Preface

Two-person zero-sum finite games, which often are called matrix games for short, are an important part of noncooperative games. Matrix games have been extensively studied and successfully applied to many fields such as management science, decision science, operational research, economics, finance, business, social science, and biology as well as engineering. However, the assumption that all payoffs are precise common knowledge to the players is not realistic in many competitive or antagonistic decision occasions. In fact, more often than not, in real competitive or antagonistic situations, the players cannot exactly estimate payoffs in the game due to lack of adequate information and/or imprecision of the available information on the environment. This lack of precision and certainty may be appropriately modeled by using the fuzzy set. Intervals and triangular fuzzy numbers, which are special and simple cases of the fuzzy sets, seem to be suitable and convenient for dealing with fuzziness or imprecision of payoffs in matrix games. On the other hand, in some real-life game problems, choice of strategies for the players is constrained due to some practical reason why this should be, i.e., not all mixed (or pure) strategies in a game are permitted for each player. As a result, there appear four important types of matrix games, which are interval-valued matrix games, matrix games with payoffs of triangular fuzzy numbers, interval-valued constrained matrix games, and constrained matrix games with payoffs of triangular fuzzy numbers. As far as I know, however, there is less investigation on them. Therefore, this book focuses on studying the concepts, properties, models, and methods of the aforementioned four types of matrix games.

This book is divided into two parts. Each part includes two chapters. Chapter 1 discusses interval-valued matrix games, mainly including interval-valued mathematical programming models of interval-valued matrix games, acceptability-degree-based linear programming models and method of interval-valued matrix games, the lexicographic method of interval-valued matrix games, and primal-dual linear programming models and method of interval-valued matrix games. Chapter 2 studies matrix games with payoffs of triangular fuzzy numbers, mainly including fuzzy multi-objective programming models and fuzzy linear programming method of matrix games with

payoffs of triangular fuzzy numbers, two-level linear programming models and method of matrix games with payoffs of triangular fuzzy numbers, the lexicographic method of matrix games with payoffs of triangular fuzzy numbers, and Alfa-cut-based primal-dual linear programming models and method of matrix games with payoffs of triangular fuzzy numbers. Chapter 3 expatiates interval-valued constrained matrix games, including the concepts of solutions of interval-valued constrained matrix games and properties, and primal-dual linear programming models and method of interval-valued constrained matrix games. Chapter 4 expounds constrained matrix games with payoffs of triangular fuzzy numbers, mainly including fuzzy multi-objective programming models and method of constrained matrix games with payoffs of triangular fuzzy numbers, and Alfa-cut-based primal-dual linear programming models and method of constrained matrix games with payoffs of triangular fuzzy numbers. The aim of this book was to develop and establish simple, efficient, and effective linear programming models and methods for solving interval-valued matrix games, interval-valued constrained matrix games, matrix games with payoffs of triangular fuzzy numbers, and constrained matrix games with payoffs of triangular fuzzy numbers. I tried my best to ensure that the models and methods developed in this book are of practicability, maneuverability, and universality.

This book is addressed to people in theoretical researches and practical applications from different fields and disciplines such as decision science, game theory, management science, fuzzy sets or fuzzy mathematics, applied mathematics, optimizing design of engineering and industrial system, expert system, and social economy as well as artificial intelligence. Moreover, it is also addressed to teachers, postgraduates, and doctors in colleges and universities in different disciplines or majors: decision analysis, management, operation research, fuzzy mathematics, fuzzy system analysis, systems engineering, project management, industrial engineering, hydrology, and water resources.

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Ultimately, I should claim that I am fully responsible for all errors and omissions in this book.

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