

FOREWORD

This book offers an abundance of concepts related to theory and applications of multiple criteria and multiple constraint-level (MC²) linear programming. The author put what he has done in this area over last decade and the related literature in this book. With careful reading and digesting, the reader could greatly expand his/her domains of thinking in research and practice.

Originally, simplex method focuses on single objective with single constraint level. It has made tremendous contributions to the area of operations research of management science. Unfortunately, many significant decision problems are involved with multiple criteria and with multiple level constraints and uncertainty. This makes it difficult to apply the single criterion and single constraint simplex method to solve nontrivial realistic problems. Realizing this difficulty, many scholars (including M. Zeleny, my friend and previous student, and myself) began to work on multiple criteria (MC) simplex methods in early 1970s.

In the middle of 1970s, L. Seiford, my friend and previous student, and I successfully extended MC-simplex method to (multi-criteria and multi-constraint level) MC²-simplex method, including the duality theory and potential solutions.

In early 1980s, Y. R. Lee, my friend and previous student, and I further extended MC²-simplex method and its application, including how to convert an infeasible solution caused by uncertainty into a feasible solution by investing more in resource level (concepts and techniques). Linear optional design and contingency plans were therefore born. However, many challenging research and application problems remained to be explored. In 1986, the current author of this book, Yong Shi, decided to tackle this difficult challenging problem as his Ph. D dissertation.

One day in my office I asked Yong, "I know you are very talented, motivated, and hard working. You have great potential to become a "top class" of scholar if you are willing to work for it. Would you like to do it? " Without hesitation, he said yes and would work hard for it. But at that time he just came from China with limited English and his skill of

mathematical analysis skill was not as strong as needed to overcome analytical problems. In order to improve his English, I suggested him to memorize one “editorial” a day of the KU (University of Kansas) newspaper “KANSANS” and write it out after memorizing the contents. Yong did this consistently for a year. His English therefore have greatly improved. In order to increase his capability of mathematical analysis, I also asked him to take a number of classes in mathematical analysis. Yong worked hard and successfully went through the training. Because of his hard work and dedication, Yong successfully finished his dissertation with distinction. He has gone much farther in research on MC^2 linear programming and applications after his graduation from KU. Yong’s persistence, dedication and hard work described as above are essential for this book to be completed.

Many Scholars or professionals might think “simplex method” is adequate for their problems and learn only simplex method. Others are aware of the limitation of simplex method and work hard to learn MC-simplex method. Still there are people who know the limitation of MC-simplex method. They work hard to learn MC^2 -simplex method and their further topics. It takes special interest, talent and drive to learn all of these advanced concepts and techniques. The reader will not to disappointed by spending the effort to learn these advanced concepts and techniques. He or she can at least avoid the trap, spoken eloquently by A. H. Maslow, “ If the only tool you have is a hammer, you tend to see every problem as a nail”. In additions, in this fast changing world, academically or industrially, the more advanced tools we have, the more competent we will be able to cope with problems and competition.

It is gratifying for me to see a talented friend and previous student who has devoted so much time and efforts to put so many materials in this book. Almost half of the book is based on the research results done by my previous students including Zeleny, Seiford, Lee, Shi, and myself. The other half, including some new form of duality theory, MC^2 transportation problems, De Novo Programming, applications, etc. are based on research results done by Shi and his colleagues. Some of new developments by Shi and his colleagues are outside of my competence and beyond my comprehension.

This book contains a large number of new ideas and a number of remaining questions for further researches. It is not only suitable for graduate students but also for professors and professionals who work in

management science and operations research. It will expand readers' vision about operations research and sharpen his/her mind in management science and technology.

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