_{right} = 42.557$
4. $1 - .05 = .95$
5. $\chi^2_{left} = 17.708$

C.I. for σ^2:

$$\frac{29 \cdot 4}{42.557} < \sigma^2 < \frac{29 \cdot 4}{17.708}$$

$$2.725 < \sigma^2 < 6.55$$

C.I for σ:

$$\sqrt{2.725} < \sigma < \sqrt{6.55}$$

$$1.65 < \sigma < 2.56$$