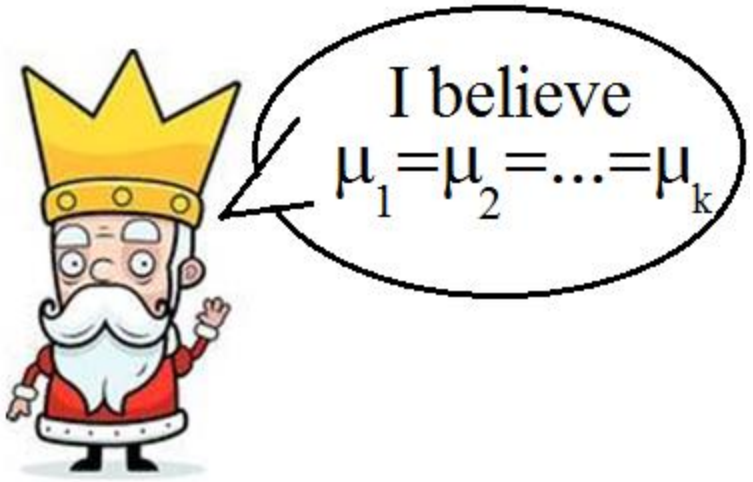
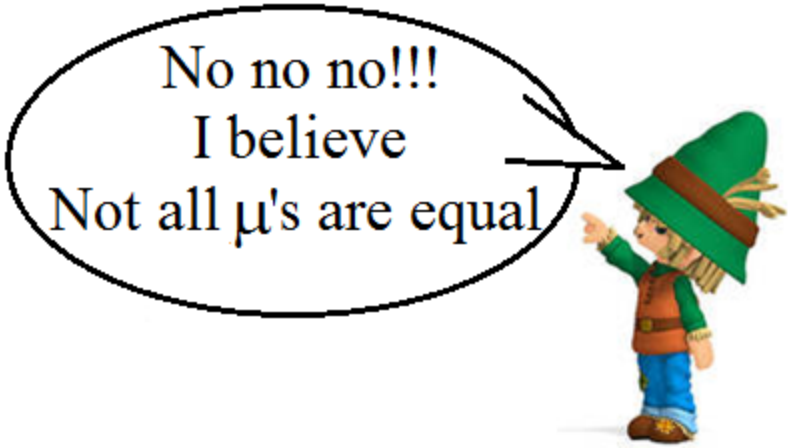
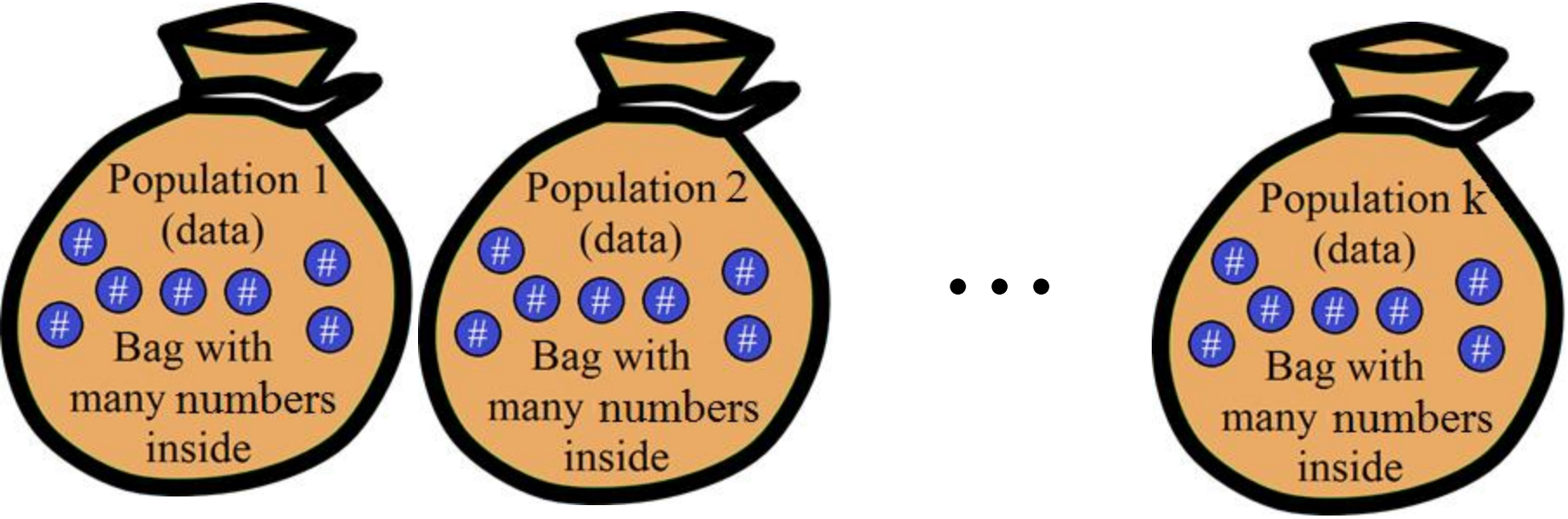
Sec. 13.1: Comparing 3 or More Means (One-Way Analysis of Variance ANOVA)

Idea Behind a One-Way ANOVA Test







Idea Behind a One-Way ANOVA Test

To settle the dispute:

1. Take 1 sample from each population
2. Calculate $\bar{x}_1,\ \bar{x}_2, \ldots,\ \bar{x}_k$

If all of the $\bar{x}_i's$ are close together (almost all equal), believe the king.

If the $\bar{x}_i's$ are far apart, believe the peasant.

One-Way ANOVA Test Formulas & Info

- H_0 will always be

$$H_0: \ \mu_1 = \mu_2 = \cdots = \mu_k$$

- H_1 will always be

$$H_1: \ Not\ all\ \mu's\ are\ equal$$

or

$$H_1: \ At\ least\ one\ of\ the\ \mu's\ is\ different\ from\ the\ others$$

One-Way ANOVA Test Formulas & Info

of populations (or number of samples): k

Individual sample sizes: n_i

Pooled sample size: n

Sample averages: $\bar{x}_i$

Sample standard deviations: s_i

Average of all data (pooled sample average): $\bar{x}$

One-Way ANOVA Test Formulas & Info

Probability Distribution: F – dist.

2 degrees of freedom:

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

Degrees of freedom of the denominator: $df_2 = n - k$

Mean square due to treatment: $$MST = \frac{\sum n_i(\bar{x}_i - \bar{x})^2}{k - 1}$$

Mean square due to error: $$MSE = \frac{\sum (n_i - 1){s_i}^2}{n - k}$$

One-Way ANOVA Test Formulas & Info

Test Statistic Formula: $F = \frac{MST}{MSE}$

Conditions:

1. Each population must have a normal distribution
2. Each population must have the same variance σ^2

One-Way ANOVA Test Formulas & Info

Note:

- All one-way ANOVA tests are RIGHT TAILED tests

Ex 1 (Sec. 13.1, Hw #15, pg. 633): **Which Delivery Method Is Best?** At a community college, the mathematics department has been experimenting with four different delivery mechanisms for content in their Intermediate Algebra courses. One method is the traditional lecture (method I), the second is a hybrid format in which half the class time is online and the other half is face-to-face (method II), the third is online (method III), and the fourth is an emporium model from which students obtain their lectures and do their work in a lab with an instructor available for assistance (method IV). To assess the effectiveness of the four methods, students in each approach are given a final exam with the results shown below. Do the data suggest that any method has a different mean score from the others at the 0.05 significance level?

Ex 1 (Sec. 13.1, Hw #15, pg. 633): **Which Delivery Method Is Best?**

a) Use the P-value method

b) Use the rejection region method

Method I	81	81	85	67	88	72	80	63	62	92	82	49	69	66	74	80
Method II	85	53	80	75	64	39	60	61	83	66	75	66	90	93		
Method III	81	59	70	70	64	78	75	80	52	45	87	82	79			
Method IV	86	90	81	61	84	72	56	68	82	98	79	74	82			

Ex 1 (Sec. 13.1, Hw #15, pg. 633): **Which Delivery Method Is Best?**

																n_i	$\bar{x}_i$	s_i
M I	81	81	85	67	88	72	80	63	62	92	82	49	69	66	74	80			
M II	85	53	80	75	64	39	60	61	83	66	75	66	90	93					
M III	81	59	70	70	64	78	75	80	52	45	87	82	79						
M IV	86	90	81	61	84	72	56	68	82	98	79	74	82						