13.1, 13.2, 13.3 One-Way ANOVA

Section 13.1, 13.2, 13.3 One-Way ANOVA

Learning Objective:

In this section, you will:

• Determine, using an ANOVA hypothesis test, whether means of three or more populations are equal or not

ANOVA is short for analysis of variance. The purpose of a one-way ANOVA test is to determine the existence of a statistically significant difference among several group means. The test actually uses **variances** to help determine if three or more means are equal or not. In order to perform a one-way ANOVA test, there are five basic assumptions to be fulfilled:

1. Each population from which a sample is taken is assumed to be normal.
2. All samples are randomly selected and independent.
3. The populations are assumed to have equal standard deviations (or variances).
4. The factor is a categorical variable.
5. The response is a numerical variable.

The calculations are very complicated. We will use our calculators to perform the computations using the F-test.

To perform and ANOVA test, first enter all the raw data into lists, one list for each sample. Then select STAT–TESTS and choose **H:ANOVA**. You will then enter the names of all your lists. If you have four populations, you would enter your data into L1 through L4, and choose ANOVA(L1,L2,L3,L4).

Use the p-value to make your conclusion.

Example 1: Listed below is head injury data from crash test dummies used in the small, medium, and large cars. These measurements are in hic (a standard head injury criterion). Use a 0.01 significance level to test the claim that the different car categories have the same mean.

Small Cars	290	406	371	544	374	501	376	499	479	475
Medium Cars	245	502	474	505	393	264	368	510	296	349
Large Cars	342	216	335	698	216	169	608	432	510	332

1. Null and Alternative Hypothesis
2. Calculator Work

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3. Test Statistic and P-Value
4. Conclusion about the null hypothesis
5. Final conclusion that addresses the original claim
6. Do these data suggest that larger cars are safer?

Example 2: The table below lists weights (in kilograms) of poplar trees that were given different treatments at different sites. Use a 0.05 significance level to test the claim that the trees with different treatments have the same mean weight.

None	Fertilizer	Irrigation	Fertilizer and Irrigation
0.15	1.34	0.23	2.03
0.02	0.14	0.04	0.27
0.16	0.02	0.34	0.92
0.37	0.08	0.16	1.07

0.22	0.08	0.05	2.38

1. Null and Alternative Hypothesis
2. Calculator Work

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3. Test Statistic and P-Value
4. Conclusion about the null hypothesis
5. Final conclusion that addresses the original claim

Does is appear that the treatment affects the weights of the trees? If so, which treatment appears to be best?

For more information and examples see online textbook OpenStax Introductory Statistics pages 743-756.