

# STAT 385: Methods for Data Analysis and System Optimization

Date: Spring 2009  
Time: MWF 1100 – 1150; T 1800-2000 (Lab)  
Location: Duncan Hall 1042; Lab is in DH Symonds II  
Course Text: Albright, Winston & Zappe (2008), *Data Analysis and Decision Making with Microsoft® Excel, Revised, 3rd Edition*, South Western Cengage Learning, 2009.  
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We will also be using OWL-Space

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## Course Description:

The three general topic areas covered in this methodology oriented course are statistical methods including regression, sampling, and experimental design; simulation based methods in statistics, queuing and inventory problems; and an introduction to optimization methods. Excel will serve as the basic computing software.

Software. The software for the course is the DecisionTools Suite Industrial, Textbook Edition. It is available for download at <http://www.palisade.com/bookdownloads/albrightwinstonzappe/> Please note that this version (REVISED 3<sup>rd</sup> edition) is for Office 2007 and above.

Grading: 50% Homework Exercises; 25% Team Projects; 25% Concept Quizzes. Late policy: Late homeworks will not be accepted without a university approved excuse. 20% penalty for HW turned in by next class; no credit for later than this. The instructor will not be able to print out emailed homework. You might be able to negotiate with the grader.

## Team Project: A Case Study

There are various case studies included in your textbook. You and your team will choose a case to solve. You will be expected to turn in a written report and give an oral presentation during the last week of class. You may pick your own team members, but the size of each team will be limited to an appropriate number.

## Quizzes

There will be closed book quizzes given during the class period. These quizzes will cover concepts discussed in class. They will be announced.

## Laboratories

Occasionally a dedicated Lab will be assigned. Weekly lab time is set aside for you to work on and receive help on homework and team projects. Attendance is optional.

Attendance:

Students are expected to attend class. If a student misses a class, then he or she is responsible for keeping up with the course material and finding out if any exams, quizzes, or homeworks have been assigned or scheduled.

Course Content: We hope to cover most of this material. Topics/chapters include

Part I: GETTING, DESCRIBING, AND SUMMARIZING DATA.

Introduction to Data Analysis and Decision Making.

1. Introduction. An Overview of the Book. The Methods. The Software. A Sampling of Examples. Modeling and Models. Conclusion.

2. Describing Data: Graphs and Tables.

Introduction. Basic Concepts. Frequency Tables and Histograms. Analyzing Relationships with Scatterplots. Time Series Graphs. Exploring Data with Pivot Tables. Conclusion.

3. Describing Data: Summary Measures.

Introduction. Measures of Central Location. Quartiles and Percentiles. Minimum, Maximum, and Range. Measures of Variability: Variance and Standard Deviation. Obtaining Summary Measures with StatTools. Measures of Association: Covariance and Correlation. Describing Data Sets with Boxplots. Applying the Tools. Conclusion.

4. Getting the Right Data.

Introduction. Sources of Data. Excel Tables for Filtering, Sorting, and Summarizing. Complex Queries with the Advanced Filter. Importing External Data from Access. Creating Pivot Tables from External Data. Web Queries. Other Data Sources on the Web. Cleansing the Data. Conclusion.

Part II: PROBABILITY, UNCERTAINTY, AND DECISION MAKING.

5. Probability and Probability Distributions.

Introduction. Probability Essentials. Distribution of a Single Random Variable. An Introduction to Simulation. Distribution of Two Random Variables: Scenario Approach. Distribution of Two Random Variables: Joint Probability Approach. Independent Random Variables. Weighted Sums of Random Variables. Conclusion.

6. Normal, Binomial, Poisson, and Exponential Distributions.

Introduction. The Normal Distribution. Applications of the Normal Distribution. The Binomial Distribution. Applications of the Binomial Distribution. The Poisson and Exponential Distributions. Fitting a Probability Distribution to Data: BestFit. Conclusion.

7. Decision Making Under Uncertainty.

Introduction. Elements of a Decision Analysis. The PrecisionTree Add-In. Bayes' Rule. Multistage Decision Problems. Incorporating Attitudes Toward Risk. Conclusion.

Part III: STATISTICAL INFERENCE.

8. Sampling and Sampling Distributions.

Introduction. Sampling Terminology. Methods for Selecting Random Samples. An Introduction to Estimation. Conclusion.

## 9. Confidence Interval Estimation.

Introduction. Sampling Distributions. Confidence Interval for a Mean. Confidence Interval for a Total. Confidence Interval for a Proportion. Confidence Interval for a Standard Deviation. Confidence Interval for the Difference Between Means. Confidence Interval for the Difference Between Proportions Controlling Confidence Interval Length. Conclusion.

## 10. Hypothesis Testing.

Introduction. Concepts in Hypothesis Testing. Hypothesis Tests for a Population Mean. Hypothesis Tests for Other Parameters. Tests for Normality. Chi-Square Test for Independence. One-Way ANOVA. Conclusion.

## Part IV: REGRESSION, FORECASTING, AND TIME SERIES.

### 11. Regression Analysis: Estimating Relationships.

Introduction. Scatterplots: Graphing Relationships. Correlations: Indicators of Linear Relationships Simple Linear Regression. Multiple Regression. Modeling Possibilities. Validation of the Fit. Conclusion.

12. Regression Analysis: Statistical Inference Introduction. The Statistical Model. Inferences About the Regression Coefficients. Multicollinearity. Include/Exclude Decisions. Stepwise Regression. The Partial F Test. Outliers. Violations of Regression Assumptions. Prediction. Conclusion.

### 13. Time Series Analysis and Forecasting.

Introduction. Forecasting Methods: An Overview. Testing for Randomness. Regression-Based Trend Models. The Random Walk Model. Autoregression Models. Moving Averages. Exponential Smoothing. Seasonal Models. Winters' Exponential Smoothing Model. Conclusion.

## Part V: DECISION MODELING.

### 14. Introduction to Optimization Modeling.

Introduction. Introduction to Optimization. A Two-Variable Model. Sensitivity Analysis Properties of Linear Models. Infeasibility and Unboundedness. A Product Mix Model. A Multiperiod Production Model. A Comparison of Algebraic and Spreadsheet Models. A Decision Support System. Conclusion.

### 15. Optimization Modeling: Applications.

Introduction. Workforce Scheduling Models. Blending Models. Logistics Models. Aggregate Planning Models. Financial Models. Integer Programming Models. Nonlinear Models. Conclusion.

### 16. Introduction to Simulation Modeling.

Introduction. Real Applications of Simulation. Probability Distributions for Input Variables. Simulation with Built-In Excel Tools. Introduction to @RISK. The Effects of Input Distributions on Results. Conclusion.

### 17. Simulation Models.

Introduction. Operations Models. Financial Models. Marketing Models. Simulating Games of Chance. Conclusion.

Rice Honor Code:

All examinations are conducted under pledged conditions. Homework may be worked on with other class members but each student must submit their own work for credit. You should indicate with whom you worked when applicable. No direct copying is allowed. You may not refer to material from previous offerings of this course, including problem sets, solution sets, and/or quizzes. Note that the use of prior years' and other solutions to text exercises is considered UNAUTHORIZED AID.

Disabilities:

Any student with a documented disability needing academic adjustments or accommodations is requested to speak with me during the first two weeks of class. All discussions will remain confidential. Students with disabilities should also contact Disability Support Services in the Ley Student Center. Further information is available at <http://dss.rice.edu/>.