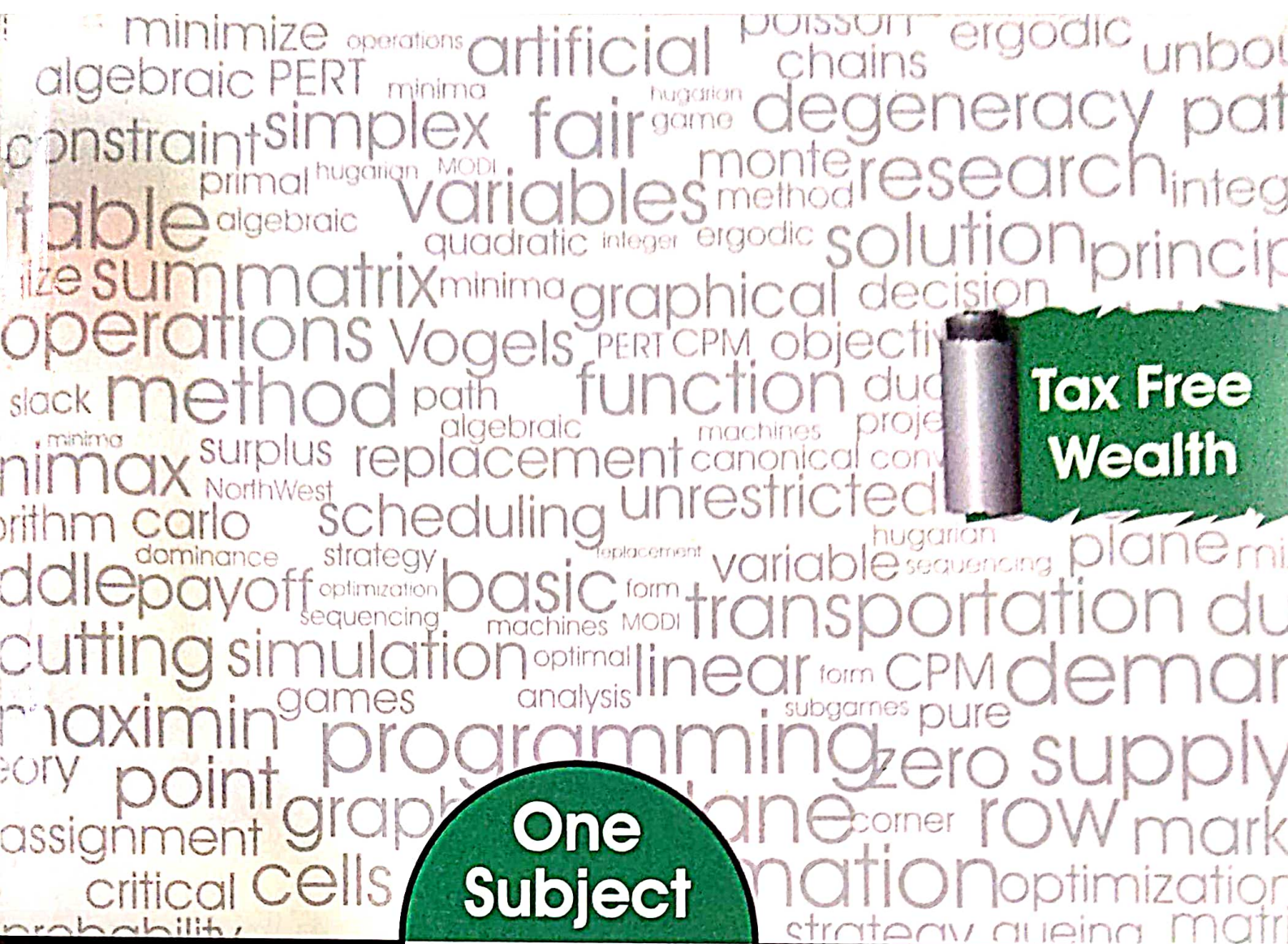

Operations Research for Beginners

Arun S. Pandhari

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OPERATIONS RESEARCH FOR BEGINNERS

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Dedicated To

Dhananjay(Jaya) Dhadphale

(19 Dec.1952 –19 Dec. 2016)

My brother (in law) and best friend of my life.

Preface

It gives me a great pleasure and satisfaction in presenting this reference book on 'Operations Research For Beginners'.

The book is written according to the needs of the students who aspire to study this subject at the initial stage and also useful to the professors teaching the subject. The book contains a systematic development of the subject. Various types of illustrations are provided at each end of a subtopic to better understand it. At the end of each chapter, a comprehensive exercise is given, followed immediately by the answers.

'Operations Research', now a days has got importance in almost all domains of our life. This is a modern method of science which involves Mathematics, Statistics, Managerial sciences, Engineering techniques, Economics, Health sciences, Business administration, Defence, Government organizations. The aim is mainly to optimize the scarce resources, may be men, material, money etc. That is why the subject is now included in the syllabi for various fields of study-B.Tech/M.Tech, M.B.A., M.C.A, M.Sc., C.A. as well as M.Sc.(Mathematics/ Statistic/Economics) and upto some extent. NET/SET/GATE examinations.

The first four chapters of the book deal with LPP, Dual Simplex Method, Integer Programming, Transportation and Assignment Models followed by sequencing and games. Chapter seven is on Replacement Models and then Network Scheduling, Simulation, Markov Chains, Queuing Theory. The final chapter is on Non-linear Programming.

Chapters 1, 2, 3, 4, 12 are deterministic O.R. models. Chapters 5, 6, 7, 10, 11 are stochastic models while chapters 8, 9 use both.

The students need some background of calculus for Chapter 12 and matrices for Majority of the content of this book. Also first course in probability distributions is a prerequisite for stochastic models used in chapter 5, 6, 7, 10, 11.

Vision Publications have always given me freedom and support to write several text books for various classes which were widely accepted by the students and professors community. I am thankful to the staff of Vision. They have taken great efforts for publishing this reference book.

I also thank my wife Prof. Mrs. Anjali and my son Dr. Abhijit (Canada) who are a constant source of energy for me. I am also thankful to the management of Anekant Education Society and our Principal Dr. C. V. Murumkar for continuous support for all this academic work done by me. I am also thankful to my department, colleagues Prof. S.R. Puranik (Head), Prof. Varsha Shinde and Prof. Shaila Jadhav for the constant support and help.

Finally, I welcome the suggestions and criticism from all the readers.

Author

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Tuljaram Chaturchand College
Baramati

Contents

Chapter 1

Linear Programming-Simplex Method

1. INTRODUCTION

Linear Programming is a special branch of a wide range of problems included in Operations Research (O.R.)

O.R. is an application of scientific methods to complex problems arising in large systems of men, machines, materials and money in the organizations such as government, business and industries. The main aim is to allocate the limited resources among competing activities in an optimal manner. This is very much useful in decision making and planning.

O.R. has a recent history. The subject is developed only in the twentieth century, during world war-II. The main inventors are *Harris* (1915, inventory system), *Erlang* (1916, queueing theory), *Shewhart* (1924, Control charts), *Dodge* (1925, sampling inspection). *Dantzig* (1947, Simplex method). *Henry L Gantt* (Job scheduling). Then in 1952, ORSA (Operation Research Society of America) was founded. Thereafter, the techniques in O.R. which involved complex computations were developed by the invention of high speed, digital computers. Then the use of probability theory helped to solve undeterministic situations at more realistic grounds was started.

Mr. A.S. Pandhari has worked as P.G. Head of Mathematics at Tuljaram Chaturchand College, Baramati (Pune). He has a long experience of 38 years of teaching Mathematics and Statistics from U.G. to P.G. classes. He is resident and past student of T.C. College. The college is Accredited A+ by NACC last year. He did his M.Sc. from University of Pune, B.Ed. from Regional College of Education Bhopal. He stood first at B.Ed. He has passed M.Ed., M.Phil from University of Pune. Has consistently first class career. His topics of interest are Pure Mathematics, Statistics and Education. He has written 12 textbooks at F.Y./S.Y. B.Sc and B.C.S. students on Calculus, Algebra, Operations Research, etc. Published more than 30 articles in Marathi on various popular Science subjects in Newspaper and in science magazines in Marathi. He has worked in the fields of Adult Education and Competitive Examination Guidance. He has a long experience of working on various University /State Govt. Committees.

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