Preface

The subject of linear programming was discovered by Dr. George B. Dantzig, and the subject of integer programming was discovered by Dr. Ralph E. Gomory. Thousands of papers and hundreds of books have been published. Is there still a need for this book?

The earlier algorithms for integer programming were based on cutting planes. In this book, we map non-basic columns into group elements to satisfy congruence relations. The first six chapters of the book are about linear programming. Then, Chapter 8 introduces the knapsack problem which is known to have time complexity of $O(nb)$, where n is the number of types of items and b is the capacity of the knapsack. We present a new algorithm which has time complexity $O(nw)$, where n is the number of types of items and w is the weight of the *best* item, that is, the item with the highest ratio of value to weight.

The unique contents of this book include:

1. The column generating technique for solving very large linear programs with too many columns to write down (Chapter 7)
2. A new knapsack algorithm with its time complexity $O(nw)$, where n is the number of types of items and w is the weight of the best item (Chapter 8)

The knapsack problem highlights two striking features of an integer program:

1. The optimum integer solution has a periodic structure.
2. The percentage of integer programs that cannot be solved by the group method becomes smaller and smaller as the right-hand side becomes larger and larger.

Thus, we explain the two features in detail and devote all of Chapter 9 to the asymptotic algorithm for integer programming; we present "The World Map on Integer Programs" in Chapter 10.

Chapter 11 of this book introduces the practical application of linear and integer programming. Ultimately, real-world problems must be formulated as linear or integer programs and then solved on computers using commercial or public-domain software packages. We give examples and pointers to this end.

This book emphasizes intuitive concepts and gives a corresponding numerical example after each concept. It is intended to be a textbook for undergraduates and graduates, a short course, or self-learning. And, its unique approach draws on over 50 years of the first author's unique experience as researcher and educator, author of textbooks on combinatorial optimization and integer programming, and 40 years of teaching combinatorial optimization and algorithms to graduate and undergraduate students alike. The book's website, http://lipme.org, gives solutions to all exercises in the book, as well as additional exercises with solutions. The website also provides worked practical application examples and links to further resources.

The book was first typed by Alex Kahng and Aidan Kahng. It was retyped and proofread by Dr. Peng Du. Further valuable feedback and inputs were provided by Alex Kahng, along with Ilgweon Kang, Jiajia Li, Hyein Lee, Kwangsoo Han, Lutong Wang, Yaping Sun, and Mulong Luo. For their efforts, the authors are extremely grateful.

We hope that you will enjoy reading this book. Please write to us at lipme@vlsicad.ucsd.edu with your comments, your criticisms, or any errors that you have found. We will update you about changes in the second printing before it appears.

Last, the authors wish to dedicate this book to the following friends who have made important contributions to the contents of the book:

G.B. Dantzig
R.E. Gomory
A.J. Hoffman
E.L. Johnson
D.J. Kleitman
M.T. Shing

Otter Cove, CA — T. C. Hu
La Jolla, CA — A. B. Kahng
June 2015

Springer

http://www.springer.com/978-3-319-23999-6

Linear and Integer Programming Made Easy
Hu, T.C.; Kahng, A.B.
2016, X, 143 p. 24 illus., 1 illus. in color., Hardcover
ISBN: 978-3-319-23999-6