FAILURE TIMES OF BEARINGS

6. Comparing the Average Failure Times

We would like to know whether there are significant differences in the failure times for the five materials. An appropriate statistical technique to examine the differences is one-way ANOVA. The purpose of ANOVA is to assess whether the observed differences among the five groups are statistically significant. More precisely, the null hypothesis is that the materials are not different in failure times on average, while the alternative hypothesis is that at least one of the material is different, on average, from the others (of course, they could all be different from each other).

SPSS produces the following output:

Variable TIME
By Variable CODE

Analysis of Variance

Source	D.F.	Sum of Squares	Mean Squares	F Ratio	F Prob.
Between Groups	4	401.2775	100.3194	5.0202	.0020
Within Groups	45	899.2370	19.9830		
Total	49	1300.5145			

The analysis of variance F-statistic is F=5.0202, with 4 and 45 degrees of freedom, giving a p-value of 0.002. That small p-value indicates strong evidence against the null hypothesis of no difference among the average failure times for the five groups. In other words, there is strong evidence of differences among the group means. The within-group mean square is 19.983, so the pooled estimate of a common standard deviation is the square root of the value, which is equal to 4.47 milion cycles.