Two-way ANOVA: JxK factorial design

MODEL:  \( y_{ijk} = \mu + \alpha_j + \beta_k + (\alpha\beta)_{jk} + \epsilon_{ijk} \)

| \( \mu_{11} \) | \( \mu_{21} \) | \( \mu_{31} \) | \( \mu_{41} \) |
| \( \mu_{12} \) | \( \mu_{22} \) | \( \mu_{32} \) | \( \mu_{42} \) |
| \( \mu_{13} \) | \( \mu_{23} \) | \( \mu_{33} \) | \( \mu_{43} \) |
| \( \mu_{14} \) | \( \mu_{24} \) | \( \mu_{34} \) | \( \mu_{44} \) |

\[ \Sigma_j \mu_{jk} = \mu_j \quad \Sigma_k \mu_{jk} = \mu_k \quad \Sigma_j \Sigma_k \mu_{jk} = \mu \]

\[ \Sigma_j \alpha_j = 0 \quad \Sigma_k \beta_k = 0 \quad \Sigma_j (\alpha\beta)_{jk} = 0 \quad \Sigma_j (\alpha\beta)_{jk} = 0 \]

The JxK factorial design is One-way CRD with JK levels of the treatment:

with  \( \tau_{jk} = \alpha_j + \beta_k + (\alpha\beta)_{jk} \) for cell \( jk \).

There are four null hypotheses that one might test.

First:  \( \tau_{jk} = 0 \) for all \( j \) and \( k \)

Second:  \( (\alpha\beta)_{jk} = 0 \) for each \( j \) and \( k \).

Third:  \( \alpha_j = 0 \) for all \( j = 1, 2, \ldots, J \)

Fourth:  \( \beta_k = 0 \) for all \( k = 1, 2, \ldots, K \)