

Quantitative Analysis for Decision Making

An Immersive Virtual Reality Learning Experience

2011-2012

Course Description

This course provides the student with the concepts, methods and tools for the application of logical and quantitative analysis to business decision making and problem solving. It familiarizes the student with a wide range of software and other classical and contemporary resources related to decision and problem analysis, including basics of logic and decision making, principles of optimization, probabilistic distributions, linear programming, simplex, queuing and transportation problems, break even analysis, inventory management, forecasting and simulation. The course highlights the benefits as well as the limits of quantitative analysis in a real-world context. This course may be adapted for the graduate and undergraduate levels.

Materials

Readings, assignments, problems and assessments are integrated into the courseware. Any additional materials will be assigned by the instructor at the start or during the course.

Course Outline & Assignments

Assignments will change from time to time as new resources become available, contemporary events have bearing on the topics, or the social, legal, or economic environments change.

FUNDAMENTALS OF DECISION MAKING AND PROBLEM SOLVING (Module One, 4-6 hours)

- Words of the Wise
- What is a Decision? What does it mean to solve a problem?
- Understanding Limitations - every problem does not have a solution
- What is a Good/Bad Decision?
- Why Process is Important
- Laziness
- Predictably Irrational - Self Deception
- The wrong people doing the analysis, making the decision
- No or Poor Objectives
- Faulty Decision Criteria
- Weak, Irrelevant Assumptions
- Selective Perceptions & Data Contamination
- Foregone Conclusions
- Readings and Resources

FUNDAMENTALS OF LOGICAL PROCESSES (Module Two, 4-6 hours)

- Examples of Logical Fallacies
- The Limits of Probabilities Built on Past Experience
- Inductive, Deductive Reasoning
- The Role of Creative Thinking in Decision and Problem Solving
- Tautologies

HOW QUANTITATIVE METHODS CAN HELP WITH DECISIONS AND PROBLEMS

(Module Three, 4-6 hours)

- Comparing Quantitative and Other Approaches
- Practical Limits on Quantitative Analyses
- Principles of Optimization
- Introduction to Optimization Software
- Statistics & Probabilities
- Readings and Resources
- Basics of Optimization and Linear Programming
- Break Even Analysis
- Product Mix

DECISION ANALYSIS PRINCIPLES AND METHODS (Module Four, 4-6 hours)

- Recognizing the Expertise of the User Limits Effectiveness
- Spreadsheets & Data Bases
- Linear Programming & Simplex
- Decision Analysis
- Decision Trees and Implications
- Probabilistic Statistics and Decision Making
- Probability Definitions
- Distributions
- Correlation
- Probability & Tests of Significance
- False Positives
- Flaw of Averages

OPTIMIZATION APPLIED TO TYPICAL BUSINESS DECISIONS (Module Five, 4-6 hours)

- Reducing bias in qualitative analysis
- Applications of linear programming that have been encountered in practice
- An appreciation for the problems that can be modeled as linear programs
- Practice and experience in formulating realistic linear programming models
- Make or buy decisions
- Production scheduling decisions
- Work force allocation decisions

MARKETING AND FINANCIAL DECISIONS (Module Six, 6-8 hours)

- Basic and feasible solutions to systems of linear equations
- Simplex method for solving linear programming problems
- Marketing decisions
- Financial decisions
- Operations decisions

DISTRIBUTION AND NETWORK DECISIONS (Module Seven, 6-8 hours)

- Special features of transportation, assignment and transshipment problems
- Network and linear programming models of the transportation, assignment and transshipment problems
- The shortest route problem
- The maximal flow problem
- The workforce assignment problem
- Inventory as a transshipment problem
- Additional software and tools

INVENTORY DECISIONS (Module Eight, 6-8 hours)

- Where inventory costs occur and why it is important inventory policy decisions are important
- Economic order quantity (EOQ) model
- Total cost models for specific inventory systems
- Total cost model for how-much-to-order and when-to-order decisions
- Inventory systems involving production lot size, planned shortages, and quantity discounts
- Single-period inventory models
- Quantity and reorder point decisions when demand must be described by a probability distribution
- Lead time demand distributions used to meet acceptable service levels
- Order quantity decisions for periodic review inventory systems

WAITING LINE DECISIONS (Module Nine, 4-6 hours)

- Where waiting line problems occur and why these problems are important
- Single-channel and multiple-channel waiting lines
- Poisson distribution describes arrivals; exponential distribution describes services times
- Formulas identifying operating characteristics of the following waiting line models:
 - Single-channel model with Poisson arrivals and exponential service times
 - Multiple-channel model with Poisson arrivals and exponential service times
 - Single-channel model with Poisson arrivals and arbitrary service times
 - Multiple-channel model with Poisson arrivals, arbitrary service times, and no waiting
 - Single-channel model with Poisson arrivals, exponential service times, and a finite calling population
- Economic considerations in decisions concerning the operation of a waiting line
- Readings and Resources

FORECASTING AND SIMULATION (Module Ten, 4-6 hours)

- Why forecasting
- Basic forecasting categories and methods
- Principles and tools for time series methods
- Principles and tools for regression methods
- Markov analysis and other methods
- Simulation as a forecasting method
- Relative advantages and disadvantages of simulation models
- Readings and Resources
- Estimating Total Demand
- Excel Forecasting
- Forecasting Rules
- How To Test Your Decisions
- Vanguard Forecasting Tool

COURSE REVIEW AND EXAM

Recommended Resources and Readings

- Free Management Library: <http://managementhelp.org/>
- Groups Discussing Inventory Quantitative Model of Decision Making – Yahoo Groups
<http://groups.yahoo.com/phrase/inventory-quantitative-model-of-decision-making>
- Applied Management Science: Making Good Strategic Decisions
<http://home.ubalt.edu/ntsbarsh/opre640/opre640.htm>
- Decision Making with Quantitative Tools
<http://www.cliffsnotes.com/WileyCDA/CliffsReviewTopic/Decision-Making-with-Quantitative-Tools.topicArticleId-8944,articleId-8866.html>

- Problem-solving and Decision-making
<http://www.businessballs.com/problemsolving.htm>
- Decision-making and Problem-solving by Herbert A. Simon and Associates
<http://dieoff.org/page163.htm>
- What Is a Decision Support System? By D. J. Power
<http://dssresources.com/papers/whatisadss/index.html>
- List of Web Sites to Complement *Decision Support Systems: A Knowledge Based Approach*
<http://www.uky.edu/BusinessEconomics/dssakba/relateds.htm>
- Instructional Sites for Decision Support, Expert Systems & Artificial Intelligence, Knowledge Management, and Other
[http://www.uky.edu/BusinessEconomics/dssakba/instmat.htm#Instructional Sites \(Software, Applications, Cases\)](http://www.uky.edu/BusinessEconomics/dssakba/instmat.htm#Instructional Sites (Software, Applications, Cases))
- Selected Periodical for Decision Support
<http://www.uky.edu/BusinessEconomics/dssakba/periodcl.htm>
- *An Introduction to Management Science: A Quantitative Approach to Decision Making, 12th Edition* by Anderson, Sweeney, Williams, and Martin. South-Western Cengage Learning, ISBN 0-324-39980-4 (includes CD with software). This book is available in electronic format, and at almost all online and used book stores.