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Order-of-addition Experiments: Design and Analysis

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Biography

Dr. Dennis K. J. Lin is a University Distinguished Professor of Supply Chain and Statistics at Penn State University. His research interests are quality assurance, industrial statistics, data mining, and response surface. He has published near 250 SCI/SSCI papers in a wide variety of journals. He currently serves or has served as an associate editor for more than 10 professional journals and was a co-editor for Applied Stochastic Models for Business and Industry. Dr. Lin is an elected fellow of ASA, IMS and ASQ, an elected member of ISI, a lifetime member of ICSA, and a fellow of RSS. He is an honorary chair professor for various universities, including a Chang-Jiang Scholar at Renmin University of China, Fudan University, and National Chengchi University (Taiwan). His recent awards include the Youden Address (ASQ, 2010), the Shewell Award (ASQ, 2010), the Don Owen Award (ASA, 2011), the Loutit Address (SSC, 2011), the Hunter Award (ASQ, 2014), and the Shewhart Medal (ASQ, 2015). Last year, he was awarded the SPES Award at the Joint Statistical Meeting.

Abstract

In Fisher (1971), a lady was able to distinguish (by tasting) from whether the tea or the milk was first added to the cup. This is probably the first popular order of addition experiment. In general, there are m required components and we hope to determine the optimal sequence for adding these m components one after another. Knowing the optimal order of addition of components related in production is crucial. It is often unaffordable to test all the m! treatments, and the design problem arises (when m=10, for example, m! is about 3.5 million). We consider the model in which the response of a treatment depends on the pairwise orders of the components. The optimal design theory under this model is established, and the optimal values of the D-, A-, E-, and M:S:-criteria are derived. We identify a special constraint on the correlation structure of such designs. The closed-form construction of a class of optimal designs is obtained, with examples for illustration. One case study for job scheduling will be discussed.

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