

Multiple Comparison Output

The following illustrations explain the proper interpretation of SPSS output concerning Multiple Comparison procedures (LSD, S-N-K, Tukey, and Scheffe).

The multiple comparison procedures are used to determine which groups are significantly different after obtaining a statistically significant result from an Analysis of Variance. For this example, three groups were compared. The groups are identified in the output as Group 1, Group 2, and Group 3. The following illustration shows a sample output from an **LSD** post hoc test.

Post Hoc Tests

Multiple Comparisons

Dependent Variable: SCORE

LSD

(I) GROUP	(J) GROUP	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
group 1	group 2	2.5000	2.09875	.247	-1.8646	6.8646
	group 3	-4.5000*	2.09875	.044	-8.8646	-.1354
group 2	group 1	-2.5000	2.09875	.247	-6.8646	1.8646
	group 3	-7.0000*	2.09875	.003	-11.3646	-2.6354
group 3	group 1	4.5000*	2.09875	.044	.1354	8.8646
	group 2	7.0000*	2.09875	.003	2.6354	11.3646

*. The mean difference is significant at the .05 level.

The two most important columns in this table are column 1 [(I) GROUP (J) GROUP] and column 4 [Sig.]. Each row involves the comparison of one group to each of the remaining two. For example, the first row of results involves the following comparisons: Group 1 v. Group 2 and Group 1 v. Group 3. In order to determine if Groups 1 and 2 are different, refer to the value in column 4 [Sig.]. For the Group 1 v. Group 2 comparison, the significance level is .247. Since this value is greater than the .05 level required for statistical significance, these two groups are **not** significantly different. Applying this same procedure to the Group 1 v. Group 3 comparison, the results would indicate a statistically significant difference (sig = .044 which is less than .05). After each of the groups has been compared to the other two, the final results would show that Groups 1 and 2 are significantly different from Group3, but Groups 1 and 2 are not significantly different from each other.

The following illustration shows a sample output from a **Student-Newman-Keuls (S-N-K)** post hoc test using the same data that was used in the previous example.

Post Hoc Tests

Homogeneous Subsets

SCORE

Student-Newman-Keuls^a

GROUP	N	Subset for alpha = .05	
		1	2
group 2	8	7.0000	
group 1	8	9.5000	
group 3	8		14.0000
Sig.		.247	1.000

Means for groups in homogeneous subsets are displayed.

a. Uses Harmonic Mean Sample Size = 8.000.

The first column in the output for the S-N-K post hoc test contains the list of groups in order from lowest to highest mean. (For this example, the mean for groups 2, 1, and 3 were 7.00, 9.50, and 14.00 respectively). The second column of the table, identifies the number of subjects in each group. The remaining columns identify the sets of groups that are statistically significantly different from each other. If two groups appear in the same column, then those groups **are not** significantly different. Additionally, a group that is listed in one column is said to be statistically significantly different from groups listed in another column. Therefore, based on the above output, groups 1 and 2 **are not** significantly different from each other since they are both listed in column 1. Since group 3 is the only group listed in column 2, then it is significantly different from group

The following illustration shows a sample output from a **Tukey** post hoc test using the same data that was used in the previous example.

Multiple Comparison Output

Post Hoc Tests

Multiple Comparisons

Dependent Variable: SCORE

Tukey HSD

(I) GROUP	(J) GROUP	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
group 1	group 2	4.5000	2.09875	.105	-.7901	9.7901
	group 3	-2.5000	2.09875	.471	-7.7901	2.7901
group 2	group 1	-4.5000	2.09875	.105	-9.7901	.7901
	group 3	-7.0000*	2.09875	.008	-12.2901	-1.7099
group 3	group 1	2.5000	2.09875	.471	-2.7901	7.7901
	group 2	7.0000*	2.09875	.008	1.7099	12.2901

*. The mean difference is significant at the .05 level.

Homogeneous Subsets

SCORE

Tukey HSD^a

GROUP	N	Subset for alpha = .05	
		1	2
group 2	8	7.0000	
group 1	8	11.5000	11.5000
group 3	8		14.0000
Sig.		.105	.471

Means for groups in homogeneous subsets are displayed.

a. Uses Harmonic Mean Sample Size = 8.000.

The output for the Tukey post hoc test combines the output formats of the LSD and S-N-K post hoc tests. The first table presents the results of the group by group comparisons and are interpreted the same as the LSD tables. The first row that compares group 1 to each of the remaining groups shows that there is no difference between group 1 and the other two groups. The second row that compares group 2 to each of the remaining groups shows that group 2 **is not** different from group 1 (sig = .105 which is greater than .05) but it is different from group 3 (sig = .008 which is less than .05).

The second table presents the results of the Tukey test in the same format that was used for the S-N-K post

Multiple Comparison Output

hoc test. The first column lists the groups in order from lowest to highest mean (group 2 = 7.00, group 1 = 11.50, group 3 = 14.00). Columns 1 and 2 show that there were no differences between groups 2 and 1 and groups 1 and 3. Since the only groups that do not overlap columns are 2 and 3, this indicates that the only groups that are different are groups 2 and 3. This is the same result that was obtained from the first table.

The following illustration shows a sample output from a **Scheffe** post hoc test using the same data that was used in the previous example.

Post Hoc Tests

Multiple Comparisons

Dependent Variable: SCORE

Scheffe

(I) GROUP	(J) GROUP	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
group 1	group 2	4.5000	2.09875	.125	-1.0264	10.0264
	group 3	-2.5000	2.09875	.503	-8.0264	3.0264
group 2	group 1	-4.5000	2.09875	.125	-10.0264	1.0264
	group 3	-7.0000*	2.09875	.012	-12.5264	-1.4736
group 3	group 1	2.5000	2.09875	.503	-3.0264	8.0264
	group 2	7.0000*	2.09875	.012	1.4736	12.5264

*. The mean difference is significant at the .05 level.

Homogeneous Subsets

SCORE

Scheffe^a

GROUP	N	Subset for alpha = .05	
		1	2
group 2	8	7.0000	
group 1	8	11.5000	11.5000
group 3	8		14.0000
Sig.		.125	.503

Means for groups in homogeneous subsets are displayed.

a. Uses Harmonic Mean Sample Size = 8.000.

Multiple Comparison Output

The output for the Scheffe post hoc test is presented and interpreted in the same format as the Tukey post hoc. The results from the above tables show that groups 2 and 1 are not significantly different and groups 1 and 3 are not significantly different. The only groups that are significantly different are 2 and 3.