$(2-1)(5-1) = 4$. The S/R term is the variation within subjects summed over groups, and the degrees of freedom are $R(n-1) = 2(4-1) = 6$. The SC/R term is the subject-by-column interactions summed over rows, and the degrees of freedom are $R(n-1)(C-1) = 2(4-1)(5-1) = 24$.

The appropriate error term for testing row effects is the S/R variance estimate. The appropriate error term for testing column effects and $R \times C$ interaction is the SC/R variance estimate. The F ratios are as follows:

$$F_r = \frac{s_r^2}{s_{s/r}^2} = \frac{32.40}{35.32} = .92 \qquad p > .05$$

$$F_c = \frac{s_c^2}{s_{sc/r}^2} = \frac{31.53}{4.36} = 7.23 \qquad p < .01$$

$$F_{rc} = \frac{s_{rc}^2}{s_{sc/r}^2} = \frac{28.10}{4.36} = 6.44 \qquad p < .01$$

In this illustrative example the row effects are not significant, whereas the column effects, row-by-column effects, and row-by-column interaction are significant at better than the .01 level.

19.10 ASSUMPTIONS UNDERLYING REPEATED-MEASUREMENT DESIGNS

A basic assumption in the analysis of variance is the homogeneity of variance assumption. In, for example, a simple analysis of variance involving k independent groups this assumption may be stated in the form $\sigma_1^2 = \sigma_2^2 = \cdots = \sigma_k^2 = \sigma^2$. It has been shown that reasonable violations of this assumption will not seriously bias the F test. The analysis-of-variance procedures are said to be robust with respect to violations of the homogeneity of variance assumption. In the analysis of variance involving repeated measurements, assumptions are made not only regarding the homogeneity of variance but also regarding the homogeneity of covariance. To illustrate, in a one-factor experiment with repeated measurements N subjects are measured under C treatments. All the covariances, $r_{ij}s_is_j$, between pairs of treatments may be calculated. The homogeneity of covariance assumption is that all $r_{ij}s_is_j$ are estimates of the same population covariance. If, for example, repeated measurements were made for N subjects on four conditions, the following covariance table, or matrix, might be calculated.

	1	2	3	4
1	s_1^2	$r_{12}s_1s_2$	$r_{13}s_1s_3$	$r_{14}s_1s_4$
2	$r_{12}s_1s_2$	s_2^2	$r_{23}s_2s_3$	$r_{24}s_2s_4$
3	$r_{13}s_1s_3$	$r_{23}s_2s_3$	s_3^2	$r_{34}s_3s_4$
4	$r_{14}s_1s_4$	$r_{24}s_2s_4$	$r_{34}s_3s_4$	s_4^2