Lab: 09/16/09

Tonight we will illustrate how to do post-hoc tests in SPSS using the same data set as last week:

1. Planned comparisons: Boferroni Procedure and Dunnett's test,
2. Pairwise comparison: Tukey, and
3. Post-Hoc correction: Scheffé's procedure

1-1. Bonferroni adjustment: We have 4 planned comparisons as below;

(1) $Ho: \mu_1 = \mu_2$

(2) $Ho: \mu_1 = \mu_4$

(3) $Ho: \mu_2 = \mu_4$

(4) $Ho: \mu_3 = \mu_4$

| | Factor 1 | Factor 2 | Factor 3 | Factor 4 | p-value | Adjusted p-value | Significant? |
|---|---|---|---|---|---|---|---|
| Contrast (1) | 1 | -1 | 0 | 0 | 0.219 | 0.876 | No |
| Contrast (2) | 1 | 0 | 0 | -1 | 0.002 | 0.008 | Yes |
| Contrast (3) | 0 | 1 | 0 | -1 | 0.017 | 0.068 | No |
| Contrast (4) | 0 | 0 | 1 | -1 | 0.633 | 2.532 | No |

a. What should be your family wise alpha in terms of the Bonferroni procedure for the comparisons you plan to make? 0.05/c = 0.05/4 = 0.0125

   What would be your family wise alpha if you had five contrasts? 0.05/5=0.01

b. Run SPSS for the four contrasts above and record the p-value for each contrast. Adjust the p-value for each contrast and decide which contrast(s) is(are) significant. Contrast 2 is significant.

1-2. Dunnett test: A researcher wants to compare the 28-hour group with the other groups.

a. What should be the reference group to do so? The last group, the 28-hour group.
b. Which group(s) is(are) significantly different from 28-hour group? Groups 1 and 2.

2. Tukey test:

a. Conduct the Tukey test.
b. Which groups are different from each other? Group 1 and 3, and groups 1 and 4.

3. Scheffé procedure:

a. Conduct the Scheffe test.
b. Which groups are different from each other? Group 1 and 3, and groups 1 and 4.

4. In conclusion or summary:

a. Let's compare significant levels from all procedures for contrast 2. Which procedure yields the lowest/highest p-value? Does the type of test used affect your conclusion?

| | p-value |
|---|---|
| Bonferonni adjustment | 0.008 |
| Dunnett | 0.004 |
| Tukey | 0.007 |
| Scheffe | 0.013 |

The Dunnett procedure produced the lowest p-value. The Scheffe procedure produced the highest value. The type of test does not affect our conclusion; they all show significant differences among groups 1 and 4, using $\alpha = 0.05$.

b. How about the contrast of group 2 to 4? Which procedure yields the lowest/highest p-value? Does the type of test used affect your conclusion?

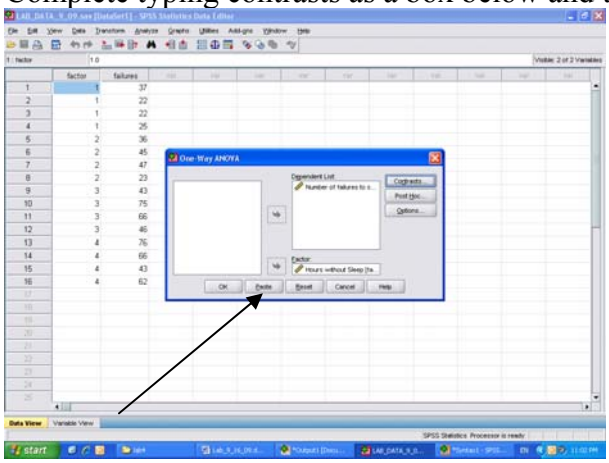
| | p-value |
|---|---|
| Bonferonni adjustment | 0.068 |
| Dunnett | 0.043 |
| Tukey | 0.071 |
| Scheffe | 0.105 |

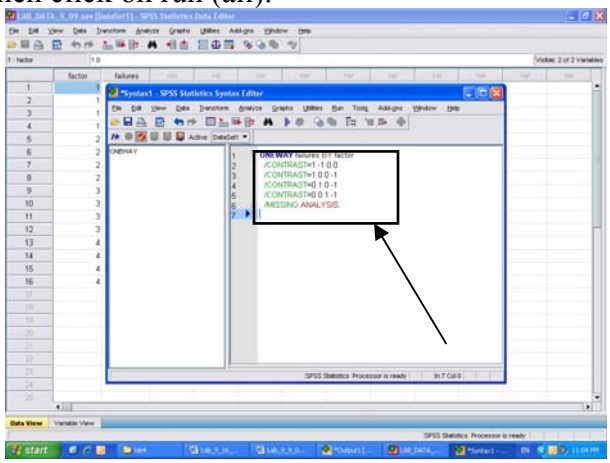
The Dunnett procedure produced the lowest p-value. The Scheffe procedure produced the highest value. The type of test does affect our conclusion; only the Dunnett procedure shows a significant differences among groups 2 and 4, using $\alpha = 0.05$.

HELP

1-1.

After coding the first contrast, click on paste. You will see a syntax mode as shown in figure 2 Complete typing contrasts as a box below and then click on run (all).



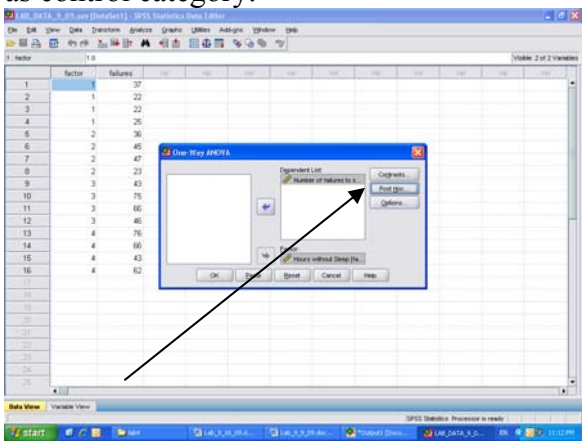


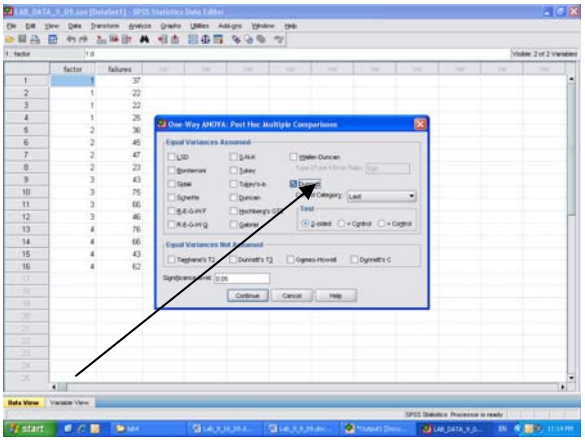
```
ONEWAY failures BY factor
  /CONTRAST=1 -1 0 0
  /CONTRAST=1 0 0 -1
  /CONTRAST=0 1 0 -1
  /CONTRAST=0 0 1 -1
  /MISSING ANALYSIS.
```

**Contrast Tests**

| | | Contrast | Value of Contrast | Std. Error | t | df | Sig. (2-tailed) |
|---|---|---|---|---|---|---|---|
| Number of failures to spot objects on screen | Assume equal variances | 1 | -11.25 | 8.673 | -1.297 | 12 | .219 |
| | | 2 | -35.25 | 8.673 | -4.064 | 12 | .002 |
| | | 3 | -24.00 | 8.673 | -2.767 | 12 | .017 |
| | | 4 | -4.25 | 8.673 | -.490 | 12 | .633 |
| | Does not assume equal variances | 1 | -11.25 | 6.530 | -1.723 | 5.165 | .144 |
| | | 2 | -35.25 | 7.777 | -4.533 | 4.496 | .008 |
| | | 3 | -24.00 | 8.811 | -2.724 | 5.699 | .036 |
| | | 4 | -4.25 | 10.383 | -.409 | 5.922 | .697 |

1-2. Click on Post Hoc rather than contrast, and then select Dunnett. Make sure you choose last as control category.





**Multiple Comparisons**

Number of failures to spot objects on screen
Dunnett t (2-sided)[a]

| (I) Hours without Sleep | (J) Hours without Sleep | Mean Difference (I-J) | Std. Error | Sig. | 95% Confidence Interval | |
|---|---|---|---|---|---|---|
| | | | | | Lower Bound | Upper Bound |
| 4 hrs | 28 hrs | -35.250* | 8.673 | .004 | -58.52 | -11.98 |
| 12 hrs | 28 hrs | -24.000* | 8.673 | .043 | -47.27 | -.73 |
| 20 hrs | 28 hrs | -4.250 | 8.673 | .927 | -27.52 | 19.02 |

a. Dunnett t-tests treat one group as a control, and compare all other groups against it.

*. The mean difference is significant at the 0.05 level.

2 and 3. Do the same thing but select Tuckey/Sheffe instead.

**Tukey HSD**

| (I) Hours without Sleep | (J) Hours without Sleep | Mean Difference (I-J) | Std. Error | Sig. | 95% Confidence Interval | |
|---|---|---|---|---|---|---|
| | | | | | Lower Bound | Upper Bound |
| 4 hrs | 12 hrs | -11.250 | 8.673 | .582 | -37.00 | 14.50 |
| | 20 hrs | -31.000* | 8.673 | .017 | -56.75 | -5.25 |
| | 28 hrs | -35.250* | 8.673 | .007 | -61.00 | -9.50 |
| 12 hrs | 4 hrs | 11.250 | 8.673 | .582 | -14.50 | 37.00 |
| | 20 hrs | -19.750 | 8.673 | .158 | -45.50 | 6.00 |
| | 28 hrs | -24.000 | 8.673 | .071 | -49.75 | 1.75 |
| 20 hrs | 4 hrs | 31.000* | 8.673 | .017 | 5.25 | 56.75 |
| | 12 hrs | 19.750 | 8.673 | .158 | -6.00 | 45.50 |
| | 28 hrs | -4.250 | 8.673 | .960 | -30.00 | 21.50 |
| 28 hrs | 4 hrs | 35.250* | 8.673 | .007 | 9.50 | 61.00 |
| | 12 hrs | 24.000 | 8.673 | .071 | -1.75 | 49.75 |
| | 20 hrs | 4.250 | 8.673 | .960 | -21.50 | 30.00 |

*. The mean difference is significant at the 0.05 level.

**Scheffe**

| (I) Hours without Sleep | (J) Hours without Sleep | Mean Difference (I-J) | Std. Error | Sig. | 95% Confidence Interval | |
|---|---|---|---|---|---|---|
| | | | | | Lower Bound | Upper Bound |
| 4 hrs | 12 hrs | -11.250 | 8.673 | .651 | -39.32 | 16.82 |
| | 20 hrs | -31.000* | 8.673 | .029 | -59.07 | -2.93 |
| | 28 hrs | -35.250* | 8.673 | .013 | -63.32 | -7.18 |
| 12 hrs | 4 hrs | 11.250 | 8.673 | .651 | -16.82 | 39.32 |
| | 20 hrs | -19.750 | 8.673 | .214 | -47.82 | 8.32 |
| | 28 hrs | -24.000 | 8.673 | .105 | -52.07 | 4.07 |
| 20 hrs | 4 hrs | 31.000* | 8.673 | .029 | 2.93 | 59.07 |
| | 12 hrs | 19.750 | 8.673 | .214 | -8.32 | 47.82 |
| | 28 hrs | -4.250 | 8.673 | .970 | -32.32 | 23.82 |
| 28 hrs | 4 hrs | 35.250* | 8.673 | .013 | 7.18 | 63.32 |
| | 12 hrs | 24.000 | 8.673 | .105 | -4.07 | 52.07 |
| | 20 hrs | 4.250 | 8.673 | .970 | -23.82 | 32.32 |

*. The mean difference is significant at the 0.05 level.

Tukey HSD[a]

| Hours without Sleep | N | Subset for alpha = 0.05 | |
|---|---|---|---|
| | | 1 | 2 |
| 4 hrs | 4 | 26.50 | |
| 12 hrs | 4 | 37.75 | 37.75 |
| 20 hrs | 4 | | 57.50 |
| 28 hrs | 4 | | 61.75 |
| Sig. | | .582 | .071 |

Scheffe[a]

| Hours without Sleep | N | Subset for alpha = 0.05 | |
|---|---|---|---|
| | | 1 | 2 |
| 4 hrs | 4 | 26.50 | |
| 12 hrs | 4 | 37.75 | 37.75 |
| 20 hrs | 4 | | 57.50 |
| 28 hrs | 4 | | 61.75 |
| Sig. | | .651 | .105 |