

## Quantitative Methods (GEO 441)

SPSS Lab 3: Analysis of Variance

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Please copy the file **S:\GEO\Marr\Quantitative Methods\SPSS Example Data\Parametric AOV.sav** and **Non-parametric Kruskal-Wallis AOV.sav** to your portable media.

- Start SPSS.
  - Open **Parametric AOV.sav**.
1. Analyze > Descriptive Statistics > Explore.
    - a. Move the variable **Economically Active (PctAct)** to *Dependents List*.
    - b. Move the variable **Group** to the *Factor List*.
    - c. Select the **Plots** radio button under *Display*.
    - d. Click on the *Plots...* option button.
      - i. Check the **None** box under *Boxplots*.
      - ii. Uncheck the **Stem-and-Leaf** box under *Descriptive*.
      - iii. Check the **Histogram** box under *Descriptive*.
      - iv. Check the **Normality plots with tests** box.
      - v. Click **Continue**.
    - e. Click **Ok**.
    - f. Are the data normally distributed or not?
  2. Click the *Recall* menu button
    - a. Click on **Explore**.
    - b. Select the **Statistics** radio button under *Display*.
    - c. Click **Ok**.
  3. In the *Output Navigation Pane* click on the **Descriptives** object.
    - a. Examine the means for each group.
      - i. Which group has the largest mean?
      - ii. Do these means appear to be 'different'?
    - b. Examine the variance for each group.
      - i. Which group has the largest variance?
      - ii. Do these variances appear to be 'different'?
      - iii. Keep these variance values in your head.
  4. Click the *Recall* menu button
    - a. Click on **Explore**.
    - b. Remove **Group** from the *Factor List*.
    - c. Click **Ok**.
      - i. Examine the mean. This is the 'grand mean' for the pooled data.
      - ii. Examine the variance. This is the 'grand variance' for the pooled data.
      - iii. How do this value relate to the earlier variance values?
  5. In the *Output Navigation Pane* click on the **Group=Lake** object in the *Detrended Normal Q-Q Plot* output group.
    - a. Double click the graphic to open the *Graph Editor*.
    - b. Click on the *Data Label Mode* button.
    - c. Click on the data point in the upper right corner of the graph.
    - d. Right click and select **Go to Case**.

- i. Examine the Economically Active (PctAct) variable for this case.
  - ii. Is it much different than other cases? Keep this value in your head.
  - e. Close the *Graph Editor*.
- 6. Analyze > Compare Means > One Way ANOVA
  - a. Move the **Economically Active (PctAct)** variable to the *Dependent List*.
  - b. Move the **Group** variable to the *Factor* list.
  - c. Click the **Options...** button.
    - i. Check the **Homogeneity of Variances** box.
    - ii. Check the **Mean Plot** box.
    - iii. Click **Continue**.
  - d. Click the *Post Hoc...* button.
    - i. Click the **LSD** box under *Equal Variances Assumed*.
    - ii. Click the **Games-Howell** box under *Equal Variances Not Assumed*.
    - iii. Click **Continue**.
  - e. Click **Ok**.
  - f. In the *Output Navigation Pane*, click on the **Test of Homogeneity of Variances** object in the *Oneway* group.
    - i. What is the probability of the Levene statistic? What does this mean?
  - g. Examine the ANOVA table.
    - i. Note the Sums of Squares output.
    - ii. What is the F statistic and its probability? What does this mean?
  - h. Examine the Multiple Comparison table.
    - i. Based on the *Sig.* column, what groups are considered different using the LSD test?
    - ii. Based on the *Sig.* column, what groups are considered different using the Games-Howell test?
    - iii. Which of these two post hoc multiple comparison tests is most appropriate?
  - i. Examine the Means Plot.
    - i. What is this plot telling us about the three groups?
- 7. Data > Select Cases
  - a. Click the *If condition is satisfied* radio button.
  - b. Click on the *If...* button.
    - i. Enter **Towns ~= "Santa Fe de la Laguna"** in the SQL statement box.
    - ii. Click **Continue**.
    - iii. Click **Ok**.
  - c. Click the *Recall* menu button and select **One-Way ANOVA**.
  - d. Click **Ok**.
    - i. Did remove of this observation alter the conclusions?
- Non-parametric Kruskal-Wallis AOV.sav
- 8. Analyze > Descriptive Statistics > Explore
  - a. Move **Surname Ratio (SurNam)** to the *Dependent List*.
  - b. Move **County** to the *Factor List*.
  - c. Choose **Plots** as the *Display* type and set up the analysis for normality tests.
  - d. Click **Ok**.
    - i. Note that 3 of the 4 counties are not normally distributed, so we will proceed with a non-parametric AOV.

9. Analyze > Nonparametric Tests > Legacy Dialogs > K Independent Samples
  - a. Move **Surname Ratio (SurNam)** to the *Test Variable List*.
  - b. Move **County** to the *Grouping Variable* list.
  - c. Click **Define Range**.
    - i. Enter **1** in the *Minimum* box and **4** in the *Maximum* box.
    - ii. Click **Continue**.
  - d. Check the **Kruskal-Wallis H** box under *Test Type*.
  - e. Click **Ok**.
    - i. Note that the test statistic is  $\text{Chi}^2$ .
    - ii. Are these groups significantly different? What is the probability?
10. Click the *Recall* menu button
  - a. Click on **Explore**.
  - b. Move **Burial Type (Type)** to the *Factor List*.
  - c. Click **Ok**.
    - i. Note that the surname ratio for the types of burying grounds are non-normal.
11. Click the *Recall* menu button
  - a. Click on **Tests for Several Independent Samples**.
  - b. Replace **County** in the *Grouping Variable* field with **Burial Type (Type)**.
    - i. Set the grouping range to be **1** and **3**.
    - ii. Click **Continue**.
  - c. Click **Ok**.
    - i. Note that the K-W AOV test found the groups to be significantly different.
    - ii. The multiple comparison test options for non-parametric tests are only available through **Two or More Independent Samples** wizard.
      1. From the Objectives tab choose **Customize Analysis**.
      2. Enter the appropriate variables using the Fields tab.
      3. Under the Settings tab, choose the test to perform, then choose **All Pairwise** from the *Multiple Comparison* drop down menu found in the Compare Distribution across Groups section.