§7.3 Estimate a Population Variance and Standard Deviation

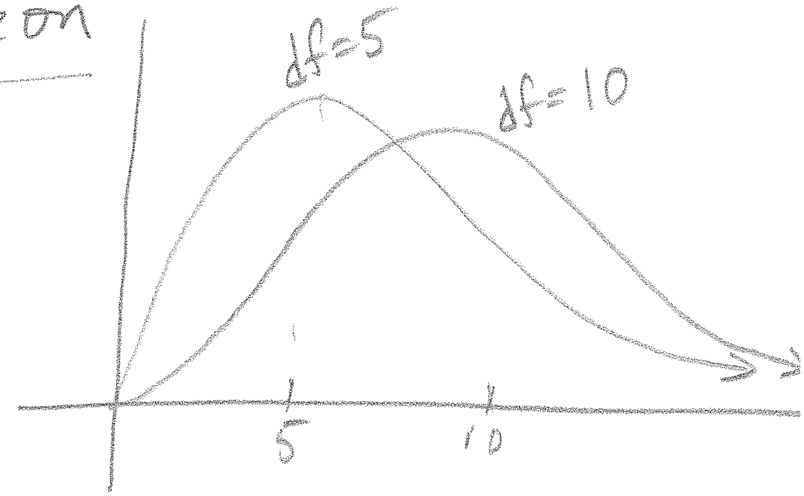
	PE: Sample Statistic	Population Parameter	CV
7.1 Proportions	$\hat{p} = \frac{x}{n}$	p	invnorm$(1-\alpha/2, 0, 1)$
7.2 Means	$\bar{x} = \frac{\Sigma x}{n}$ 1-Varstats L_1	μ	invT$(1-\alpha/2, df)$ $df = n-1$
7.3 Standard Deviations	$s = S_x$	σ	invχ2$(1-\alpha/2, \ldots$
Variances	$s^2 = S_x^2$	σ^2	

Procedure for a Confidence Interval for σ or σ^2

1. Requirements – Population must be Normal
2. Find s or s^2 using 1-Varstats PE: s
3. Find CV: $\chi^2 = $ Invχ2
4. Formula $\sqrt{\frac{(n-1)s^2}{\chi_R^2}} < \sigma < \sqrt{\frac{(n-1)s^2}{\chi_L^2}}$
5. Interpret

The χ^2-distribution

1. Always Positive
2. Skewed Right
3. Changes for each value of $df = n-1$
4. Mode = Peak ≈ Near df
5. CV: χ^2_L and χ^2_R



we say "Chi square left"

↑ Pronounced Kai

Ex Find the χ^2 critical values for a 95% confidence Interval for σ When $n = 20$.

$\alpha = .05 = 1 - CL = 1 - .95 = .05$

Run $\boxed{PRGM}$ 4: InvX2

Press Enter

It will ASK

deg FREED = 19

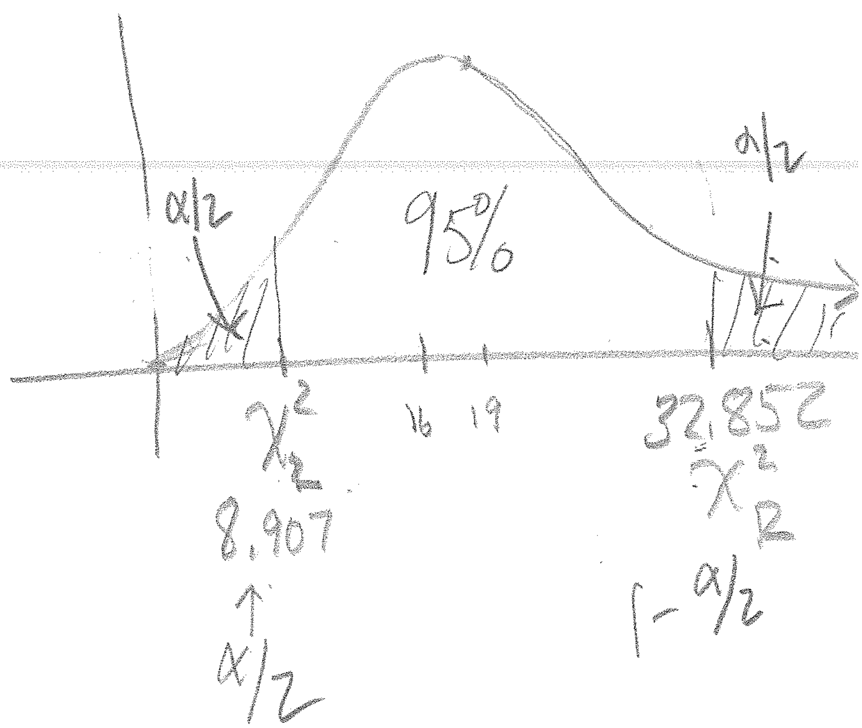
3: Confidence Interval

CONF LEVEL = .95

$\chi^2_L = 8.907$

$\chi^2_R = 32.852$

invT(AreaLeft, df)



Find a 95% CI for the Standard deviation of shower lengths

$\bar{x} = 11.8$ ← ignor

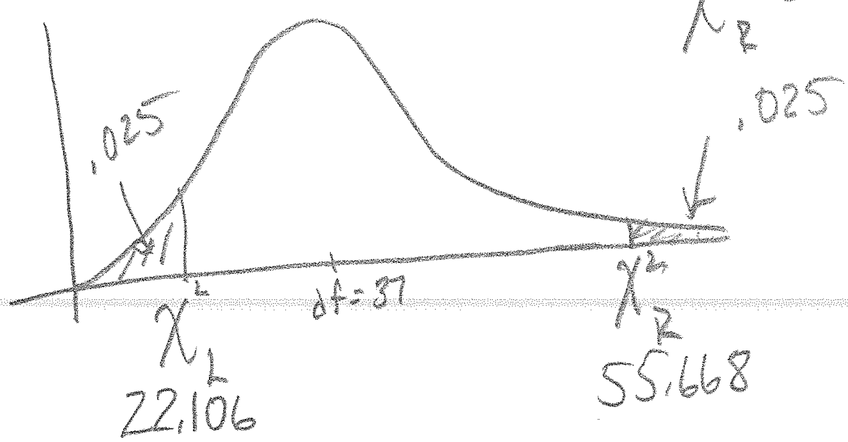
$s = 4.26$

$n = 38$

Formula $\sqrt{\frac{(n-1)s^2}{\chi^2_R}} < \sigma < \sqrt{\frac{(n-1)s^2}{\chi^2_L}}$

Find CV: Inv X2 → $\chi^2_L = 22.106$

$\chi^2_R = 55.668$



$$\sqrt{\frac{37 \cdot 4.26^2}{55.667}} < \sigma < \sqrt{\frac{37 \cdot 4.26^2}{22.106}}$$

$$3.473 < \sigma < 5.511$$

Ex2 Construct a 95% CI for the Standard Deviation of the weight of Eggs, given the Summary Stats

$n = 20 \quad \bar{x} = 1.37 \quad S = 0.33$

Formula $\sqrt{\dfrac{(n-1)\,S^2}{\chi^2_R}} < \sigma < \sqrt{\dfrac{(n-1)\,S^2}{\chi^2_L}}$

$$\sqrt{\frac{19 \cdot (.33)^2}{32.852}} < \sigma < \sqrt{\frac{19\,(.33)^2}{8.907}}$$

One More than S_x $\longrightarrow$ $.2509 < \sigma < .482$

We are 95% confident that the standard deviation in the weight of the eggs is between .251 and .482

Find χ^2 - critical values for a 95% confidence Interval and a sample of size 20.

$\boxed{\text{PRGM}}$

INV X2

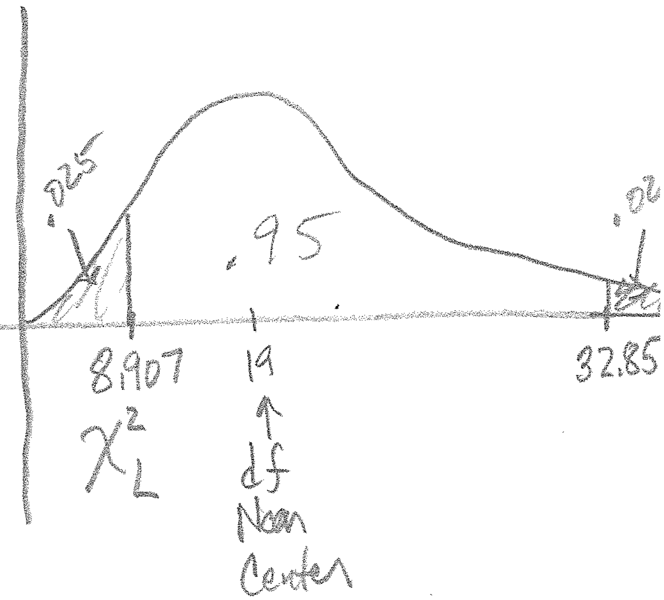
Deg Freed = 19

4% Confidence Interval

Conf Level = .95

Lt Pt = 8.907 = χ^2_L

Rt Pt = 32.85 = χ^2_R



Confidence interval for <u>population</u> Variance, σ^2

Approximate with point estimate PE: s^2 =

$$\frac{(n-1)\cdot s^2}{\chi^2_R} < \sigma^2 < \frac{(n-1)\, s^2}{\chi^2_L}$$

CI for population s.d., σ

$$\sqrt{\frac{(n-1)s^2}{\chi^2_R}} < \sigma < \sqrt{\frac{(n-1)\, s^2}{\chi^2_L}}$$

How large a Sample is Needed?
To estimate σ

Find n = Sample Size

There is No formula go to page 338

Look it up in the Table

Ex for a 95% CL estimate σ to within 10%, How large a Sample is Needed? $\boxed{192}$