## Contents

*About the Authors*  xi

### Chapter 1  INTRODUCTION TO FORECASTING ............................................................................. 1

1.1 Introduction  1

1.2 Forecasting  2
   1.2.1 Importance  2
   1.2.2 Four Forecasting Factors to Consider  2
   1.2.3 Forecasting Method Decision Tree  3
   1.2.4 Forecasting Techniques  4

1.3 Excel  5
   1.3.1 Installing the Data Analysis ToolPak  6

References  8

### Chapter 2  SUMMARIZING AND DISPLAYING DATA IN EXCEL ..................................................... 9

2.1 Introduction  9

2.2 Summarizing Continuous Data (Descriptive2.xls and Boxplot.xls)  10
   2.2.1 Descriptive Statistics (Descriptive2.xls\Worksheet: Descriptive)  10

2.3 Graphing Continuous Data (Descriptive, Worksheets: Histogram1, Histogram2, and Time Series Plot)  12
   2.3.1 Box plot (Descriptive2: Worksheet: Descriptive; Boxplot.xls: Worksheet: Simple)  12
   2.3.2 Histogram  13
   2.3.3 Time Series Plot (Worksheet: Time Series Plot)  16

2.4 Summarizing Qualitative and Discrete Data; Graphs and Tables with Qualitative and Discrete Data (Descriptive2.xls)  17
Chapter 3

**BASIC TIME SERIES ANALYSIS**.................................................................33

3.1 Introduction 33

3.2 Components of a Time Series (Files: Datats.xls and Randomness.xls) 34
    3.2.1 Trend Component (Worksheet: Trend) 34
    3.2.2 Linear Trend Analysis 34
    3.2.3 Test for Significant Trend 37
    3.2.4 Seasonal Component (Worksheet: Seasonal) 38
    3.2.5 Cyclical Component 40
    3.2.6 Irregular Component (Randomness.xls) 41

3.3 Decomposition (Datats.xls) 41
    3.3.1 Multiplicative Decomposition (without cycle component) (Worksheet: Decomp1) 42
    3.3.2 Multiplicative Decomposition (with cycle component) 45

3.4 Moving Averages (File: Datats.xls, Worksheet: MA) 48

3.5 Exponential Smoothing (Worksheet: EA(.1)) 50
    3.5.1 Optimal Smoothing Constant 54
    3.5.2 Summary 55

References 55

Chapter 4

**FORECASTING PERFORMANCE MEASUREMENTS, TRACKING SIGNALS, AND RANDOMNESS TESTS...**57

4.1 Introduction 57

4.2 Forecast Performance Measures 58

4.3 Tracking Signals 61

4.4 Randomness 61

References 68
Chapter 5  ADVANCED TIME SERIES FORECASTING TECHNIQUES ................................................. 69

5.1 Introduction  69
5.2 Advanced Time Series Techniques  70
  5.2.1 Double Moving Average  70
  5.2.2 Double Exponential Smoothing  73
  5.2.3 Brown’s Double Exponential Smoothing  73
  5.2.4 Holt’s Double Exponential Smoothing  74
  5.2.5 Exponential Smoothing with a Seasonal Component and with/without a Trend  76

5.3 Autoregressive Integrated Moving Average (ARIMA) Models  79
  5.3.1 Autocorrelation  79
  5.3.2 Differencing  83
  5.3.3 Autoregressive and moving average models  84
  5.3.4 ARIMA models  85

5.4 Index Numbers  87
  5.4.1 Deflating data  88
  5.4.2 Aggregate Index numbers  90

References  91

Chapter 6  SIMPLE LINEAR REGRESSION ANALYSIS IN FORECASTING ................................................. 93

6.1 Introduction  93
6.2 The Simple Linear Regression Model  94
6.3 Assumptions Underlying the Simple Linear Regression Model  94
6.4 Standard Error of the Estimate  95
6.5 Predicting Y  95
6.6 Correlation  95
6.7 Coefficient of Determination  96
6.8 Residuals  96
6.9 Statistical Inference on the Slope of the Regression Model  96
6.10 Testing for First-Order Autocorrelation  98
  6.10.1 The Durbin-Watson Statistic  98
6.11 An Example of Simple Linear Regression  99
6.12 Hypothesis Testing  102
6.13 Example Problems in Excel 2007 for Simple Linear Regression Forecasting  103
Chapter 7

**MUltiple Linear Regression Analysis in Forecasting**

7.1 Introduction 133
7.2 The Multiple Regression Model 134
7.3 The Multiple Regression Model in Matrix Terms 134
7.4 Analysis of Variance 135
7.5 F Test for the Multiple Regression Model 136
7.6 Coefficient of Multiple Determination 136
7.7 Inference about the Regression Parameters 136
7.8 Estimation and Prediction 137
7.9 Diagnostics and Their Use in Multiple Regression Models 137
    7.9.1 Scatter Plots 137
    7.9.2 Residual Plots 137
7.10 An Example Problem 137
7.11 Another Example Problem 138
7.12 Qualitative Variable 139
Chapter 8

MARKOVIAN FORECASTING MODELS ................................................................. 157

8.1 Introduction 157
8.2 A Markovian Model 158
8.3 The First-Order Markovian Model 158
8.4 Computation of the Steady State 159
  8.4.1 An Example Problem for Steady State Calculations 159
  8.4.2 Problem 1—Brand Calculations Steady State 160
8.5 Absorbing States in the Markov Process 162
  8.5.1 Problem 2—Absorbing States Calculations for Credit 163
  8.5.2 Problem 3—Inventory Questions 165
References 166

Chapter 9

DIFFUSION MODELING AND FORECASTING .................................................... 167

9.1 Introduction 167
9.2 Diffusion Model 169
9.3 Another Model for Estimators: The Product Life Cycle Using Excel Computation 170