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6. STATISTICAL ANALYSIS

6.1 Introduction to Tests of Significance

The normal distribution of individual scores and the understanding of standard deviation are key elements to understanding significance tests.

6.1.1 ANOVA

The standard deviation, t-test, and correlation coefficients involve variance in the concepts and/or calculation methods. Use of the phrase "analysis of variance" (ANOVA) is reserved for a broad range of analytic techniques that address questions of statistical significance through calculation methods that divide overall variance into components. The calculation method uses a technique involving the 'sums of squares.' In one-way ANOVA, the following are calculated: the total sums of squares, sums of squares among groups, and residual sums of squares. Dividing each sums of squares by its associated degrees of freedom results in values called mean squares. Instead of calculating a t-test, ANOVA requires calculation of the F-ratio. Dividing the mean square among groups by the mean square yields the F-ratio. Traditionally, one would consult a table to locate the p-value associated with a specific combination of F, degrees of freedom for groups, and degrees of freedom for the error term. Today's use of computers makes the process of obtaining p-value easy. See Willoughby, T. Lee. (1995-96) for further details.

Table 6.01 shows a sample of a single factor ANOVA test performed on the first three cases (basecase, case 02, and case 03) of this research on the cage occupied zone averaged concentration values. The summary section shows the number of cages in each group, the sum of the concentration values in all cages in a group, the mean average concentration values in all cages in a group, and the variance around the mean. The ANOVA test itself reports an F and an F_{crit} value. If F_{crit} is less than F it can be said that there is a statistical difference between the members of the group. This is true for the sample given below and for all other groups of whole room runs.

Table 6.01 ANOVA Example for Concentration (basecase, case 02, and case 03)

SUMMARY:						
Groups	**Count**	**Sum**	**Average**	**Variance**		
Basecase	210	0.5774	0.0027	2.09E-07		
Case 02	210	0.4556	0.0022	1.67E-07		
Case 03	210	0.4196	0.0020	1.90E-07		
ANOVA:						
Source of Variation	**SS**	**df**	**MS**	**F**	**P-Value**	**Fcrit**
Between Groups	6.51E-05	2	3.26E-05	172.3	2.27E-60	3.0101
Within Groups	0.00012	627	1.89E-07			
Total	0.00018	629				

Table 6.02 ANOVA Example for Temperature (basecase, case 02, and case 03)

SUMMARY						
Groups	**Count**	**Sum**	**Average**	**Variance**		
Basecase	210	4631.6	22.06	0.1601		
Case 02	210	4689.7	22.33	0.0708		
Case 03	210	4905.7	23.36	0.2327		
ANOVA						
Source of Variation	**SS**	**df**	**MS**	**F**	**P-Value**	**Fcrit**
Between Groups	198.71	2	99.35	643.0	1.3E-152	3.01
Within Groups	96.89	627	0.155			
Total	295.59	629				

These examples show the F-value is much larger than the F_{crtit} and, therefore, the means are significantly different.