

# Module 14a – One-Way Analysis of Variance (ANOVA): Comparing several means

[Review Against All Odds: Unit 31 \(One Way ANOVA\)](#)

# Stat Procedure Diagram – Where we are

		<u>Descriptive Statistics (Describing Pops or Samples)</u>		<u>Inferential Statistics (from Samples)</u>
	Variable Types	Display	Describe	Estimation
Univariate	categorical (nominal or ordinal)*	Bar Graph/Pie Chart	Counts/Percentages	When binary/dichotomous: Confidence interval for proportions
	quantitative/continuous	Histogram/Stem & Leaf Box Plot	Mean/St Dev (normal) Median/Min, Q1, Q3, Max (skewed)	Confidence interval for means
		Display	Describe	Significance Tests/Hypothesis Tests
Bivariate	2 categorical	Tables or Bar Graphs	Two-way tables/Crosstabulation	Chi-square test (for goodness of fit)
	1 categorical, 1 quant.	Bar Graphs	Comparison of means/average	T-test (one sample/group, two samples/groups) ANOVA (two or more samples/groups)
	2 quant.	Scatterplot	Correlation Coef. (Coef. of determ)/ Regression Line	T-test for correlation
		Display	Describe	Significance Tests/Hypothesis Tests
Multivariate	Response Variable is Quant.	-	Ordinary Least Squares Regression (OLS)	F-test for overall model T-tests for each explanatory variable
	Response Variable is categorical (dichotomous)	-	Logistic Regression	Chi-square tests of significance

NOTE: Items highlighted in yellow are covered in this course.

\*When a categorical variable has two categories, it is called dichotomous.

Still focused on...

*...quantitative/continuous variables (inference)*

- Mean Comparisons (with ***unknown*** population standard deviation)
- Types (all are categorical IV and quantitative/continuous DV)
  - One sample/group comparison
  - Two sample/group comparison (matched pairs/before & after)
  - Two sample/group comparison (independent samples)
  - **Two or more sample/group comparison (ANOVA)**

# Analysis of Variance

- In this scenario we are going to compare raw scores (0 to 100) on the quantitative skills test for three groups.
  - Mountain State mean compared to Valley State mean compared to Prairie State mean
  - Institution is our explanatory/independent variable and test score in our response/dependent variable
- Null Hypothesis: The mean scores for the three institutions are equal.
- Alternative Hypothesis: The mean scores for the three institutions are not equal

# Analysis of Variance

- When we select a sample divided into multiple groups and calculate the average of each group we find...
  - There is variation among the observations within each of the groups
  - There is variation among the averages between each of the groups.
- We calculate an F-statistic that reflects the ratio of variation between groups to the total variation
- This F-statistic is then compared to a critical value for “F” to determine whether or not there is statistical significance.

# Analysis of Variance

- If the F-statistic is greater than the critical value, we have statistical significance and can reject the null hypothesis. This means there is good evidence that the mean scores of the schools are NOT the same.
- Finally, we use a “post hoc” test to determine which institutions are different from the others.
  - Is the Mountain State mean different from Valley State?
  - Is the Mountain State mean different from Prairie State?
  - Is the Valley State mean different from Prairie State?
- These more specific hypotheses are tested with a type of “t-test.”