Contents

Preface ix
Preface to the First Edition xiii

Chapter 1
Introduction 1
Planning and Scheduling 2
Project Control 8
Why Schedule Projects? 8
The Scheduler 10
Scheduling and Project Management 12
Chapter 1 Exercises 12

Chapter 2
Bar (Gantt) Charts 15
Definition and Introduction 16
Advantages of Bar Charts 19
Disadvantages of Bar Charts 20
Chapter 2 Exercises 21

Chapter 3
Basic Networks 23
Definition and Introduction 24
Arrow Networks 24
Node Networks 32
## Contents

Comparison of Arrow and Node Networks 38  
Networks versus Bar Charts 39  
Time-Scaled Logic Diagrams 40  
Chapter 3 Exercises 41  

### Chapter 4  
The Critical Path Method (CPM) 45  

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Introduction</td>
<td>46</td>
</tr>
<tr>
<td>Steps Required to Schedule a Project</td>
<td>47</td>
</tr>
<tr>
<td>Supplemental Steps</td>
<td>54</td>
</tr>
<tr>
<td>Resource Allocation and Leveling</td>
<td>56</td>
</tr>
<tr>
<td>Beginning-of-Day or End-of-Day Convention</td>
<td>58</td>
</tr>
<tr>
<td>The CPM Explained through Examples</td>
<td>58</td>
</tr>
<tr>
<td>Logic and Constraints</td>
<td>81</td>
</tr>
<tr>
<td>Chapter 4 Exercises</td>
<td>84</td>
</tr>
</tbody>
</table>

### Chapter 5  
Precedence Networks 91  

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Definition and Introduction</td>
<td>92</td>
</tr>
<tr>
<td>The Four Types of Relationships</td>
<td>95</td>
</tr>
<tr>
<td>The Percent Complete Approach</td>
<td>96</td>
</tr>
<tr>
<td>Fast-Track Projects</td>
<td>97</td>
</tr>
<tr>
<td>A Parallel Predecessor?</td>
<td>99</td>
</tr>
<tr>
<td>CPM Calculations for Precedence Diagrams</td>
<td>100</td>
</tr>
<tr>
<td>The Detailed Approach</td>
<td>108</td>
</tr>
<tr>
<td>The Critical Path Revisited</td>
<td>117</td>
</tr>
<tr>
<td>Final Discussion</td>
<td>117</td>
</tr>
<tr>
<td>Chapter 5 Exercises</td>
<td>119</td>
</tr>
</tbody>
</table>

### Chapter 6  
Resource Allocation and Resource Leveling 123  

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Introduction</td>
<td>124</td>
</tr>
<tr>
<td>The Three Categories of Resources</td>
<td>124</td>
</tr>
<tr>
<td>What Is Resource Allocation?</td>
<td>125</td>
</tr>
<tr>
<td>Resource Leveling</td>
<td>125</td>
</tr>
<tr>
<td>Materials Management</td>
<td>148</td>
</tr>
<tr>
<td>Chapter 6 Exercises</td>
<td>151</td>
</tr>
</tbody>
</table>

### Chapter 7  
Schedule Updating and Project Control 155  

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Introduction</td>
<td>156</td>
</tr>
<tr>
<td>The Need for Schedule Updating</td>
<td>156</td>
</tr>
</tbody>
</table>
Contents

Project Control Defined 156
Schedule Updating 157
Project Control 184
Chapter 7 Exercises 205

Chapter 8 Schedule Compression and Time-Cost Trade-Off 211

Introduction 212
Setting Priorities 213
Accelerating a Project 213
Construction versus Manufacturing 221
Direct and Indirect Costs 224
Recovery Schedules 231
Accelerating Projects Using Computers 236
Potential Issues with Uncoordinated Project Acceleration 237
Chapter 8 Exercises 244

Chapter 9 Reports and Presentations 247

Introduction 248
The Difference between Reports and Presentations 252
Skills Necessary for Giving Good Presentations 254
The Power of Presentations 255
Reviewing Reports before and after Printing 257
General Tips on Printing Reports 258
Summary Reports 259
Paper or Electronic Reports? 259
E-Reports 262
Communications in the International Environment 263
Chapter 9 Exercises 264

Chapter 10 Scheduling as Part of the Project Management Effort 267

Introduction 268
Project Objectives 269
Defining and Measuring Project Success 270
Scheduling and Estimating 271
Estimating and Accounting 278
Scheduling and Accounting 279
Scheduling and Change Orders 280
Paperless Project Management 281
Contents

Chapter 10 Exercises 290

Chapter 11 Other Scheduling Methods 291

Chapter 12 Dynamic Minimum Lag Relationship 329

Chapter 13 Construction Delay and Other Claims 343
Contents

Delay Claims Resolution 356
The Importance of CPM Schedules in Delay Claims 358
Methods of Schedule Analysis 359
Chapter 13 Exercises 366

Chapter 14  Schedule Risk Management 367

Introduction 368
Types of Risk in Construction Projects 369
Schedule Risk Types 369
Definition of Risk Terms 375
Importance of Good Planning for Risk Management 377
Importance of Good CPM Scheduling Practices for Risk Assessment 377
Risk Shifting in Contracts 379
Schedule Risk Management Steps 381
Expected Value 387
Application in Scheduling 388
Examples of Risk Adjustment 389
Conclusion 390
Chapter 14 Exercises 390

Chapter 15  BIM-Based 4D Modeling and Scheduling 393

Overview of the Building Information Modeling (BIM) 393
Case Study 399
Chapter 15 Exercises 420

Appendix A  Computer Project 421

General Guidelines 421
Cost Loading 426
Updating the Project 428
Change Order 429
Resource Leveling 430
Schedule Compression 431
Schedule Compression 2 433
Delay Claim 1: Unforeseen Conditions 433
Delay Claim 2: Change in the Owner's Requirements 433
Appendix B  Sample Reports  435

Tabular Reports  435
Graphic Reports  453

Abbreviations  464
Glossary  469
References  493
Bibliography  498
Index  505