

**M339D/M389D(unique: 52930/53255): Introduction to Financial
Mathematics for Actuaries**
Fall 2019, University of Texas at Austin
Instructor: Milica Čudina

First-Day Information Sheet

Welcome! Here is some information and some ground rules. I will stick to these rules, and I assume you will, too. Read carefully, and let me know as soon as possible – **certainly by the 12th day of classes: September 13th, 2019** – if there is anything unclear.

Treat this document like a contract.

Technicalities

Lectures: Mon/Wed/Fri 12noon-1:00pm in RLM 5.104

Office Hours: Mon/Wed/Fri 10:00am-10:50am in RLM 13.142

My e-mail: mcudina@math.utexas.edu

Phone numbers: (512)232-6186 (the instructor's office)
(512)471-7711 (Department of Mathematics - main office)

About the Course

A few (serious) introductory remarks

- ◇ *Course URL.* <http://www.ma.utexas.edu/users/mcudina/course2.html>
- ◇ *Course description.* This course is intended to provide the **mathematical foundations** necessary to prepare for a portion of the SoA Exam IFM and CAS Exam 3F.

Additionally, the course is aimed at building up the vocabulary and the techniques indispensable in the workplace at current financial and insurance institutions. **This is not an exam-prep seminar. There is intellectual merit to the course beyond the ability to prepare for a professional exam.**

The material exhibited includes: basic risk management, forward contracts, options, futures, the binomial asset pricing model and its application to option pricing.

It should be stressed that this course is more sophisticated mathematically than is evident at first glance. A thorough understanding of probability and skillful application of notions from interest theory will be needed to advance through the varied and very dense material. The students will be required to actively participate in the class meetings and contribute to the successful conclusion of this course.

The remainder of the Exam IFM/3F curriculum is exhibited in course M339W (also offered by the Department of Mathematics).

- ◇ *Learning outcomes.*
 - The student will become literate in the basic terminology of financial markets.
 - The student will understand the principles of basic risk management (hedging).
 - The student will acquire the ability to distinguish between various agents in a financial market (hedgers, speculators, market makers, e.g.).
 - The student will gain proficiency in the vocabulary of derivatives markets.
 - The student will be able to recognize the properties and usage of a variety of common financial positions.
 - The student will be able to define and use the mathematical notion of **arbitrage**.
 - The student will gain competence in the area of binomial option pricing.

 - ◇ *Prerequisites.* Courses M329D and M362K with a grade of at least C-.

 - ◇ *Drop dates.* The last drop date for this class is the one announced on the academic calendar of the University of Texas at Austin (see <http://registrar.utexas.edu/calendars/>). This term it is **October 31st, 2019**.
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A few words about the assignments and grading

***Homework.* This is important information: I will not accept homework that does not conform to the guidelines that follow!**

Homework will be assigned in class and/or available on the course website. The homework will **not** be posted on *Canvas*. You will have two different ways in which to hand in your homework:

1. online submission of **typed-up** solutions through Canvas, or
2. in-person submission of handwritten solutions in the beginning of class.

You do not need to commit to a single way of submitting homework in the beginning of the course; it is acceptable to mix and match, but it is not acceptable to submit a single homework assignment twice. Regardless of the fashion in which your work is submitted, your solutions need to be in order and you should number the pages.

If you choose to upload your typed-up answers through Canvas, you will receive a 5% bonus on top of the score you earn in that particular assignment.

If you choose to hand in your assignment in the beginning of class when it is due, you should follow these guidelines. Homework assignments you turn in must be organized and stapled. As will business or official documents, the homework assignments must be done carefully and written legibly on standard size paper. Please do homework on standard size good quality paper and write only on the front of each sheet. Box final answers where possible. Staple in the top left-hand corner. On the first page and the outside page write your **name, course number, assignment number, and date**. Also, put your last name on each page.

The lowest two homework scores will be dropped. The homework assignments and the due dates will be announced as the term progresses.

Having read and understood this *First-Day Handout* in its entirety will count as one homework assignment. To get the credit, read this entire document with understanding. Then complete the final page of this document and return that page to your instructor by **September 13th, 2019**. Not handing in this assignment does **not** exempt you from abiding by the First-Day Handout.

Quizzes. You should **not** expect to have quizzes and in-class assignments to be completed and handed in during our class meetings. Instead, you will have various warm-up and review worksheets to complete at home. They will all be gathered under the category of *Quizzes* when the final scores are calculated. Please, be vigilant in class to learn about how your quizzes are supposed to be submitted and when they are due!

The lowest two quiz scores will be dropped. The quizzes and the due dates will be announced as the term progresses.

The In-Term Exams. The in-term exams will take place during the regular lecture time and in the same classroom. The exact dates are stated in the table at the end of this document. Especially note that the first in-term exam is intended to cover **prerequisite material**. The coverage of the remaining two exams will be announced in class.

The Final Exam. The final exam is going to be comprehensive. That means that any material covered in class or assigned as reading can (and probably will) appear. According to the registrar's office, our final exam will take place on **Thursday, December 12th (9:00am-12:00noon)**. You should be rechecking this information as the term progresses.

For more information on the **uniform** UT final-examination policy, please consult

<http://catalog.utexas.edu/general-information/academic-policies-and-procedures/examinations/>

These are the things you *must* to bring to the exams:

- i. a sufficient amount of paper to work on and hand-in your solutions on;
- ii. calculators of any kind.

These are the things you *must not* to bring to the exams:

- i. books, notes, manuals, cheat sheets, anything containing solved problems;
- ii. your own standard IFM Exam or normal distribution tables (you will get a new copy to use during the exam should you need one).

Your scores are non-negotiable.

The grades will not be “curved”!!!!

The Final Grades. Students whose total score in the assessments prior to the end of classes is above 90 will get an automatic A and will not be required to take the final exam. This total score will be calculated giving the following **weights**:

Homework average (after the two lowest scores are dropped): 10%

Quizzes (after the two lowest scores are dropped): 10%

The prerequisite in-term exam: 30%

Other in-term exams (each): 25%

If you miss an in-term exam for **any** reason, you are immediately out of contention for the automatic A based on the in-term average.

If you do not qualify for an automatic A, your scores will be used to calculate your final score in the course on the 100 point scale. These are the **weights** assigned to the assessment components:

Homework average (after the two lowest scores are dropped): 10%

Quizzes (after the two lowest scores are dropped): 10%

The prerequisite in-term exam: 20%

Other in-term exams (each): 15%

The final exam: 30%

In the end, let me caution you that there will be **no make-up in-term exams**. If you provide me with a written proof that your absence was legitimate (e.g., a note from your doctor or your lawyer), you can expect your mid-term score to be dropped and your final exam will then be given the extra weight of the missed in-term exam. Again, if you miss an in-term exam for whichever reason, you are immediately out of contention for the automatic A based on the in-term average.

Graduate students. Students who are taking this as a graduate course will be having extra special homework assignments. They should contact the instructor about the exact content of those assignments.

Final grades. The final letter grades will be assigned relative to your numerical score obtained from the above scheme in the following way

<i>A</i>	: 90 – 100
<i>B</i>	: 80 – 90
<i>C</i>	: 65 – 80
<i>D</i>	: 55 – 65

- **A few bits of friendly advice**

- ◇ *Please, come prepared to every class meeting* – review your notes, pay attention to the current material, and bring the necessary supplies (most importantly – the calculator of your choosing). **Meaningful** class participation will earn you extra credit **at the sole discretion of your instructor.**
- ◇ *Discuss the course with your colleagues* - In order to be able to participate in class, you first need to build up a vocabulary - and there will be a lot of new vocabulary in the beginning. Who better to practice the new concepts with than your classmates who are in the same situation? I suggest that you try to work on homework assignments in pairs and small groups. Of course, you will be required to write up your own final version (and I urge you to do so - that is the only way you will be able to tell what your individual knowledge is, as opposed to the collective knowledge of your study-group).
- ◇ *Don't try to cheat* - This is an unpleasant topic, but unfortunately a necessary one! One is often tempted to stretch the boundaries of mere discussion/collaboration with a fellow student into the territory of pure and simple cheating. In short, everything that you present as your own work (especially the work that is supposed to be graded!) should, in fact, be your own work, and not something copied from an external source. In case that a student is caught in violation of the principles of academic honesty enforced at this university, he/she is immediately reported to the higher authorities and assigned a failing grade in this course. You are expected to have read and understood the current issue of General Information Catalog, published by the Registrar's Office, for information about procedures and about what constitutes scholastic dishonesty. Please visit http://deanofstudents.utexas.edu/sjs/acint_student.php.
- ◇ *Have realistic impressions of your performance* - The grading scheme for this course is described above and I do not intend to stray from it. You are solely responsible for keeping a tally of your scores throughout the semester and entering your results in the grading formula above to avoid any surprises at the end of the semester. Do not just rely on *Canvas* - build your own spreadsheet!!!
- ◇ *On email and office hours* - Email should be used for brief messages about the organization of and current goings on in the course. As a rule, you should first consult the first-day handout to see if your question is answered here. If there is still any ambiguity, contact the instructor. Your instructor is handling a great number of email messages. You should not expect to have your particular email answered in less than 48 hours. You should not be asking mathematical questions via email, since they are incredibly

difficult to answer through a typed message. To get an answer to this type of questions, you should come to office hours and ask in person. When coming to office hours, you should be able to present the mathematical question you have, the route(s) you took in attempting to solve the problem and the obstacles you encountered.

- *UT mandated notes*

“Counselling and Mental Health Center Student Services Bldg (SSB), 5th Floor Hours:
M–F 8am–5pm
Phone: 512 471 3515
<http://www.cmhc.utexas.edu>”

“The University of 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, 471-6441 TTY or <http://diversity.utexas.edu/disability/>”

“Religious holy days sometimes conflict with class and examination schedules. Sections 51.911 and 51.925 of the Texas Education Code relate to absences by students and instructors for observance of religious holy days.

Section 51.911 states that a student who misses an examination, work assignment, or other project due to the observance of a religious holy day must be given an opportunity to complete the work missed within a reasonable time after the absence, provided that he or she has properly notified each instructor.

It is the policy of The University of Texas at Austin that the student must notify each instructor at least fourteen days prior to the classes scheduled on dates he or she will be absent to observe a religious holy day. For religious holidays that fall within the first two weeks of the semester, the notice should be given on the first day of the semester. The student may not be penalized for these excused absences but the instructor may appropriately respond if the student fails to complete satisfactorily the missed assignment or examination within a reasonable time after the excused absence.”

“This course carries the Quantitative Reasoning flag. Quantitative Reasoning courses are designed to equip you with skills that are necessary for understanding the types of quantitative arguments you will regularly encounter in your adult and professional life. You should therefore expect a substantial portion of your grade to come from your use of quantitative skills to analyze real-world problems.”

“ Recommendations regarding emergency evacuation from the Office of Campus Safety and Security, 512-471-5767, <http://www.utexas.edu/safety/>:

- Occupants of buildings on The University of Texas at Austin campus are required to evacuate buildings when a fire alarm is activated. Alarm activation or announcement requires exiting and assembling outside.
- Familiarize yourself with all exit doors of each classroom and building you may occupy. Remember that the nearest exit door may not be the one you used when entering the building.

- Link to information regarding emergency evacuation routes and emergency procedures can be found at: <http://www.utexas.edu/emergency/>
- Students requiring assistance in evacuation shall inform their instructor in writing during the first week of class.
- In the event of an evacuation, follow the instruction of faculty or class instructors.
- Do not re-enter a building unless given instructions by the following: Austin Fire Department, The University of Texas at Austin Police Department, or Fire Prevention Services office.
- Behavior Concerns Advice Line (BCAL): 512-232-5050”

“All students are welcome to take advantage of the Sanger Center’s classes and workshops, private learning specialist appointments, peer academic coaching, and tutoring for more than 70 courses in 15 different subject areas. For more information, please visit <http://www.utexas.edu/ugs/slc> or call 512-471-3614 (JES A332).”

This syllabus is subject to modification. Any changes will be announced in class.

A TENTATIVE schedule.

#	Wday	Date	Material to be covered
1	W	Aug 28	Orientation. Role of financial markets.
2	F	Aug 30	Standing assumptions. Conventions.
3	W	Sept 4	Financial portfolios.
4	F	Sept 6	Outright Purchase. Discrete-dividend-paying stocks. Foreign currencies.
5	M	Sept 9	The prerequisite in-term exam.
6	W	Sept 11	Continuous dividends. Market indices. Initial cost. Payoff. Profit.
7	F	Sept 13	Payoff and profit curves.
8	M	Sept 16	Short-sales. Long/short position.
9	W	Sept 18	Fully-leveraged purchase. Basic risk management. Forward contracts.
10	F	Sept 20	Hedging using forward contracts.
11	M	Sept 23	European call options.
12	W	Sept 25	Hedging using a call option. Covered option writing.
13	F	Sept 27	European put options. Floors. Covered puts.
14	M	Sept 30	Moneyness. Collars. Hedging with collars.
15	W	Oct 2	Derivative securities. American and Bermudan options. Dynamic portfolios.
16	F	Oct 4	Arbitrage portfolios. Law of the unique price.
17	M	Oct 7	Forward and prepaid forward pricing (stocks).
18	W	Oct 9	Futures.
19	F	Oct 11	Put-call parity.
20	M	Oct 14	In-term exam I.
21	W	Oct 16	Chooser options.
22	F	Oct 18	Gap calls. Gap puts. Gap-option parity.
23	M	Oct 21	Options on currencies.
24	W	Oct 23	Exchange options. Maximum options. Generalized put-call parity.
25	F	Oct 25	Option price bounds and monotonicity. Bull spreads.
26	M	Oct 28	Option price "slope" bounds. Bear Spreads. Box spreads.
27	W	Oct 30	Option price convexity. Butterfly Spreads.
28	F	Nov 1	Straddles. Strangles.
29	M	Nov 4	Collars. Ratio Spreads.
30	W	Nov 6	No-arbitrage revisited. Binomial asset-pricing.
31	F	Nov 8	Pricing by replication. Risk-neutral probability.
32	M	Nov 11	Arbitrage in binomial pricing.
33	W	Nov 13	The forward tree.
34	F	Nov 15	In-term exam II.
35	M	Nov 18	Two-period binomial pricing.
36	W	Nov 20	Multiple binomial periods.
37	F	Nov 22	Early exercise (revisited).
38	M	Nov 25	Pricing American options.
39	M	Dec 2	Properties of American-option prices.
40	W	Dec 4	Asian options and their binomial pricing.
41	F	Dec 6	Barrier options.
42	M	Dec 9	Compound options.

I have read and understood
the First-Day Handout
for M339D/M389D(unique number: 52930/53255).

Signature

Legibly written: first name, last name, uteid

Date