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LOCALLY MOST POWERFUL RANK TESTS FOR RANDOM EFFECTS IN TWO-WAY EXPERIMENTS

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A locally most powerful (LMP) rank test against logistic alternatives is derived for the two-way experiment with random treatment effects and fixed block effects. We tabulate the critical values of the test criterion for $b = 2, 3, 4$, $c = 2, 3, 4$ and $n_{ij} \equiv n = 2(1)\ 10$. We study its asymptotic behavior when the null hypothesis is true.

1. Introduction and Summary. The use of blocks in a design represents an attempt to remove a source of variability in the observations and so makes it possible to obtain a more accurate evaluation of the factor of interest. Observational material is segregated into groups which should be as homogeneous as possible and the effect of the factor of interest is observed on each of the groups individually.

The model one would use for this situation is

$$X_{ijk} = \mu + \beta_i + Y_j + \varepsilon_{ijk},$$
$$k = 1, \cdots, n_{ij}, \quad j = 1, \cdots, c; \quad \text{and} \quad i = 1, \cdots, b,$$

where Y_j and ε_{ijk} are mutually independent random variables. The hypothesis we wish to test is: H_0 : the treatment Y_j produces uniform results, hence its variance is 0.

Traditionally one would assume that the ε_{ijk} are normally distributed with mean zero and variance σ_e^2; that the Y_j are also normal, with mean zero and variance σ_T^2; and that the block effects, the β_i, are additive. One would then usually use the familiar test criterion F =MST/MSE.

In this paper we describe a locally most powerful (LMP) rank test of H_0 against logistic alternatives. We also study its asymptotic behavior and find its computational form, and provide a table of critical values of the test critierion for $b = 2, 3, 4$, $c = 2, 3, 4$, and $n_{ij} \equiv n = 2(1)10$.

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