DIET AND LONGEVITY STUDY

7.   Comparing the Average Effects with the F-Test

In the experiment mice were divided at random into six experimental groups. We would like to know whether diet restriction had any effect on the life span of the mice. An appropriate statistical technique to examine the effect is one-way ANOVA. The purpose of ANOVA is to assess whether the observed differences among treatment groups are statistically significant. More precisely, the null hypothesis is that the treatments are not different on average, while the alternative hypothesis is that at least one of the treatments is different, on average, from the others (of course, they could all be different from each other).

SPSS produces the following output:

Analysis of Variance

Source	D.F.	Sum of Squares	Mean Squares	F Ratio	Prob.
Between Groups	5	12733.9418	2546.7884	57.1043	.0000
Within Groups	343	15297.4150	44.5989		
Total	348	28031.3568			

Group	Count	Mean	Standard Deviation	Standard Error	95 Pct Conf Int for Mean	
NP	49	27.4020	6.1337	.8762	25.6402 TO	29.1638
N/N85	57	32.6912	5.1253	.6789	31.3313 TO	34.0512
LOPRO	56	39.6857	6.9917	.9343	37.8133 TO	41.5581
N/R50	71	42.2972	7.7682	.9219	40.4585 TO	44.1359
R/R50	56	42.8857	6.6832	.8931	41.0960 TO	44.6755
N/R40	60	45.1167	6.7034	.8654	43.3850 TO	46.8483
Total	349	38.7971	8.9750	.4804	37.8522 TO	39.7420

The instructions how to obtain the above output are given in the *Computer Instructions* module (click on it to access them).

In the computer output, the columns in the upper part of the table are labeled **Source**, **DF**, **Sum of Squares**, **Mean Squares**, **F Ratio**, and **Prob.** The rows are labeled **Between Groups**, **Within Groups**, **Total**. These are the three sources of variation in the one-way ANOVA.

The value of the F statistic is 57.1043, and the p-value of the test is reported as zero. In fact, the p-value is an extremely small but positive number. Therefore, there is overwhelming evidence that mean lifetimes in the six treatments are different.

The output also provides the mean, standard deviation, and 95% confidence interval for the mean for each of the six treatment groups.

According to the assumptions stated in Section 6.1, the treatment groups should come from treatments (populations) with equal variances. To test this assumption, you can use Levene's homogeneity-of-variance test. However, the test is not robust against nonnormality. The normal quantile plots obtained in Section 6 indicate that the normality assumption might be slightly violated. Therefore, the test might be not reliable in this case. SPSS produces the following output:

Levene Test for Homogeneity of Variances

Statistic	df1	df2	2-tail Sig.
3.1463	5	343	.009

As you can see, the test provides strong evidence against the assumption of equal variances, which is inconsistent with the results obtained in Section 6.2. Nonnormality has strongly affected the outcome of the test.