

# OPERATIONS RESEARCH

N

658.4034

M3376



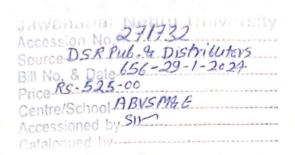


P. MARIAPPAN



658.4034 M3376 Op 658.4034 M3371





Althoughtheauthorandpublisherhavemadeeveryefforttoensurethattheinformationinthisbookwascorrectatthetimeofeditingandprinting, theauthorandpublisher donotassumeand herebydisclaimany liabilitytoanyparty foranyloss or damage arising out of the use of this book caused by errors or omissions, whether such errors or omissions result fromnegligence, accidentoranyothercause. Further, names, pictures, images, characters, businesses, places, events and incidents are itherthe products of the author's imagination or used in a fictious manner. Any resemblance to actual persons, living or dead or actual events is purely coincidental and do not intend to hurt sentiments of any individual, community, sect or religion.

Incaseofbindingmistake, misprintsormissing pagesetc., the publisher's entire liability and your exclusive remedy is replacement of this book within reasonable time of purchase by similar edition/reprint of the book.

## Copyright@2022PearsonIndiaEducationServicesPvt.Ltd

All rights reserved. This book is sold subject to the condition that it shall not, by way of trade or otherwise, be lent, resold, hiredout, or otherwise circulated without the publisher's prior written consentinany form of binding or cover other than that in which it is published and without a similar condition including this condition being imposed on the subsequent purchaser and without limiting the rights under copyright reserved above, no part of this publication may be reproduced, stored in or introduced into a retrieval system, or transmitted in any form or by any means (electronic, mechanical, photocopying, recording or otherwise), without the prior written permission of both the copyrightowner and the publisher of this book.

ISBN978-81-317-9934-5

#### FirstImpression

PublishedbyPearsonIndiaEducationServicesPvt.Ltd,CIN:U72200TN2005PTC057128.

HeadOffice:15thFloor,Tower-B,WorldTradeTower,PlotNo.1,Block-C, Sector16, Noida201 301, UttarPradesh, India.RegisteredOffice:7thFloor,SDB2,ODC 7,8&9,SurveyNo. 01ELCOTIT/ITES-SEZ,Sholinganallur, Chennai-600119,Tamilnadu,India.

Phone: 044-66540100

Website:in.pearson.com,Email:companysecretary.india@pearson.com

Printer Manipal Technologies Limited, Manipal

# Contents

Foreword Preface			Ĺ
			х
Ab	out the	Author	xii
1	Intro	duction	1
	1.1	The History of Operations Research	1
	1.2	The Meaning of Operations Research	1
	1.3	Models of Operations Research	2
	1.4	Scope of Operations Research	2
	1.5	Phases of OR	4
	1.6	Limitations of Operations Research	2
		Exercise Problems	3
		Review Questions	5
2	Linear Programming Problem (LPP)		6
	2.1	Introduction	6
	2.2	General Model of the Linear Programming Problem	$\epsilon$
	2.3	Characteristics of an LPP	7
	2.4	Assumptions of Linear Programming	
	2.5	Formulation of an LPP	8
	2.6	Standard Form of an LPP	27
	2.7	Solution to an LPP	29
	2.8	Types of Possible Solutions to an LPP	30
	2.9	Convex Set and Extreme Point	34
	2.10	Graphical Solution to an LPP	35
	2.11	Simplex Methods	48
	2.12	Penalty Method/Big-M Method/Charnes Method	58
	2.13	Two-phase Method	64
	2.14	The Duality Concept in a Linear Programming	70
	2.15	Dual Simplex Method (DSM)	76
	2.16	The Revised Simplex Method (RSM)	82
		Exercise Problems	96
		Answers to the Exercise Problems	106
		Review Questions	111

### Sensitivity Analysis (or) Post-Optimal Analysis Introduction Change in the Objective Function Co-efficient of a Non-basic Variable Change in the Objective Function Co-efficient of a Basic Variable 3 3.2 Change in the Objective Function Co-efficient of a Basic Variable 3.3 Change in the Objective Function Co-efficient of a Basic Variable 3.4 Change in the Right-hand Side of a Constraint 3.5 Change in the Column of a Non-basic Variable 3.6 Adding a New Constraint Adding a New Variable Exercise Problems Answers to the Exercise Problems Review Questions Transportation Problem 4.2 Conversion of a TP into an Equivalent LPP Form 4.3 Formulation of a Transportation Problem 4.3 Concepts of Feasibility Basicness, and Degeneracy in the Solution 4.5 Methods Used to Find the Solution to a Transportation Problem 4.5 Memous Osca to Find the Initial Basic Feasible Solution 4.6 Description of Various Methods to Find the Initial Basic Feasible Solution 4.7 Stepping Stone Method/Modified Distributive Method 4.8 Transshipment Problems 4.9 Sensitivity Analysis for Transportation Problem Exercise Problems Answers to the Exercise Problems Review Questions **Assignment Problem** 18 5.1 Introduction 5.2 General Model of the Assignment Problem 5.3 Conversion into an Equivalent LPP 5.4 Solution to the Assignment Problem 19 5.5 Travelling Salesman Problem 20 Exercise Problems 20 Answers to the Exercise Problems 21 Review Questions 213 PERT - CPM 213 6.1 Introduction 214 6.2 Method for Construction of a Network 215 6.3 Numbering the Nodes 218 6.4 Critical Path Method (CPM)

227 234 239
242 245 251
253
253 253 263 263 268 268
269
269 269 272 291 297 301 302 306 307
309
309 312 319 332 <i>335</i> <i>338</i> 339
341
341 341 342 343 350

Contents vii

### viii Contents

- 10.6 Quadratic Programming Problem (QPP)
- 10.7 Wolfe's Method to Solve a QPP
- 10.8 Beals Method to Solve a QPP

  Exercise Problems

  Answers to the Exercise Problems

  Review Questions

Appendix A Appendix B Index