


volume 139

lecture notes in pure and applied mathematics



graphs, matrices, and designs

edited by
Rolf S. Rees

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This Festschrift in honor of Norman J. Pullman's sixtieth birthday reflects and enhances his important contributions to a **wide range** of topics in matrix theory, linear algebra, and graph theory.

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Festschrift in Honor of Norman J. Pullman

edited by

Rolf S. Rees

*Memorial University of Newfoundland
St. John's, Newfoundland, Canada*



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Preface

It is customary in mathematics to show one's love and respect for a senior colleague by dedicating a research paper to him or her—birthdays and special anniversaries are two usual occasions. This is a book containing 21 such research papers in honor of the sixtieth birthday of Professor Norman J. Pullman on March 31, 1991.

Professor Pullman, who hails from New York, obtained his Ph.D. at Syracuse University in 1962. He taught for three years at McGill University before taking up a postdoctoral fellowship at the University of Alberta in 1965. Since then he has been on the faculty of Queen's University, Kingston, Ontario, where he was promoted to Professor in 1971. In addition to being his sixtieth birthday, 1991 also marks his 25th year of service at Queen's. In this time Professor Pullman has supervised 13 graduate students, three of whom are represented in this collection (D. de Caen, W. Jackson, and R. Rees). He has been an Invited Lecturer at six different professional meetings over the last 12 years, including annual meetings of the American Mathematical Society and the Australian Mathematical Society.

Professor Pullman has a long-standing association with Curtin University of Technology (formerly Western Australian Institute of Technology), Perth, Australia. He has been a Visiting Scholar there on several occasions in the last ten years.

Professor Pullman's research has spanned a wide range of topics in matrix theory, linear algebra, and graph theory. He has made significant contributions to the theory of tournaments and tournament matrices, the study of clique and biclique covering numbers and their relation to the problem of determining the boolean and real ranks of binary matrices, and the study of linear operators that preserve some prescribed property of a matrix (over some semiring). The 21 excellent chapters in this volume cover many aspects of his interests and constitute a representative sampler of current research in these areas. As such, we expect that this book will be of interest to anyone working in one or more of these areas.

To those who are familiar with Professor Pullman's work, the inclusion of design theory as one of his interests may at first seem to be something of a curiosity. Keeping in mind, however, that a pairwise balanced design is just an edge-clique partition of the complete graph, one of Professor Pullman's favorite problems (that of determining the clique partition number of the graph $K_v \setminus K_k$) is very closely related to a well-known extremal problem in design theory (that of determining the smallest number $g^{(k)}(v)$ of blocks required to construct a pairwise balanced design on v points in which the largest block has size k).

I would like to thank the referees, without whose invaluable assistance this volume would not have been possible. In this regard, special thanks go to D. Archdeacon, R. Brualdi, D. Hoffman, E. Kramer, E. Lamken, and C. H. Yang. I would also like to thank Professors Dominique de Caen and Walter D. Wallis for their encouragement and support in the early stages of this project. Finally, I wish to thank Professor Pullman for being my supervisor, mentor, and very dear friend.

I am certain that I speak for all the contributors in wishing our colleague and friend Norman J. Pullman a very happy birthday and continued success in all his endeavors.

Rolf S. Rees

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