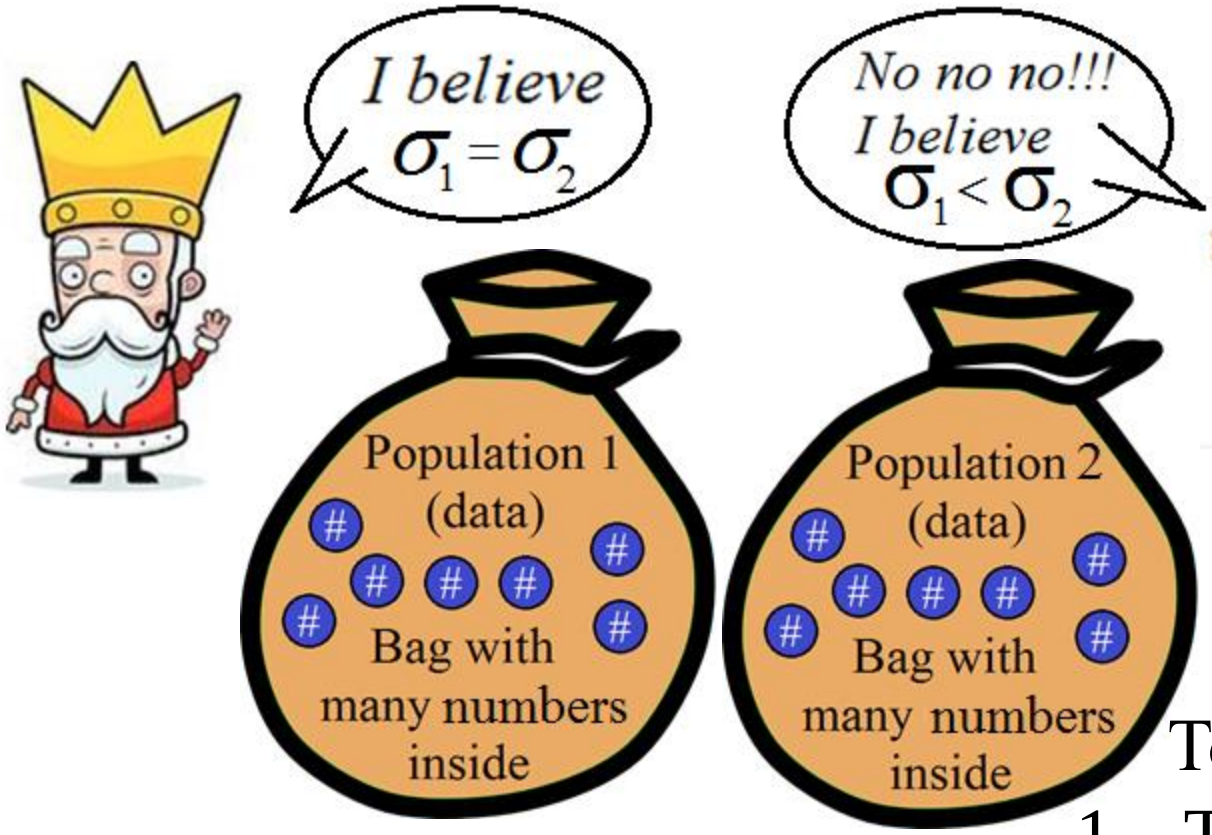
Sec. 11.4: Hypothesis Tests for 2 Population Standard Deviations σ_1 and σ_2 (or 2 Population Variances σ_1^2 and σ_2^2)

Idea Behind 2 Population Hypothesis Tests

(for σ_1 & σ_2 , or σ_1^2 & σ_2^2)



To settle the dispute…

1. Take 2 samples (one from each population)
2. Calculate s_1 & s_2

If $s_1 = s_2$, believe the king

If $s_1 > s_2$, believe the king

If $s_1 < s_2$, it depends!

If $s_1 < s_2$ but s_1 is close to s_2, still believe the king

If $s_1 < s_2$ but s_1 is far from s_2 , then believe the peasant

Hypothesis Tests for 2 Population Standard Deviations σ_1 & σ_2 Formulas & Info

Population 1	Population 2
Population parameter: σ_1	Population parameter: σ_2
Sample 1	Sample 2
Sample size: n_1	Sample size: n_2
Sample standard deviation: s_1	Sample standard deviation: s_2

Hypothesis Tests for 2 Population Standard Deviations σ_1 & σ_2 Formulas & Info

Quantities you are performing a hypothesis test for: σ_1 & σ_2

Probability distribution: *F* - distribution

2 degrees of freedom:

Degrees of freedom of the numerator: $df_1 = n_1 - 1$

Degrees of freedom of the denominator: $df_2 = n_2 - 1$

Test statistic formula: $$F = \frac{{s_1}^2}{{s_2}^2}$$

Condition: Population from which samples are drawn have a NORMAL distribution

Hypothesis Tests for 2 Population Standard Deviations σ_1 & σ_2 Formulas & Info

Notes:

- All samples in this section will be independent
- When using the rejection region method, the F – table will only give you the cutoff number for a right tail. So…
  - For a right-tail test, you can find the cutoff number by looking it up in the F – table
  - For a left-tail or 2-tail test, start off by looking up the right-tail cutoff number (even if there is no right tail because you're performing a left-tail test), then find the left- tail cutoff number by using the formula …

$$F_{1-\alpha} = \frac{1}{F_{\alpha}}$$

Ex 1 (Sec. 11.4, Hw #15, pg. 574): **Elapsed Time to Earn a Bachelor's Degree** Clifford Adelman, a researcher with the Department of Education, followed a cohort of students who graduated from high school in 1992. He monitored the progress the students made toward completing a bachelor's degree. One aspect of his research was to compare students who first attended a community college to those who immediately attended and remained at a 4-year institution…

Ex 1 (Sec. 11.4, Hw #15, pg. 574): **Elapsed Time to Earn a Bachelor's Degree** …The sample standard deviation time to complete a bachelor's degree of the 268 students who transferred to a 4-year school after attending community college was 1.162. The sample standard deviation time to complete a bachelor's degree of the 1145 students who immediately attended and remained at a 4-year institution was 1.015. Assuming the time to earn a bachelor's degree is normally distributed, does the evidence suggest the standard deviation time to earn a bachelor's degree is different between the two groups? Use the $\alpha = 0.05$ level of significance.

a) Use the P-value method

b) Use the rejection region method

Ex 2 (Sec. 11.4, Hw #20, pg. 575): **Filling Machines**

A quality-control engineer wants to find out whether or not a new machine that fills bottles with liquid has less variability that the machine currently in use. The engineer calibrates each machine to fill bottles with 16 ounces of a liquid. After running each machine for 5 hours, she randomly selects 15 filled bottles from each machine and measures their contents. She obtains the data below. Is the variability in the new machine less than that of the old machine at the $\alpha = 0.05$ level of significance?

a) Use the P-value method

b) Use the rejection region method

Ex 2 (Sec. 11.4, Hw #20, pg. 575): **Filling Machines**

Ounces of Liquid (Old Machine)				Ounces of Liquid (New Machine)		
16.01	16.04	15.96		16.02	15.96	16.05
16.00	16.07	15.89		15.95	15.99	16.02
16.04	16.05	15.91		16.00	15.97	16.03
16.10	16.01	16.00		16.06	16.05	15.94
15.92	16.16	15.92		16.08	15.96	15.95
	n =				n =	
	xbar =				xbar =	
	s =				s =	