*Data Analysis & Decision Making*, Revised 3e

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Note: The only change from the (original) third edition is the new name for section 4.3 (shown in red below).

1. Introduction to Data Analysis and Decision Making
   1. Introduction
   2. An Overview of the Book
      1. The Methods
      2. The Software
   3. A Sampling of Examples
   4. Modeling and Models
      1. Graphical Models
      2. Algebraic Models
      3. Spreadsheet Models
      4. The Seven-Step Modeling Process
   5. Conclusion

**Part I: Getting, Describing, and Summarizing Data**

1. Describing Data: Graphs and Tables
   1. Introduction
   2. Basic Concepts
      1. Populations and Samples
      2. Variables and Observations
      3. Types of Data
   3. Frequency Tables and Histograms
      1. Shapes of Histograms
   4. Analyzing Relationships with Scatterplots
   5. Time Series Graphs
   6. Exploring Data with Pivot Tables
   7. Conclusion
2. Describing Data: Summary Measures
   1. Introduction
   2. Measures of Central Location
      1. The Mean
      2. The Median
      3. The Mode
   3. Quartiles and Percentiles
   4. Minimum, Maximum, and Range
   5. Measures of Variability: Variance and Standard Deviation
      1. Interpretation of the Standard Deviation: Empirical Rules
   6. Obtaining Summary Measures with StatTools
   7. Measures of Association: Covariance and Correlation
   8. Describing Data Sets with Boxplots
   9. Applying the Tools
   10. Conclusion
3. Getting the Right Data
   1. Introduction
   2. Sources of Data
      1. Data from Surveys
      2. Data from Controlled Experiments
   3. Excel Tables for Filtering, Sorting, and Summarizing
   4. Complex Queries with the Advanced Filter
      1. Tips for Forming Criteria
      2. Database Functions
   5. Importing External Data from Access
      1. A Brief Introduction to Relational Databases
      2. Using Microsoft Query to Import Data from a Database
      3. SQL Statements
   6. Creating Pivot Tables from External Data
   7. Web Queries
   8. Other Data Sources on the Web
   9. Cleansing the Data
   10. Conclusion

**Part II: Probability, Uncertainty, and Decision Making**

1. Probability and Probability Distributions
   1. Introduction
   2. Probability Essentials
      1. Rule of Complements
      2. Addition Rule
      3. Conditional Probability and the Multiplication Rule
      4. Probabilistic Independence
      5. Equally Likely Events
      6. Subjective Versus Objective Probabilities
   3. Distribution of a Single Random Variable
   4. An Introduction to Simulation
   5. Distribution of Two Random Variables: Scenario Approach
   6. Distribution of Two Random Variables: Joint Probability Approach
   7. Independent Random Variables
   8. Weighted Sums of Random Variables
   9. Conclusion
2. Normal, Binomial, Poisson, and Exponential Distributions
   1. Introduction
   2. The Normal Distribution
      1. Continuous Distributions and Density Functions
      2. The Normal Density
      3. Standardizing: Z-values
      4. Normal Tables and Z-values
      5. Normal Calculations in Excel
      6. Empirical Rules Revisited
   3. Applications of the Normal Distribution
   4. The Binomial Distribution
      1. Mean and Standard Deviation of the Binomial Distribution
      2. The Binomial Distribution in the Context of Sampling
      3. The Normal Approximation to the Binomial
   5. Applications of the Binomial Distribution
   6. The Poisson and Exponential Distributions
      1. The Poisson Distribution
      2. The Exponential Distribution
   7. Fitting a Probability Distribution to Data: BestFit
   8. Conclusion
3. Decision Making Under Uncertainty
   1. Introduction
   2. Elements of a Decision Analysis
      1. Payoff Tables
      2. Possible Decision Criteria
      3. Expected Monetary Value (EMV)
      4. Sensitivity Analysis
      5. Decision Trees
      6. Risk Profiles
   3. The PrecisionTree Add-In
      1. The Decision Tree Model
      2. Sensitivity Analysis
   4. Bayes’ Rule
   5. Multistage Decision Problems
      1. The Value of Information
   6. Incorporating Attitudes Toward Risk
      1. Utility Functions
      2. Exponential Utility
      3. Is Expected Utility Maximization Used?
   7. Conclusion

**Part III: Statistical Inference**

1. Sampling and Sampling Distributions
   1. Introduction
   2. Sampling Terminology
   3. Methods for Selecting Random Samples
      1. Simple Random Sampling
      2. Using StatTools to Generate Simple Random Samples
      3. Systematic Sampling
      4. Stratified Sampling
      5. Cluster Sampling
      6. Multistage Sampling Schemes
   4. An Introduction to Estimation
      1. Sources of Estimation Error
      2. Key Terms in Sampling
      3. Sampling Distribution of the Sample Mean
      4. The Central Limit Theorem
      5. Sample Size Determination
      6. Summary of Key Ideas for Simple Random Sampling
   5. Conclusion
2. Confidence Interval Estimation
   1. Introduction
   2. Sampling Distributions
      1. The t Distribution
      2. Other Sampling Distributions
   3. Confidence Interval for a Mean
   4. Confidence Interval for a Total
   5. Confidence Interval for a Proportion
   6. Confidence Interval for a Standard Deviation
   7. Confidence Interval for the Difference Between Means
      1. Independent Samples
      2. Paired Samples
   8. Confidence Interval for the Difference Between Proportions
   9. Controlling Confidence Interval Length
      1. Sample Size for Estimation of the Mean
      2. Sample Size for Estimation of Other Parameters
   10. Conclusion
3. Hypothesis Testing
   1. Introduction
   2. Concepts in Hypothesis Testing
      1. Null and Alternative Hypotheses
      2. One-Tailed Versus Two-Tailed Tests
      3. Types of Errors
      4. Significance Level and Rejection Region
      5. Significance from p-values
      6. Type II Errors and Power
      7. Hypothesis Tests and Confidence Intervals
      8. Practical Versus Statistical Significance
   3. Hypothesis Tests for a Population Mean
   4. Hypothesis Tests for Other Parameters
      1. Hypothesis Tests for a Population Proportion
      2. Hypothesis Tests for Differences Between Population Means
      3. Hypothesis Test for Equal Population Variances
      4. Hypothesis Tests for Differences Between Population Proportions
   5. Tests for Normality
   6. Chi-Square Test for Independence
   7. One-Way ANOVA
   8. Conclusion

**Part IV: Regression, Forecasting, and Time Series**

1. Regression Analysis: Estimating Relationships
   1. Introduction
   2. Scatterplots: Graphing Relationships
      1. Linear Versus Nonlinear Relationships
      2. Outliers
      3. Unequal Variance
      4. No Relationship
   3. Correlations: Indicators of Linear Relationships
   4. Simple Linear Regression
      1. Least Squares Estimation
      2. Standard Error of Estimate
      3. R-Square: The Coefficient of Determination
   5. Multiple Regression
      1. Interpretation of Regression Coefficients
      2. Interpretation of Standard Error of Estimate and R-Square
   6. Modeling Possibilities
      1. Dummy Variables
      2. Interaction Variables
      3. Nonlinear Transformations
   7. Validation of the Fit
   8. Conclusion
2. Regression Analysis: Statistical Inference
   1. Introduction
   2. The Statistical Model
   3. Inferences About the Regression Coefficients
      1. Sampling Distribution of the Regression Coefficients
      2. Confidence Intervals for the Regression Coefficients
      3. Hypothesis Tests for the Regression Coefficients
      4. A Test for the Overall Fit: The ANOVA Table
   4. Multicollinearity
   5. Include/Exclude Decisions
   6. Stepwise Regression
   7. The Partial F Test
   8. Outliers
   9. Violations of Regression Assumptions
      1. Nonconstant Error Variance
      2. Nonnormality of Residuals
      3. Autocorrelated Residuals
   10. Prediction
   11. Conclusion
3. Time Series Analysis and Forecasting
   1. Introduction
   2. Forecasting Methods: An Overview
      1. Extrapolation Methods
      2. Econometric Methods
      3. Combining Forecasts
      4. Components of Time Series Data
      5. General Notation and Formulas
   3. Testing for Randomness
      1. The Runs Test
      2. Autocorrelation
   4. Regression-Based Trend Models
      1. Linear Trend
      2. Exponential Trend
   5. The Random Walk Model
   6. Autoregression Models
   7. Moving Averages
   8. Exponential Smoothing
      1. Simple Exponential Smoothing
      2. Holt’s Model for Trend
   9. Seasonal Models
      1. Winters’ Exponential Smoothing Model
      2. Deseasonalizing: The Ratio-to-Moving-Averages Method
      3. Estimating Seasonality with Regression
   10. Conclusion

**Part V: Decision Modeling**

1. Introduction to Optimization Modeling
   1. Introduction
   2. Introduction to Optimization
   3. A Two-Variable Model
   4. Sensitivity Analysis
      1. Solver’s Sensitivity Report
      2. The SolverTable Add-In
      3. Comparison of Solver’s Sensitivity Report and SolverTable
   5. Properties of Linear Models
      1. Proportionality
      2. Additivity
      3. Divisibility
      4. Discussion of the Linear Properties
      5. Linear Models and Scaling
   6. Infeasibility and Unboundedness
      1. Infeasibility
      2. Unboundedness
      3. Comparison of Infeasibility and Unboundedness
   7. A Product Mix Model
   8. A Multiperiod Production Model
   9. A Comparison of Algebraic and Spreadsheet Models
   10. A Decision Support System
   11. Conclusion
2. Optimization Modeling: Applications
   1. Introduction
   2. Workforce Scheduling Models
   3. Blending Models
   4. Logistics Models
      1. Transportation Models
      2. Minimum Cost Network Flow Models
   5. Aggregate Planning Models
   6. Financial Models
   7. Integer Programming Models
      1. Capital Budgeting Models
      2. Fixed-Cost Models
      3. Set-Covering Models
   8. Nonlinear Models
      1. Basic Ideas of Nonlinear Optimization
      2. Managerial Economics Models
      3. Portfolio Optimization Models
   9. Conclusion
3. Introduction to Simulation Modeling
   1. Introduction
   2. Real Applications of Simulation
   3. Probability Distributions for Input Variables
      1. Types of Probability Distributions
      2. Common Probability Distributions
   4. Simulation with Built-In Excel Tools
   5. Introduction to @RISK
      1. @RISK Features
      2. Loading @RISK
      3. @RISK Models with a Single Random Input Variable
      4. @RISK Models with Several Random Input Variables
   6. The Effects of Input Distributions on Results
      1. Effect of the Shape of the Input Distribution(s)
      2. Effect of Correlated Input Variables
   7. Conclusion
4. Simulation Models
   1. Introduction
   2. Operations Models
      1. Bidding for Contracts
      2. Warranty Costs
      3. Drug Production with an Uncertain Yield
   3. Financial Models
      1. Financial Planning Models
      2. Cash Balance Models
      3. Investment Models
   4. Marketing Models
      1. Models of Customer Loyalty
      2. Market Share Models
   5. Simulating Games of Chance
      1. Simulating the Game of Craps
      2. Simulating the NCAA Basketball Tournament
   6. Conclusion

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