**OPTIMIZATION MODELING WITH SPREADSHEETS**

**Table of Contents**

|  |  |
| --- | --- |
| **Chapter 1** | **Introduction to Spreadsheet Models for Optimization** |
| 1.1 | Elements of a Model |  |  |  |
| 1.2 | Spreadsheet Models |  |  |  |
| 1.3 | A Hierarchy for Analysis |  |  |  |
| 1.4 | Optimization Software |  |  |  |
| 1.5 | Using Solver |  |  |  |  |
|  |  |  |  |  |  |  |
| **Chapter 2** | **Linear Programming: Allocation, Covering and Blending Models** |
| 2.1 | Linear Models |  |  |  |  |
|  | 2.1.1 Linear Constraints |  |  |  |
|  | 2.1.2 Formulation |  |  |  |  |
|  | 2.1.3 Layout |  |  |  |  |
|  | 2.1.4 Results |  |  |  |  |
| 2.2 | Allocation Models |  |  |  |  |
|  | 2.2.1 The Product Mix Problem |  |  |
| 2.3 | Covering Models |  |  |  |  |
|  | 2.3.1 The Staff-Scheduling Problem |  |  |
| 2.4 | Blending Models |  |  |  |  |
| 2.5 | Modeling Errors in Linear Programming |  |  |
|  | 2.5.1 Exceptions |  |  |  |  |
|  | 2.5.2 Debugging |  |  |  |  |
|  | 2.5.3. Logic |  |  |  |  |
|  |  |  |  |  |  |  |
| **Chapter 3** | **Linear Programming: Network Models** |  |  |
| 3.1 | The Transportation Model |  |  |  |
| 3.2 | The Assignment Model |  |  |  |
| 3.3 | The Transshipment Model |  |  |  |
| 3.4 | Features of Special Network Models |  |  |
| 3.5 | Building Network Models with Balance Equations |  |
| 3.6 | General Network Models with Yields |  |  |
|  | 3.6.1 Models with Yield Losses |  |  |
|  | 3.6.2 Models with Yield Gains |  |  |  |
| 3.7 | General Network Models with Transformed Flows |  |
|  |  |  |  |  |  |  |
| **Chapter 4** | **Sensitivity Analysis in Linear Programs** |  |  |
| 4.1 | Parameter Analysis in the Transportation Example |  |
| 4.2 | Parameter Analysis in the Allocation Example |  |
| 4.3 | The Sensitivity Report and the Transportation Example |
| 4.4 | The Sensitivity Report and the Allocation Example |  |
| 4.5 | Degeneracy and Alternative Optima |  |  |
| 4.6 | Patterns in Linear Programming Solutions |  |
|  | 4.6.1 The Transportation Model |  |  |
|  | 4.6.2 The Product Portfolio Model |  |  |
|  | 4.6.3 The Investment Model |  |  |  |
|  | 4.6.4 TheAllocation Model |  |  |  |
|  | 4.6.5 The Refinery Model |  |  |  |
|  |  |  |  |  |  |  |
| **Chapter 5** | **Linear Programming: Data Envelopment Analysis** |  |
| 5.1 | A Graphical Perspective on DEA |  |  |
| 5.2 | An Algebraic Perspective on DEA |  |  |
| 5.3 | A Spreadsheet Model for DEA |  |  |  |
| 5.4 | Indexing |  |  |  |  |  |
| 5.5 | Finding Reference Sets and HCUs |  |  |
| 5.6 | Assumptions and Limitations of DEA |  |  |
|  |  |  |  |  |  |  |
| **Chapter 6** | **Integer Programming: Binary Choice Models** |  |
| 6.1 | Using Solver with Integer Requirements |  |  |
| 6.2 | The Capital Budgeting Problem |  |  |
| 6.3 | Set Covering |  |  |  |  |
| 6.4 | Set Packing |  |  |  |  |
| 6.5 | Set Partitioning |  |  |  |  |
| 6.6 | Playoff Scheduling |  |  |  |  |
| 6.7 | Solving a Large-Scale Set Partitioning Problem |  |
| 6.8 | The Algorithm for Solving Integer Programs |  |
|  |  |  |  |  |  |  |
| **Chapter 7** | **Integer Programming: Logical Constraints** |  |
| 7.1 | Simple Logical Constraints: Contingency and Exclusivity |
| 7.2 | Linking Constraints: The Fixed Cost Problem |  |
| 7.3 | Linking Constraints: The Threshold Level Problem |  |
| 7.4 | Linking Constraints: The Facility Location Model |  |
|  | 7.4.1 Capacitated Version |  |  |  |
|  | 7.4.2 Uncapacitated Version |  |  |  |
| 7.5 | Disjunctive Constraints: The Machine Sequencing Problem |
| 7.6 | Tour and Subset Constraints: The Traveling Salesperson Problem |
|  |  |  |  |  |  |  |
| **Chapter 8** | **Nonlinear Programming** |  |  |  |
| 8.1 | One-Variable Models |  |  |  |
|  | 8.1.1 An Inventory Example |  |  |  |
|  | 8.1.2 A Quantity Discount Example |  |  |
| 8.2 | Local Optima and the Search for an Optimum |  |
| 8.3 | Two-Variable Models |  |  |  |
|  | 8.3.1 Curve Fitting |  |  |  |  |
|  | 8.3.2 Two-Dimensional Location |  |  |
| 8.4 | Nonlinear Models with Constraints |  |  |
|  | 8.4.1 A Pricing Example |  |  |  |
|  | 8.4.2 Sensitivity Analysis for Nonlinear Programs |  |
|  | 8.4.3 The Portfolio Optimization Model |  |  |
| 8.5 | Linearizations |  |  |  |  |
|  | 8.5.1 Linearizing the Maximum |  |  |
|  | 8.5.2 Linearizing the Absolute Value |  |  |
|  |  |  |  |  |  |  |
| **Chapter 9** | **Heuristic Solutions with the Evolutionary Solver** |  |
| 9.1 | Features of the Evolutionary Solver |  |  |
| 9.2 | An Illustrative Example: Nonlinear Regression |  |
| 9.3 | The Machine-Sequencing Problem Revisited |  |
| 9.4 | The Traveling Salesperson Problem Revisited |  |
| 9.5 | Two-Dimensional Location |  |  |  |
| 9.6 | Line Balancing |  |  |  |  |
| 9.7 | Group Assignment |  |  |  |  |