The expectations of the variance estimates or mean squares for a two-factor experiment with repeated measurements on one factor, and assuming the row and column treatment variables to be fixed, are as follows:

ROWS, s_r^2	$\sigma_e^2 + C\sigma_s^2 + nC\sigma_a^2$
S/R, $s_{s/r}^2$	$\sigma_e^2 + C\sigma_s^2$
COLUMNS, s_c^2	$\sigma_e^2 + \sigma_{bs}^2 + nR\sigma_b^2$
$R \times C$, s_{rc}^2	$\sigma_e^2 + \sigma_{bs}^2 + n\sigma_{ab}^2$
$(C \times S)/R$, $s_{cs/r}^2$	$\sigma_e^2 + \sigma_{bs}^2$

The quantities σ_a^2, σ_b^2, σ_{ab}^2, and σ_e^2 are variance components as described in Section 16.6. The quantity σ_s^2 is a variance component which is due to the variation of subjects within groups.

Examination of the above expectations indicates that the correct error term for testing row effects is the S/R variance estimate. The correct error term for testing column and $R \times C$ interaction effects is the $(C \times S)/R$ variance estimate.

19.8 COMPUTATION FORMULAS FOR TWO-FACTOR EXPERIMENTS WITH REPEATED MEASUREMENTS ON ONE FACTOR

Computation formulas may readily be obtained to compute the required sums of squares. As previously the sum of all nRC observations will be denoted by T. We denote the row and column totals by $T_{r..}$ and $T_{.c.}$, respectively. The total for the rth row and cth column summed over subjects is $T_{rc.}$. The total for any subject in any row summed over columns is $T_{r.s}$. The total for n subjects for any group summed over columns is $T_{rc.}$. Given this notation, the computation formulas are as follows:

BETWEEN SUBJECTS

[19.1] $$\frac{1}{C}\sum^{R}\sum^{n} T_{r.s}^2 - \frac{T^2}{nRC}$$