OMS 301 Winter 2010
Business Statistics and Management Science
Syllabus (Preliminary)

Instructors:

Laurie Morgan (course coordinator): Sections 1, 3, 4, and 5
Office: R4474
E-mail morganla@umich.edu
Office hours: Thursdays 10:00 AM – 12:00 PM
Fridays 9:30 AM—12:00 PM and 1:00 PM—4:00 PM
and by appointment.

Yan Yin: Section 2
Office:
E-mail:
Office hours:

Objective: The ability to make "intelligent" decisions is critical for both managers and firms. In today's business world, problems are too complex to rely simply on intuition and common sense. Quantitative decision tools such as management science and statistics allow decision makers to base decisions on data-driven and scientific methods. This course prepares students to describe, gather and analyze business data, and to use statistical and management science tools to make effective business decisions in operations, finance, marketing, management, and new product development.

Overview: This course teaches quantitative methods used in data analysis and business decision making. Topics include: optimization models, probability, decision trees, statistical inference and sampling, hypothesis testing, simulation, computer simulation and regression analysis. Business applications of these techniques are emphasized. Students in this course will acquire expertise in computer based methods for data analysis and decision making, through computer analysis of business datasets.

Materials:

1. **Lecture notes (Required):** The PowerPoint slides that will be used for lectures. These will consist of two parts. Part I will cover material for the first half of the class, including all the material for the mid-term exam. Part 2 will cover material for the second half. Both will be distributed in class. There is no charge for the packet.

2. **Text**
   Custom text from Cengage, ISBN 1111208239. It includes selected chapters from:
   David R. Anderson, Dennis J. Sweeney and Thomas A. Williams, *Modern Business Statistics* (3rd e.), and Ragsdale, Cliff T., *Spreadsheet Modeling and Decision Analysis* (5th ed).
   The custom text also included three case studies:
   "Northwest Newsprint" (Ivey)
   "Exotic Adventures Inc.: The Amazon River Voyage" (Ivey)

"Colonial Broadcasting" (Harvard)

Campus area bookstores will stock the custom text. It will also be available directly from Cengage in electronic form. We will post separate instructions for obtaining the electronic version.

3. **CTools website:** A common website will be maintained for all sections and any information/documents posted on the website will apply to all sections unless specifically noted otherwise. *Students are responsible for checking the website regularly for announcements, assignments and supplementary material. We consider posting information in the CTools website to be sufficient notice for you to be held responsible for it.*

4. **Software:** The course will involve extensive use of Microsoft Excel. The following additional tools will also be used and are available on RSB lab computers:
    i. **Solver:** Available as an Add-in in Excel.
    ii. **Analysis Tool pack:** Available as an Add-in in Excel
    iii. **Treeplan:** Available on the RSB computing clusters.
    iv. **Crystal Ball:** Available on the RSB computing clusters.

Grading:
Grading will be according to the guidelines of the Ross School of Business BBA program as outlined in the BBA program bulletin. It will be based on homework assignments, exams and class participation. The distribution of grades is given below:

Homework assignments, case studies and class participation	30.0%
Midterm exam	30.0%
Final Exam	40.0%

Homework assignments:

1. There will be 9 homework assignments in total, with more details about each assignment noted in the outline. All assignments are mandatory and will count toward your final grade.

2. *You may work on the homework assignments, including case studies, in a team of three students.* You may form the teams on our own, but all members must belong to the same section. Once you have formed a team, download the "Homework team request form" from the CTools assignment "Homework Group Request," fill it out, and submit it to ONE of the team members' assignment tabs by no later than noon on Sunday, January 10. There will be a space in the form for you to indicate if you want your instructor to assign you a team. If your name does not appear on a homework group request form that is submitted by noon on January 10, we will assume you want us to assign you a group. You will work with your homework team for the entire term, and will submit peer assessments of each of your team members along with the final homework assignment.

3. No *discussion of assignments* is permitted with anyone outside your team until after the deadline for the assignment submission has expired. You may contact the instructors with your questions, and tutors may also be available. Discussing the assignment with anyone other than your homework group members, or Professors Morgan or Yin is a violation of the RSB honor code and will be handled accordingly.

4. **Assignments are due to be submitted to CTools by 11:45 PM on the due date**. Case studies will be discussed in class on the day after the assignment is due.

   Assignment submissions consist of two components:
   - **Write-Up**: A single Word or PDF document. This must contain the answers to all your questions, and is the only document which will be completely examined by your graders. You must submit an electronic copy of this as well as a hard copy in class at the beginning of the lecture following the due date. The hard-copy will facilitate prompt grading. Please note that he hard copy you turn in must be identical to the electronic copy submitted on CTools: any deviation is a violation of the Honor Code. Both the electronic submission and the hard copy should list the names of all group members. You should submit the electronic files to only one group member's CTools assignment tab; likewise you should turn in only one hard copy.
   - **Appendices**: Almost all homework assignments will involve Excel computations. These Excel files must be submitted on CTools, but hard copies are not required. The graders will refer to these Excel files online when they grade your write-up. Homework assignments will include explicit instructions on which Excel files must be submitted on CTools.

5. Because you will work in teams for your homework assignments, no late submissions are permitted and we expect you to resolve by yourself any time conflicts within your team.

6. Each assignment will be assigned at least one week before it is due. The graded assignments will be returned to you within 10 days of the due date.

7. If you have any questions about the graded assignments and would like a re-grade, you must contact your section instructor with a **written request within one week** of the assignment being returned to you. No re-grade requests will be entertained after the one-week period.

8. The assignments will have different weights, since they will differ in length and content. The relative weight of each assignment will be announced at the beginning of each homework assignment.

9. **Cases:** There will be three case assignments in the course. Each case will also be discussed in the lecture immediately following the day in which the corresponding assignment is due. A detailed note on what we expect in your case write-ups will be posted on CTools at last one week before the first case assignment is due. Please be prepared to refer to your case write-up and participate fully in the case discussion.

Exams:
There will be one mid-term and one final exam. The final exam will emphasize material covered after the mid-term. The exam schedule is as follows:

Midterm exam:	**Monday, February 22, 6:00 PM—8:00 PM**
Final Exam:	**Monday, April 26, 8:00 AM—10:00 AM**

Absences from the exam will be entertained only in cases of emergencies. The instructor must be notified before the exam if you will be unable to take it and will require documented proof. In such cases, a make-up exam will be rescheduled.

We will also post sample exams and review packets on the CTools website at least one week before the exams.

The exams will be closed-book, but you can prepare up to five letter sized "cheat-sheets" which you can use during the exam. Only cheat-sheets and a calculator are allowed at the exam.

Honor policy and our expectations from you:

- **Honor:** Please use this class as a forum to practice the courtesy, respect and high ethical standards fitting of a top BBA program; the Ross School Honor Code can be found at: http://www.bus.umich.edu/Academics/Resources/communityvalues.htm. You should review it carefully if you have not already done so. Both instructors and the administration take the honor code very seriously. Any suspected violations will be referred to the RSB Community Values Committee (CVC). If you have any questions about the honor code, please feel free to contact the instructors or any member of the administration.
- **Preparation:** You should review class lecture notes for both the previous and current day's lecture ahead of class.
- **Participation:** Active participation and meaningful discussions contribute significantly to effective learning, and therefore will be encouraged, and earn grades in this class. Please come prepared to engage in class discussions, answer questions posed by the instructor or your colleagues. You should expect to answer "cold calls" from your instructor. Contributions relating to quantitative analysis and managerial insights will be particularly appreciated, and your grade will depend on the quality of your contribution more significantly than the quantity.
- **Time:** a rule of thumb for time requirements at the university level is 150 clock hours (for a three credit hour course) spent in preparation, class review and examinations. Trimming this time input will diminish the value of the education experience for everyone. Please recognize the importance of advance preparation and begin now to level-load your course time-input.

Our commitment to you:

- **Time:** We will be at class each session and will spend time with you in person, and via e-mail as necessary to make sure you understand our favorite subject.
- **Preparation:** We will be prepared to discuss the topics in each lecture as well as relevant questions you raise, subject to time constraints. We will also be prepared to discuss each assignment and the principles it illustrates. All relevant questions are welcome, in class or outside.
- **Honor:** We will live by the Ross School of Business Honor Policy, using this class as a forum to practice courtesy, respect and the highest ethical standards.

Course Outline: The following pages list a lecture-by-lecture outline of the entire course. The learning objectives, readings and assignments for each lecture are listed. We will attempt to stick to this schedule as much as possible, through the instructions reserve the right to modify the contents of the lectures depending on the evolution of the course. Sufficient notice will be given for any changes.

Course Outline

Module I: Introduction to Optimization and Linear Programming

January 6: Course overview and Introduction to optimization

Learning objectives:

- Understand course structure and expectations
- Brief overview of application areas of business statistics and management science
- Structure of a linear program
- Concept of optimization
- Text: Ragsdale chapter 2

January 11: Solving linear programs

Learning objectives:

- Graphical method as a tool for solving simple linear programs
- Setting up a linear programming problem in Excel
- Using Excel Solver
- Text: Ragsdale chapter 3.0-3.7

January 13: Sensitivity analysis

Learning objectives:

- Sensitivity of the LP solution to changes in coefficients and constraints
- Analyzing the Solver sensitivity report
- Text: Ragsdale chapter 4.0-4.6

January 20: LP Applications

Learning objectives:

- Practice formulating various business applications of LP
- Learn a few well known LP applications from marketing, finance, operations

- Advantages and limitations of LP
- Text: Ragsdale chapter 3.9-3.11

Module II: Introduction to probability

January 25: Introduction to probability

Learning objectives:

- Random events, probability spaces and the basics of probability
- Computing the probability of a compound event
- Conditional probability and the concept of independence
- Text: ASW chapter 4.1—4.4
- Homework 1 due (at 11:45 PM on January 24), including linear programming case study

January 27: Bayes' rule

Learning objectives:

- Be able to apply Bayes' rule as a tool to compute probability before and after new information is available
- Text: ASW chapter 4.5

Module III: Decision analysis

February 1: Decision trees: Introduction

Learning objectives:

- Understand EMV as a basis for decision-making
- Solve simple decision analysis problems using decision trees
- Use Treeplan software in Excel to automate decision trees
- Text: Ragsdale chapter 15.0-15.11
- Homework 2 due (at 11:45 PM on January 31)

February 3: Decision Trees: Applications

Learning objectives:

- Multi-state decision making problems and their solution using decision trees
- Incorporating additional information in decision analysis
- Computing the value of information
- Applications of information-based decision analysis in the context of market research and the use of external "experts"
- Text: Ragsdale chapter 15.13-15.14

Module IV.a. Discrete probability distributions

February 8: Discrete Distributions: Introduction

Learning objectives:

- Understand the notion of a probability distribution
- Mean and variance of a discrete random variable

- Bernoulli random variables and the Binomial distribution
- Text: ASW chapter 5.1—5.4
- Homework 3 due (at 11:45 PM on February 7) including decision theory case study

February 10: Binomial and Poisson distributions

Learning objectives:

- Recognize situations when the Binomial distribution applies and learn how to solve business decision making problems involving the Binomial distribution
- Recognize situations when the Poisson distribution applies and learn how to solve business decision making problems involving the Poisson distribution.
- Text: ASW chapter 5.4—5.5

Module IV.b: Continuous probability distributions

February 15: Continuous probability distributions

Learning objectives:

- Characterizing random variables with continuous values
- Overview of the Normal distribution
- Properties of the normal distribution
- Obtaining normal distribution parameters from normal tables and Excel.
- Recognizing situations when the normal distribution applies and learn how to solve business decision making problems involving the normal distribution.
- Text: ASW chapter 6.1—6.2
- Homework 4 due (at 11:45 PM on February 14)

Midterm Exam

February 17: Midterm Review

- Review for the midterm exam
- Homework 5 due (at 11:45 on February 21)

February 22: Midterm: 6:00 PM – 8:00 PM Rooms TBA

- No lecture: instructors will be available at their offices for office hours

Module IV.b: Continuous probability distributions, continued

February 24: Exponential and Uniform distributions

Learning objectives:

- Recognizing situations when the exponential and uniform distributions apply
- Applications to business decision-making problems
- Relationship between exponential and Poisson distribution
- Text: ASW chapter 6.3

Module V: Sampling, inference and hypothesis testing

March 8: Sampling distributions

Learning objectives:

- Explore why sampling leads to errors
- "Sampling distributions": distributions of sample statistics
- Central Limit Theorem
- Text: ASW chapter 7

March 10: Estimating population parameters: intervals

Learning objectives:

- Point estimate and an interval estimate
- Constructing a confidence interval for a population parameter (mean or proportion)
- t-distribution and learn how to find the probability using t-table and Excel
- Computing required sample size to meet desired levels of "margin of error" for a confidence interval
- Text: ASW chapter 8

March 15: Hypothesis tests I (mean and proportion)

Learning objectives:

- Conceptual underpinnings of hypothesis testing
- Formulating null and alternative hypotheses
- Two approaches of testing hypotheses: critical values and p-values.
- Factors affecting the outcome of hypothesis tests
- Testing hypotheses about population means
- Testing hypotheses about population proportions
- Text: ASW chapter 9
- Homework 6 due (at 11:45 PM on March 14)

March 17: Hypothesis tests II

Learning objectives:

- Learn how to test hypotheses or form interval estimates for two independent population means
- Understand the difference between two independent samples and paired samples
- Text: ASW chapter 10

Module VI: Simulation

March 22: Inference and simulation

Learning objectives:

- Simulation as repeated controlled trials
- Conduct simple simulations in Excel using the Crystal ball simulation software
- Relationship between simulation and sampling, exploring how confidence intervals and hypothesis tests continue to apply

- Text: Ragsdale chapter 12.0-12.13
- Homework 7 due (at 11:45 PM on March 21)

March 24: Simulation using Crystal Ball

Learning objectives:

- Reporting simulation results using confidence intervals
- Relationship between sampling and simulation and conduct hypothesis tests based on the simulation output
- Decision-making and optimization using simulation
- Additional simulation applications
- Text: Ragsdale chapter 12.14

Module VII: Regression

March 29: Correlation and Regression

Learning objectives:

- Covariance and correlation
- Simple linear regression model
- Assumptions required for the linear regression model
- Text: ASW chapter 3.5 and 14.1—14.4
- Homework 8 due (at 11:45 PM on March 28)

March 31: Interpretation of regression results

Learning objectives:

- Using linear regression models to estimate population parameters
- "Significance" and "fit" of a linear regression model
- Constructing confidence intervals and testing hypotheses for regression coefficients
- Constructing prediction and confidence intervals for dependent variable
- Text: ASW chapter 14.5—14.8

April 5: Multiple regression: Introduction

Learning objectives:

- Extension of simple model concepts: model significance and fit, confidence intervals and hypothesis testing for coefficients, confidence and prediction intervals for DV
- Learn how to interpret regression coefficients
- Text: ASW chapter 15.1—15.4

April 7: Multiple regression: Model construction and violations

Learning objectives:

- Understand the implications of the assumptions of the regression model and the consequences of their violation
- Learn how to build a "good" model in terms of choosing the appropriate independent variables
- Text: ASW chapter 15.5—15.6 and 15.8

April 12: Multiple regression: Modeling non-linearities

- Use dummy variables to model qualitative variables
- Create and use interaction variables
- Business applications of multiple regression
- Text: ASW chapter 15.7
- Homework 9 due (at 11:45 on April 11)

April 14: Multiple regression: Modeling non-linearities

- Transformations of the independent and dependent variables to improve model "fit"
- Business applications of multiple regression
- Text: ASW chapter 15.7

Module VIII: Wrap-up and final exam

April 19: Final Exam Review and Problem Solving

- We will work review problems in class
- Colonial Broadcasting case study due (at 11:45 PM on April 18)

April 26: Final Exam: 8:00 am—10:00 am Rooms TBA