Financial Modeling and Optimization-Course Syllabus

RM 392- unique # 04285
TTh 3:30-5:00, UTC 4.122
Fall 2010

Instructor

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Course web page: www.utexas.edu/courses/lasdon, and our web page on UT's "Blackboard" system.

Course Topics

1. The Process of Modeling
   - 1.1 A six-stage framework
   - 1.2 The craft of modeling
   - 1.3 Visual modeling tools
   - 1.4 Spreadsheet engineering
   - 1.5 Analysis using spreadsheets
2. Deterministic Cash Flow Streams
   - 2.1 Fixed income securities: duration and convexity, bond portfolios, immunization
   - 2.2 Term structure of interest rates
   - 2.3 Applications: capital budgeting, dynamic cash flows, valuation of a firm
3. Basic ideas of risk analysis
4. Single Period Random Cash Flows
   - 4.1 Mean-variance portfolio theory
   - 4.2 Capital asset pricing model
   - 4.3 Variants of mean-variance models: factor models, arbitrage pricing theory, model parameter estimation
   - 4.4 Utility theory
5. Derivative Securities
   - 5.1 Forwards, futures, and swaps
   - 5.2 Models of asset dynamics
   - 5.3 Basic options theory
   - 5.4 Additional options topics
   - 5.5 Interest rate derivatives
6. Multiperiod models
   - 6.1 Optimal portfolio growth

6.2 General investment evaluation

Software Used

Learn to use state of the art optimization and simulation software including the following:
1. Excel and the Excel Solver for optimization
2. @RISK for Monte Carlo Simulation
3. Precision Tree for Decision Tree analysis
4. The GAMS algebraic modeling language.

This software, and the concepts underlying it, has applications in all areas of business.

This course is designed for MBA students, engineers, operations research students, computer scientists, and others who are interested in quantitative methods and their application to finance and investing. The level of mathematics used in the course is fairly basic-algebra, elementary calculus, and basic probability and statistics. You also need the ability to think logically and systematically, but improving this ability is a course goal.

Instructional Methods

The basic approach is to learn by doing. We will organize small learning groups, who work together to solve problems in class. These problems are stated on the plan for each class. Last year's plans are on the course website, and are a reasonable guide to those used in the current year. We then discuss the problem solutions. This is interspersed with lecture segments when needed. There will also be occasional outside speakers, who will explain how they use course topics in their work.

Course Materials

The text is "Financial Modeling" by Simon Benninga, MIT Press, 3rd edition, 2008. It is available at the Co-op or online and should be purchased by each student or group of students. The author is a professor in Finance at Wharton.
A second book, "Financial Models Using Simulation and Optimization III" by Wayne Winston, Palisade Corp (pub), 3rd edition, 2010, will provide many problems and cases, all framed as Excel spreadsheet models, provided on a CD-ROM which accompanies the book. The CD-ROM also includes full trial versions of the PALISADES Excel add-in software @RISK (for Monte Carlo simulation), PRECISION TREE (for decision tree analysis), and EVOLVER, a genetic algorithm for optimization that can solve non-smooth and discrete problems. This book and its 68 excellent examples provide problem templates and solution software which many students will be able to apply in their future careers. Although individual purchase is encouraged, one copy may be purchased and shared by each learning group. It is available at online vendors.

Grading

There will be a midterm exam counting 30%, and a term project selected by the student and approved by the instructor counting 30%. Cases and homework count 40%.

Tentative Schedule of Topics

Class #	Topic	Text Chapters and pages	Other book Chapters and pages	Readings	Cases and Exams
1	Introduction, modeling framework			Art of modeling Ch 1	
2	Craft of modeling			Art of modeling Ch 1, 2	Begin case 1
3	Excel and Spreadsheet Engineering			Art of modeling Ch 3-6	
4	Racquetball case, Financial statement modeling	Ch 3		Art of modeling Ch 3-6	
5	Case 1 presentations				Case 1 due
6	Financial statement modeling	Ch 3			
7	Financial statement modeling	Ch 3			Begin case 2
8	Financial statement modeling	Ch 3			
9	Financial statement modeling	Ch 4			
10	Financial statement modeling	Ch 4, 5			
11	Asset allocation	Ch 8			
12	Asset allocation	Ch 8			Case 2 due,begin Case 3
13	Asset allocation	Ch 10			
14	Asset allocation	Ch 12	Winston Ch 10		
15	Scenario approach and other risk measures Asset allocation		Winston Ch 10	Quadratic programming, 3scen.xls	Mid-term exam
16	Case 3 presentations, asset allocation				
17	Factor Models Scenario approach and other risk measures		Winston, Ch 47, 49, 50		
18	Factor models Black-Litterman approach	Ch 13			Case 3 due
19	Black-Litterman approach, portfolios of oil and gas E&P projects			Papers under readings/E&P project portfolios	Begin case 4
20	Modeling oil and gas E&P projects and selecting project portfolios		Winston Ch 19, 53	Papers under readings/E&P project portfolios	
21	Scenario generators for oil and gas projects		Winston Ch 42	Papers under readings/E&P project	

				portfolios	
22	Risk measures other than variance, Scenario generators for oil and gas projects			Papers under readings/E&P project portfolios	Case 4 due
23	Project portfolios: scenario generation and portfolio optimization		Winston Ch 43	Papers under readings/E&P project portfolios	
24	Project portfolio optimization, lognormal stock price models,VAR	Ch 18	Winston Ch 44-47	Papers under readings/E&P project portfolios	
25	VAR, multiperiod portfolio models			Papers under readings\multiperiod portfolio models	
26	Multiperiod models-scenario generation		Winston Ch 44-46	Papers under readings\multiperiod portfolio models	
27	Multiperiod models-scenario generation		Winston Ch 44-46	Papers under readings\multiperiod portfolio models	
28	Review, discussion of term projects				Term projects due during finals week

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The University of Texas at Austin provides upon request appropriate academic accommodations for qualified students with disabilities. For more information, contact the Office of the Dean of Students at 471-6259.

By UT Austin policy, you must notify me of your pending absence at least fourteen days prior to the date of observance of a religious holy day. If you must miss a class, an examination, a work assignment, or a project in order to observe a religious holy day, you will be given an opportunity to complete the missed work within a reasonable time after the absence.

Policy on Academic Integrity:
Students who violate University rules on academic dishonesty are subject to disciplinary penalties, including the possibility of failure in the course and/or dismissal from the University. Since such dishonesty harms the individual, all students, and the integrity of the University, policies on academic dishonesty will be strictly enforced. For further information please visit the Student Judicial Services Web site:
http://deanofstudents.utexas.edu/sjs