

ORDER RESTRICTED RANDOMIZED DESIGNS FOR CONTROL VERSUS TREATMENT COMPARISON

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Abstract. We develop a method of randomizing units to treatments that relies on subjective judgement or on possible coarse modeling to produce restrictions on the randomization. The procedure thus fits within the general framework of ranked set sampling. However, instead of selecting a single unit from each set for full measurement, all units within a set are used. The units within a set are assigned to different treatments. Such an assignment translates the positive dependence among units within a set into a reduction in variation of contrasting features of the treatments.

A test for treatment versus control comparison, with controlled familywise error rate, is developed along with the associated confidence intervals. The new procedure is shown to be superior to corresponding procedures based on completely randomized or ranked set sample designs. The superiority appears both in asymptotic relative efficiency and in power for finite sample sizes. Importantly, this test does not rely on perfect rankings; rather, the information in the data on the quality of rankings is exploited to maintain the level of the test when rankings are imperfect. The asymptotic relative efficiency of the test is not affected by estimation of the quality of rankings, and the finite sample performance is only mildly affected.

Key words and phrases: Ranked set sampling, sampling design, sign test.