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Block Designs: A Randomization Approach

Volume II: Design

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To Maria Calińska and Masako Kageyama

Preface

The book is composed of two volumes, each consisting of five chapters. In Volume I, following some statistical motivation based on a randomization model, a general theory of the analysis of experiments in block designs has been developed. In the present Volume II, the primary aim is to present methods of constructing block designs that satisfy the statistical requirements described in Volume I, particularly those considered in Chapters 3 and 4, and also to give some catalogues of plans of the designs. Thus, the constructional aspects are of predominant interest in Volume II, with a general consideration given in Chapter 6. The main design investigations are systematized by separating the material into two contents, depending on whether the designs provide unit efficiency factors for some contrasts of treatment parameters (Chapter 7) or not (Chapter 8). This distinction in classifying block designs may be essential from a practical point of view. In general, classification of block designs, whether proper or not, is based here on efficiency balance (EB) in the sense of the new terminology proposed in Section 4.4 (see, in particular, Definition 4.4.2). Most of the attention is given to connected proper designs because of their statistical advantages as described in Volume I, particularly in Chapter 3. When all contrasts are of equal importance, either the class of $(v-1;0;0)$-EB designs, i.e., orthogonal designs, or that of $(0;v-1;0)$-EB designs, i.e., efficiency balanced designs, is to be recommended in the search for an appropriate design, where v is the number of distinct treatments to be compared in the experiment. If not, that is, when the experimenter wants to estimate some of the contrasts of treatment parameters with higher and some other with lower efficiencies, the case of $(\rho_0;\rho_1,...,\rho_{m-1};0)$-EB designs, with $m=2$, 3 or more, may be of interest, where $\{\rho_\beta\}$ denote multiplicities of the relevant efficiency factors. In these designs, of several distinct efficiency factors, one of them could be equal to 1, i.e., ρ_0 could be nonzero. This may be very desirable in certain practical situations in which the experimenter wants to estimate some of the contrasts with full efficiency.

In separate chapters, resolvable designs (Chapter 9) and some special designs (Chapter 10), including nonbinary designs and some disconnected designs, are considered. Each chapter gives some general considerations on the characterization and construction of the relevant block designs. The reader can choose any chapter according to his/her experimental interest. In this sense the reader may find in each chapter design characteristics (called the parameters of the design), actual plans or methods of construction, the efficiency factors of the designs, and finally some illustrations by examples.

To avoid repetition, the term design is used to denote a connected block design, except when stated otherwise, particularly in Section 10.4, where some disconnected block designs are considered. In the terminology of Section 4.4, this means that unless otherwise stated, it will always be assumed that $\rho_m = 0$ (see again Definition 4.4.2).

As stated in the preface to Volume I, the book is aimed at an advanced audience, including students at the postgraduate level and research workers interested in designing and analyzing experiments with full understanding of the principles. Whereas in the previous volume the main interest has been in the analysis, in the present volume the emphasis is on the design. The knowledge of the rules underlying the analysis is, however, essential at the stage of choosing a proper design for the experiment to be conducted.

The help of several colleagues in the preparation of this book is appreciated. In particular thanks are due to Dr. Paweł Krajewski for his help in computing the example analyses and to Dr. Idzi Siatkowski, Dr. Takashi Seo, and Dr. Miwako Mishima for their assistance in the technical preparation of the manuscript. Last but not least, the authors are most grateful to Dr. John Kimmel, the editor at Springer, and to several reviewers for their many instructive comments and suggestions, and also for their inspiring encouragement.

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Comments and corrections will be welcomed. The authors' email addresses are in page iv. We plan to maintain a list of corrections for Volume I that will be found on our home pages. At the present time our home pages have the following address:

http://home.hiroshima-u.ac.jp/matedu/staff/ftp/corre.pdf

or

http://home.hiroshima-u.ac.jp/matedu/staff/kageyama-e.html

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