STATISTICAL INFERENCE FOR ORDER RESTRICTED RANDOMIZED DESIGNS

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Abstract. In many scientific studies, there is an abundance of information about the characteristics of interest, such as the color, texture, general quality of the experimental unit, etc. This type of information is subjective and not easily translated into covariates. Thus, the model based inference such as covariance analysis is not applicable. On the other hand, use of this type of information significantly improve statistical inference.

In the first part of this talk, I will provide an overview of ranked set sampling and discuss why it may not be feasable to use in the desing of experiments. In the second part of the talk I will introduce a randomization scheme that relies on subjective judgments about experimental units to design an experiment. Since the randomization is tied to subjective quality measures of the units prior to performing the experiment, the proposed scheme is a special case which fits well within the general framework of ranked set sampling. On the other hand, unlike ranked set sampling, it uses all the units within each set with some restricted randomization to treatment combinations. Such an assignment induces positive dependence among within set units, but the restrictions on randomization translate this positive dependence into a variance reduction technique. As a result the precision of traditional designs can be achieved with smaller sample sizes with the new design.

I provide motivation for restricted randomization and introduce optimal designs for certain hypotheses in linear models. I also develop a unified theory to analyze data sets collected through order restricted randomization. Analysis uses the general framework of generalized linear models with some modification to our randomization scheme. It is shown that the estimators and test statistics have limiting normal and chi-square distributions even under imperfect judgment ranking, respectively. A simulation study shows that the asymptotic results remain valid even for relatively small sample sizes.

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