## **Financial Modeling and Optimization-Course Syllabus**

RM 392 Topic 1- unique # 04350 MW 2:00-3:15, CBA 4.324 Spring 2013

## **Instructor**

Leon S. Lasdon Office Phone: 471-9433 E-Mail: <u>lasdon@mail.utexas.edu</u> Office: CBA North 5.244 Office hours MW 3:15-4:00 or by appointment Teaching Assistant: Sebastian Souyris TA e-mail: sebastian.souyris@utexas.edu TA Office: CBA 6.490 Course web page: <u>www.utexas.edu/courses/lasdon</u> for previous years versions, and our web page on UT's Blackboard system for this years course.

# **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. Financial Statement Modeling
  - 2.1 Basics: income statements, balance sheets, cash flow, etc
  - 2.2 Applications: PPG Corporation
- 3. Single Period Asset Allocation
  - 3.1 Mean-variance portfolio theory
  - 3.2 Capital asset pricing model
  - 3.3 The scenario approach and risk measures other than variance
  - 3.4 Maximizing expected utility
  - 3.5 Portfolios of projects
- 4. Multiperiod Asset Alocation Models
  - 4.1 Periodic rebalancing and its benefits
  - 4.2 Rebalancing to an optimal fixed mix
- 5. Bonds and other income-producing securities

## Software Used

Learn to use state of the art optimization and simulation software including the following:

1. Excel and the Excel Solver for optimization. We will use a much more powerful version of the Solver called Risk Solver Platform-see www.solver.com

- 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 may also be occasional outside speakers, who will explain how they use course topics in their work.

### **Course Materials**

#### <u>required</u>

The text is "Financial Modeling" by Simon Benninga, MIT Press, 3<sup>rd</sup> 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.

### <u>optional</u>

A second book, "Financial Models Using Simulation and Optimization II" by Wayne Winston, Palisade Corp (pub), 2010, provides 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, including Palisade Corp (\$60).

### **Course Requirements and Grading**

There will be four cases, done in teams, worth 10% each, an in-class midterm worth 20%, a final exam worth 20%, and a term project, done in teams, worth 20%. The term

project will involve selecting a financial modeling application area, researching and writing a survey on it, or building and solving some prototype models from some application area, or some other topic proposed by students and accepted by the instructor.

The five cases will be completed in self-selected groups of two to three people. Please form your case groups as soon as possible. If you have problems finding a group, please see me. At minimum, your case write-up (report) should address the questions posed. Please use the following format for case reports: a one page executive summary, a description of analysis section (maximum four pages), and an appendix. The executive summary should be a clear statement of your findings using *non-technical language*. It should entice the reviewer (the TA or me) to want to read the analysis section. Be as clear and concise in the analysis section as possible. Relegate any detailed supporting material (e.g., figures, tables, and equations) to an appendix and reference it appropriately. The entire report should use 1.5 line spacing, 12-point font, and one-inch margins. No late case assignments will be accepted since solutions will be posted or covered in class on the day they are due. If you encounter a grading problem on a case study, please see me.

For each class session, you should familiarize yourself with the topics covered in the assigned chapter of the textbook. In addition, I will assign additional problems that may be worked for self-study, but they are not to be turned in for grading.

Date	Class	Торіс	Text	Other book	Readings	Cases and Exams
	#		Chapters	Chapters and		
			and pages	pages		
1/14	1	Introduction, modeling			Art of modeling Ch 1	
		framework				
1/16	2	Craft of modeling			Art of modeling Ch 1, 2	Begin case 1
1/23	3	Excel and Spreadsheet			Art of modeling Ch 3-6	
		Engineering				
1/28	4	Financial statement	Ch 3			
		modeling				
2/4	5	Case 1 presentations				Case 1 due
2/6	6	Financial statement	Ch 3			Begin Case 2
		modeling				-
2/11	7	Financial statement	Ch 4			
		modeling				
2/13	8	Financial statement	Ch 4			
		modeling				
2/18	9		Ch 8			
		Asset allocation: mean-				
		variance models				
2/20	10	Case 2 presentations	Ch 8,10			Case 2 due
		Asset allocation				
2/25	11	Asset allocation	Ch 10,12			Begin case 3
		Factor Models				-
2/27	12	Asset allocation	Ch 12	Winston Ch 10	Quadratic	
		Scenario approach and			programming, 3scen.xls	
		other risk measures				
3/4		Global trips, informal				

## **Tentative Schedule of Topics**

		-1				
215		Classes				
3/6		Global trips, informal				
2 / 1 /		classes				
3/11		Spring break				
3/13		Spring break				
3/18	13	Factor Models	Ch 13	Winston, Ch 47,		
		Maximizing Expected		49, 50		
		utility				
3/20	14	Expected utility,		Winston Ch 19,	Papers under	
		project portfolio		53	readings/E&P project	
		optimization			portfolios	
3/25	15	In class Mid-term				Mid-term exam
		exam				
3/27	16	Project portfolio		Winston ch42	Papers under	
		optimization,			readings/E&P project	
		Portfolios of oil and			portfolios	
		gas E&P projects				
4/1	17	Case 3 presentations			Papers under	Case 3 due
		Portfolios of E&P			readings/E&P project	
		projects, scenario			portfolios	
		generation				
4/3	18	Portfolios of E&P	Ch 18		Papers under	
		projects, scenario			readings/E&P project	
		generation			portfolios	
4/8	19	lognormal stock price	Ch 18	Winston Ch 44-		
		models, VAR		47		
4/10	20	VAR, multiperiod				Begin case 4
		portfolio models				
4/15	21	Multiperiod models			Papers under	
		-			readings\multiperiod	
					portfolio models	
4/17	22	Multiperiod models-		Winston Ch 44-	Papers under	Case 4 due
		scenario generation		46	readings\multiperiod	
					portfolio models	
4/22	23	Bonds : duration,	Ch 26		Files under	
		convexity,			readings/fixed income	
		immunization models			investing	
4/24	24	Bonds and other	Ch 27		Files under	
		securities for income			readings/fixed income	
		portfolios			investing	
4/29	25	Bonds and other	Ch 28		Files under	
		securities for income			readings/fixed income	
		portfolios			investing	
5/1	26	Bonds and other			Files under	Term projects
	-	securities for income			readings/fixed income	due
		portfolios			investing	
		14 · · · · · · · · · · · · · · · · · · ·				

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: <u>http://deanofstudents.utexas.edu/sjs</u>