

ACTS 4302

SYLLABUS

FALL 2016

Principles of Actuarial Models: Financial Economics

BRIEF DESCRIPTION: This 3 semester credit hour course develops the student's knowledge of the theoretical basis of certain actuarial models and the application of those models to insurance and other financial risks. The topics discussed include interest rate models, rational valuation of derivative securities, mathematical and probabilistic foundation of risk management. This class covers parts of CAS exam 3F and SOA exam MFE. Prerequisites: [STAT 4351](#) and [STAT 4382](#). Prerequisite or Corequisite: [FIN 3390](#) or instructor consent required.

The class meets on T/TH 10:00 am – 11:15 am in room [CB1 1.106](#)

REQUIED BACKGROUND: This course assumes a basic knowledge of calculus and an introductory knowledge of probability and finance.

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Office Hours: T/TH 1:00 pm – 2:00 pm, or by appointment.

LEARNING OUTCOMES.

At the end of the course students will be able to:

- A. Understand the rational valuation of derivative securities. Specifically:
 1. Use put-call parity to determine the relationship between prices of European put and call options and to identify arbitrage opportunities.
 2. Calculate the value of European and American options using the binomial model.
 3. Calculate the value of European options using the Black-Scholes option-pricing model.
 4. Identify the situations where the values of European and American options are the same.
 5. Interpret the option Greeks.
 6. Explain the cash flow characteristics of the following exotic options: Asian, barrier, compound, gap, and exchange.
 7. Explain the properties of a lognormal distribution and explain the Black-Scholes formula as an expected value for a lognormal distribution.
 8. Explain what it means to say that stock prices follow a diffusion process.
 9. Apply Itô's lemma in the one-dimensional case.

- B. Understand the principles of the Monte Carlo simulation. Specifically:
1. Simulate lognormal stock prices.
 2. Use variance reduction techniques to accelerate convergence.
- C. Understand the principles of risk management techniques. Specifically:
1. Explain and demonstrate how to control risk using the method of delta-hedging.

TEXTBOOK (required): ASM MFE *Study manual for Exam MFE/Exam 3F. Financial Economics (Ninth Edition)*, recent edition, Abraham Weishaus.

ADDITIONAL TEXT (not required, but useful – check the library for this resource):

Derivatives Markets (Recent Edition), Robert L. McDonald.

MATERIAL COVERED:

| Topic Number | Topic Name | Topic Number | Topic Name |
|--------------|---|--------------|--|
| 1 | Put-Call Parity | 11 | The Black-Scholes formula: applications and volatility |
| 2 | Comparing Options | 12 | Delta hedging |
| 3 | Binomial Trees - Stock, One Period | 13 | Asian, Barrier, and Compound options |
| 4 | Binomial Trees - General | 14 | Gap, Exchange, and Other options |
| 5 | Risk-Neutral Pricing | 15 | Monte Carlo valuation |
| 6 | Binomial Trees: Miscellaneous Topics | 16 | Brownian Motion |
| 7 | Modeling stock prices with the lognormal distribution | 17 | Itô's lemma |
| 8 | Fitting stock prices to a lognormal distribution | 18 | Binomial tree models for interest rates |
| 9 | The Black-Scholes formula: Introduction | 19 | The Black formula for bond options |
| 10 | The Black-Scholes formula: Greeks | 20 | Equilibrium interest rate models: Vasicek and Cox-Ingersoll-Ross |

General Note: Unless otherwise states chapter appendices are not included in the required readings from this text

USEFUL LINKS:

<https://www.soa.org/education/exam-req/edu-exam-mfe-detail.aspx>

(MFE Exam information)

GRADING: Your grade will be based on weekly homework, two midterms and a final exam and will be assigned based on the following grade scale and weights:

| | |
|--------|----|
| 98-100 | A+ |
| 93-97 | A |
| 90-93 | A- |
| 85-89 | B+ |
| 80-84 | B |
| 75-79 | B- |
| 70-74 | C+ |
| 65-69 | C |
| 60-64 | C- |
| 55-59 | D+ |
| 50-54 | D |
| 45-49 | D- |
| 0-44 | F |

DATES: Homework – weekly;

Midterm I – Thursday, September 22, 2016, 10:00 am - 11:15 am, [CB1 1.106](#);

Midterm II – Thursday, November 3, 2016, 10:00 am - 11:15 am, [CB1 1.106](#);

Final – Thursday, December 15, 2016, 11:00 am – 1:45 pm, [CB1 1.106](#)

WEIGHTS: Attendance and Participation: 5%, Homework: 15%, Midterms: 25% each, Final: 30%

Assignments should be submitted by due date specified in class at the beginning of the class period. Only the grades for the assignments collected **in class** will be recorded. There will be **no make-up exams** unless accompanied by a note from a doctor, religious or otherwise documented official reason pertained to the University business. Undocumented cases will not be honored.

CALCULATORS: In order to simulate an actuarial exam conditions, an SOA approved exam calculator is recommended: **the battery or solar-powered Texas Instruments BA-35 model calculator, the BA II Plus, the BA II Plus Professional**, the TI-30Xa or TI-30X II* (IIS solar or IIB battery), or TI-30X MultiView (XS Solar or XB Battery).

For additional information please see:

<http://www.soa.org/education/exam-req/exam-day-info/edu-calculators.aspx>

USE OF CELL PHONES or OTHER ELECTRONIC DEVICES: Unless there is a true emergency, any use of cell phones or other electronic devices unrelated to the course during the class period is **strictly prohibited**. Violators will be asked to stop using the device immediately. Repeated violations will be reflected in the student's grade.

Please note: the instructor reserves the right to make changes to this syllabus

GENERAL RULES:

Field Trip Policies, Off-Campus Instruction and Course Activities

Off-campus, out-of-state, and foreign instruction and activities are subject to state law and University policies and procedures regarding travel and risk-related activities.

Information regarding these rules and regulations may be found at

http://www.utdallas.edu/BusinessAffairs/Travel_Risk_Activities.htm. Additional information is available from the office of the school dean.

Student Conduct and Discipline

The University of Texas System and The University of Texas at Dallas have rules and regulations for the orderly and efficient conduct of their business. It is the responsibility of each student and each student organization to be knowledgeable about the rules and regulations which govern student conduct and activities. General information on student conduct and discipline is contained in the UT Dallas printed publication, *A to Z Guide*, which is available to all registered students each academic year.

The University of Texas at Dallas administers student discipline within the procedures of recognized and established due process. Procedures are defined and described in the *Rules and Regulations, Series 50000*, Board of Regents, The University of Texas System, and in *Title V, Rules on Student Services and Activities* of the university's *Handbook of Operating Procedures*. Copies of these rules and regulations are available to students in the Office of the Dean of Students, where staff members are available to assist students in interpreting the rules and regulations (SU 1.602, 972/883-6391) and online at <http://www.utdallas.edu/judicialaffairs/UTDJudicialAffairs-HOPV.html>.

A student at the university neither loses the rights nor escapes the responsibilities of citizenship. He or she is expected to obey federal, state, and local laws as well as the Regents' Rules, university regulations, and administrative rules. Students are subject to discipline for violating the standards of conduct whether such conduct takes place on or off campus, or whether civil or criminal penalties are also imposed for such conduct.

[Added July 2010] Students are expected to be attentive during class and to participate actively in group activities. Students are expected to listen respectfully to faculty and to other students who are speaking. Racism, sexism, homophobia, classism, ageism, and other forms of bigotry are inappropriate to express in class. Classes may discuss issues that require sensitivity and maturity. Disruptive students will be asked to leave and may be subject to disciplinary action.

Academic Integrity

The faculty expects from its students a high level of responsibility and academic honesty. Because the value of an academic degree depends upon the absolute integrity of the work done by the student for that degree, it is imperative that a student demonstrate a high standard of individual honor in his or her scholastic work.

Scholastic Dishonesty: Any student who commits an act of scholastic dishonesty is subject to discipline. Scholastic dishonesty includes but is not limited to cheating, plagiarism, collusion, submitting for credit any work or materials that are attributable in whole or in part to another person, taking an examination for another person, or any act designed to give unfair advantage to

a student or the attempt to commit such acts.

Plagiarism, especially from the web, from portions of papers for other classes, and from any other source, is unacceptable and will be dealt with under the university's policy on plagiarism (see general catalog for details). This course will use the resources of *turnitin.com*, which searches the web for possible plagiarism and is over 90% effective.

Copyright Notice

The copyright law of the United States (*Title 17, United States Code*) governs the making of photocopies or other reproductions of copyrighted materials, including music and software. Copying, displaying, reproducing, or distributing copyrighted works may infringe upon the copyright owner's rights and such infringement is subject to appropriate disciplinary action as well as criminal penalties provided by federal law. Usage of such material is only appropriate when that usage constitutes "fair use" under the Copyright Act. As a UT Dallas student, you are required to follow the institution's copyright policy ([Policy Memorandum 84-I.3-46](#)). For more information about the fair use exemption, see <http://copyright.lib.utexas.edu/copypol2.html>.

Email Use

The University of Texas at Dallas recognizes the value and efficiency of communication between faculty/staff and students through electronic mail. At the same time, email raises some issues concerning security and the identity of each individual in an email exchange. The university encourages all official student email correspondence be sent only to a student's UT Dallas email address and that faculty and staff consider email from students official only if it originates from a UT Dallas student account. This allows the university to maintain a high degree of confidence in the identity of all individuals corresponding and the security of the transmitted information. UT Dallas furnishes each student with a free email account that is to be used in all communication with university personnel. The Department of Information Resources at UT Dallas provides a method for students to have their UT Dallas mail forwarded to other accounts.

Class Attendance

Regular and punctual class attendance is expected. Students who fail to attend class regularly are inviting scholastic difficulty. Absences may lower a student's grade where class attendance and class participation are deemed essential by the instructor. In some courses, instructors may have special attendance requirements; these should be made known to students during the first week of classes.

Withdrawal from Class

The administration of this institution has set deadlines for withdrawal from any college-level courses. These dates and times are published in that semester's course inventory and in the

academic calendar. Administration procedures must be followed. It is the student's responsibility to handle withdrawal requirements from any class. In other words, a professor or other instructor cannot drop or withdraw any student. You must do the proper paperwork to ensure that you will not receive a final grade of "F" in a course if you choose not to attend the class once you are enrolled.

Student Grievance Procedures

Procedures for student grievances are found in *Title V, Rules on Student Services and Activities*, of the university's *Handbook of Operating Procedures*.

In attempting to resolve any student grievance regarding grades, evaluations, or other fulfillments of academic responsibility, it is the obligation of the student first to make a serious effort to resolve the matter with the instructor, supervisor, administrator, or committee with whom the grievance originates (hereafter called "the respondent"). Individual faculty members retain primary responsibility for assigning grades and evaluations. If the matter cannot be resolved at that level, the grievance must be submitted in writing to the respondent with a copy of the respondent's School Dean. If the matter is not resolved by the written response provided by the respondent, the student may submit a written appeal to the School Dean. If the grievance is not resolved by the School Dean's decision, the student may make a written appeal to the Dean of Graduate or Undergraduate Education, and the dean will appoint and convene an Academic Appeals Panel. The decision of the Academic Appeals Panel is final. The results of the academic appeals process will be distributed to all involved parties.

Copies of these rules and regulations are available to students in the Office of the Dean of Students, where staff members are available to assist students in interpreting the rules and regulations.

Incomplete Grade Policy

As per university policy, incomplete grades will be granted only for work unavoidably missed at the semester's end and only if 70% of the course work has been completed. An incomplete grade must be resolved within eight (8) weeks from the first day of the subsequent long semester. If the required work to complete the course and to remove the incomplete grade is not submitted by the specified deadline, the incomplete grade is changed automatically to a grade of F.

Office of Student AccessAbility (OSA)

UT Dallas is committed to providing equal educational opportunities for students with documented disabilities to all University courses and programs. Any student with a documented physical, psychological, or learning disability, which affects his/her academic performance, is eligible for services. If you need classroom accommodations, please make an appointment with the Office of Student AccessAbility at: SSB 3.200 (3rd Floor in SSB), 972-883-2098. Office

hours are Monday – Thursday, 8:30 a.m. - 6:00 p.m., Friday 8:00 a.m. – 5:00 p.m. Evening appointments are available by request. <http://www.utdallas.edu/studentaccess/>

OSA provides registered students with an accommodation letter to present to faculty members. The letter verifies that the student is qualified to receive certain accommodations. The accommodation letter should be presented to instructors of each course at the beginning of the semester. The approved accommodations should be discussed at that time. It is the student's responsibility to notify his/her professor of their needs.

The University of Texas at Dallas is proud to be an educational institution that welcomes and supports a diverse student body.

Religious Holy Days

The University of Texas at Dallas will excuse a student from class or other required activities for the travel to and observance of a religious holy day for a religion whose places of worship are exempt from property tax under Section 11.20, Tax Code, *Texas Code Annotated*.

The student is encouraged to notify the instructor or activity sponsor as soon as possible regarding the absence, preferably in advance of the assignment. The student, so excused, will be allowed to take the exam or complete the assignment within a reasonable time after the absence: a period equal to the length of the absence, up to a maximum of one week. A student who notifies the instructor and completes any missed exam or assignment may not be penalized for the absence. A student who fails to complete the exam or assignment within the prescribed period may receive a failing grade for that exam or assignment.

If a student or an instructor disagrees about the nature of the absence [i.e., for the purpose of observing a religious holy day] or if there is similar disagreement about whether the student has been given a reasonable time to complete any missed assignments or examinations, either the student or the instructor may request a ruling from the chief executive officer of the institution, or his or her designee. The chief executive officer or designee must take into account the legislative intent of *TEC 51.911(b)*, and the student and instructor will abide by the decision of the chief executive officer or designee.

Avoiding Plagiarism

[Adapted from Duke University's guidelines for writers; added July 2010]

Take time to make careful choices among--and learn to use--the research tools available to you. You will probably find that your favorite web search engine is not adequate by itself for college-level research. Consult with your professor or a librarian. You may need to use specialized research tools, some of which may require learning new searching techniques.

Expect to make trips to the library. While you can access many of the library's resources from

your home computer, you may find that you need to make several trips to use materials or research tools that are not accessible remotely. Of course, you will be seeking the best information, not settling for sources simply because they happen to be available online.

Allow time for gathering materials that are not available at UT Dallas. The InterLibrary Loan Office can borrow articles and books from other libraries, but this process takes additional time.

Allow time for reading, rereading, absorbing information, taking notes, synthesizing, and revising your research strategy or conducting additional research as new questions arise.

Sloppy note-taking increases the risk that you will unintentionally plagiarize. Unless you have taken note carefully, it may be hard to tell whether you copied certain passages exactly, paraphrased them, or wrote them yourself. This is especially problematic when using electronic source materials, since they can so easily be copied and pasted into your own document.

Identify words that you copy directly from a source by placing quotation marks around them, typing them in a different color, or highlighting them. (Do this immediately as you are making your notes. Don't expect to remember days or weeks later what phrases you copied directly.) Make sure to indicate the exact beginning and end of the quoted passage. Copy the wording, punctuation and spelling exactly as it appears in the original.

Jot down the page number and author or title of the source each time you make a note, even if you are not quoting directly but are only paraphrasing.

Keep a working bibliography of your sources so that you can go back to them easily when it's time to double-check the accuracy of your notes. If you do this faithfully during the note-taking phase, you will have no trouble completing the "works cited" section of your paper later on.

Keep a research log. As you search databases and consult reference books, keep track of what search terms and databases you used and the call numbers and URLs of information sources. This will help if you need to refine your research strategy, locate a source a second time, or show your professor what works you consulted in the process of completing the project.

You must cite direct quotes.

You must cite paraphrases. Paraphrasing is rewriting a passage or block of text in your own words. If you paraphrase, you must still cite the original source of the idea.

You must cite ideas given to you in a conversation, in correspondence, or over email.

You must cite sayings or quotations that are not familiar, or facts that are not "common knowledge." However, it is not necessary to cite a source if you are repeating a well known quote or familiar proverb. Common knowledge is something that is widely known. For example, it is widely known that Bill Clinton served two terms as president; it would not be necessary to cite a source for this fact.

These types of sources should be cited as well. Printed sources: Books, parts of books, magazine or journal articles, newspaper articles, letters, diaries, public or private documents; *Electronic sources:* Web pages, articles from e-journals, newsgroup postings, graphics, email messages, software, databases; *Images:* Works of art, illustrations, cartoons, tables, charts, graphs; *Recorded or spoken material:* Course lectures, films, videos, TV or radio broadcasts, interviews, public speeches, conversations.

Resources to Help You Succeed

The GEMS Center (located within the Conference Center) provides a wide array of free academic support and enhancement for UT Dallas undergraduate students. Offerings include, but are not limited to, a Math Lab and Writing Center, Peer Tutoring (with a focus on science, technology, engineering and math courses), test review sessions, and academic success coaching. The current menu of services, schedules, and contact information is posted on the GEMS website: <http://www.utdallas.edu/ossa/gems/>. [Added July 2010]