Course Description
A data model describes how structured data is represented in a business environment. Data modeling is a natural consequence of the prevalence of management information systems (MIS) in the real world. Together they form what in our days has become known as a Data Analytics system that provides management tools to evaluate performance and make decisions. The course aims to introduce the fundamentals of data models tools and methods and related topics. Business applications of the topics covered will be highlighted. The emphasis will be on modeling and evaluating uncertainty, understanding the nature of decision-making, using data and limited information efficiently, simulating complex systems, and optimally allocating resources.

Course Materials:


  From the authors’ description: This text uses data analysis techniques (statistics, simulation, probabilistic modeling and optimization), but only as tools to facilitate problem solving. The book embraces the following dictum as its premise: “The final test of any theory is its capacity to solve the problems which originated it. This book is used in the core MBA program at MIT’s, Sloan School of Management for the class titled: “Data, Models and Decisions”. It is used in over ten universities in both core and elective classes, including Stanford University, Chicago’s graduate school of Business, Babson College, among several others. The book contains many real business cases from the authors consulting experience.’

- **Other Resources:** I will provide additional at: [reading materials](#) during the course.

  - Start with: [Review of Probability](#)

Learning Goals and Objectives: The aim is to develop decision-making skills. It is impossible to teach one all there is to know about data analysis techniques in a semester; hence the objective is to enable you to become intelligent users of data analysis techniques. This will necessitate some use of formulas and computer manipulations of data. However, the goal is not that you will become experts on equations and computer software, but rather to give you a perspective on how data models and techniques are used in practice. Hence, much of the material will be presented in a setting of practical business situations. decisions. The focus is on ways of modeling and structural ideas about, decision problems.

Specific goals: There will be an introduction to the concepts and applications of those basic ideas that are considered to be most important for the practical analysis of management, listed below.

2. Monte Carlo simulation.
4. Sampling and Sampling Distributions.
5. Estimation & Confidence Intervals.
7. Regression Analysis.
8. Additional Forecasting Methods.
10. Decision Theory.

Prerequisites:

b) Calculus with a grade of B or better; or 22:135:571 Calc for Mgrs.

Academic Integrity:

Students are responsible for understanding the [RU Academic Integrity Policy](https://business.rutgers.edu/ai). Students must sign the RU Honor Pledge. See [business.rutgers.edu/ai](https://business.rutgers.edu/ai) for more details.

Teaching Method: The course will be largely taught using computer presentation. Class-related material (lecture notes, messages, etc.) will be posted on Blackboard. Additional visual material and demos may be shown in some classes. Most of your work will take place outside the classroom, as you study, and apply the material to which you are introduced in class.

Grading: Your grade will be based on a final exam, a quiz, case write-ups, homework assignments, and class participation, as follows:

- Final exam (3-hour exam) 40%, May 6.
- Case write-ups and homework assignments 20%.
- Quiz (2-hour test held in class) 25% on 3/18 in class.
- Class participation and conduct 15%

Homework Assignments are designed to help you learn the material discussed in class. In addition doing a thorough job on the homework assignments is the best preparation for the quiz and the final examination. There are three types of assignments: read, prepare, and hand in.

- **Read:** When the assignment is to read some material, this reading is an important introduction to the topics to be discussed in class. I will make the assumption that you have done the reading before class and have understood much (but not necessarily all) of it. When the assignment is to read a problem, that problem will often be used in class to introduce new concepts.

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1Your final grade is not subject to negotiation. If you feel I have made an error, submit your written argument to me within one week of receiving your final grade. Clarify the precise error I made and provide all due supporting documentation. If I have made an error, I will gladly correct it. But I will adjust grades only if I have made an error.
• **Prepare:** Fully analyze the problem. Be ready to discuss it in class, with the numbers computed, etc. I will call on people, so please be ready.

• **Hand In:** The same as prepare, but you must turn in your analysis. All written assignments must be handed in at the beginning of class on the day they are due, and so you will probably want to make a copy of your assignment for reference during class. All written assignments will be graded. These assignments should be submitted in typed form using a word processor. Please write your name, RUID and email on all homework submitted. Team work on this homework is not allowed. Unless a documented reason is produced for unusual circumstances, late submissions will not be accepted more than a week late.

**Case write-ups** should consist of a summary of no more than two pages of single-sided text. The summary should not contain any calculations. In it you should clearly present your recommendations and proposals. Supporting documents (calculations, charts, figures, etc.) may be appended to the summary. Case write-ups should represent only the work of a single student. You may discuss the case with other students in your team, the teaching assistants, or the professor of the course, but the memo and the analysis should represent only your own work.

**Term Project:** A Data Models related topic is part of the course. For the project work only, students may team up into groups of 3 or so.

**Class Participation and Conduct.** Your class participation will be evaluated subjectively, but will rely upon measures of punctuality, attendance, familiarity with the required readings, relevance and insight reflected in classroom questions, and commentary. Your class participation will be judged by what you add to the class environment, regardless of your technical background. Although several lectures will be didactic, we will rely heavily upon interactive discussion within the class. Students will be expected to be familiar with the readings, even though they might not understand all of the material in advance. In general, questions and comments are encouraged. Comments should be limited to the important aspects of earlier points made, and reflect knowledge of the readings. You may called on to answer questions about the homework or classroom discussion. Your classroom participation evaluation is based on the extent to which you contribute to the learning environment. However, correcting a mistake of the professor and asking what appear to be "dumb questions" about what is being covered are positive contributions. In the case of so-called "dumb questions," very often half of the class will have the same questions in mind and are relieved to have them asked.

**Other requirements are:** On-time arrival to classes, with uninterrupted attendance for the duration. Maintenance of a professional atmosphere - use respectful comments and humor. Turning off electronic devices in class: silent wireless devices, no Web-browsing or emailing. Refraining from distracting or disrespectful activities, e.g., avoiding side conversations. Courtesy towards all participants in the classroom.

**Tentative Course Outline.**

○ Weeks 1-3: BASIC CONCEPTS
  Sections 2.1 through 2.11 & 2.13 of chapter 2
    – Random Variables
      Discrete Distributions: Bernoulli, Binomial, Poisson, Uniform, Geometric.
    – Laws of Large Numbers
– Simulation Modeling
  Sections 4.1 and 4.2 of chapter 4
  * Simulation: Simple Example
  * The Binomial Model and its Simulation
  * Simulation of an Inventory System

◊ Week 4: CONTINUOUS DISTRIBUTIONS
  Sections 3.1 through 3.8
  – Normal, Exponential Distribution, \( t_n, \chi^2_n \)
  – Defining the Poisson Process
  – American Options
  – Capital Asset Pricing Model

◊ Weeks 5-6: STATISTICAL SAMPLING
  Section 4.4 through 4.6 of chapter 4
  – Estimators
  – Confidence Intervals
  – Test of Hypothesis
  – Bayes Estimation

◊ Weeks 9-10: REGRESSION MODELS: CONCEPTS AND PRACTICE
  Sections 6.1 through 6.7 of chapter 6
  – Linear Models
  – Analysis of Correlation
  – Ridge regression
  – Lasso method

◊ Weeks 11-13: OPTIMIZATION.
  Sections 7.1-7.6 of chapter 7
  – Linear Optimization
  – Binary Optimization
  – Non-Linear Optimization