

Mathematical Models in Finance

ACTSC/STAT 446/846, Winter 2013

Instructor: Ruodu Wang, M3 3122, ext.31569, wang@uwaterloo.ca
Lectures: 2:30-3:50 Tuesdays and Thursdays, AL 113.
Tutorials: Only used for making up classes or midterm.
Office hours: Tuesdays and Thursdays 4:00-5:00 or by appointment.
You are welcome to knock at my office at any time,
and if I am **not busy** I will be happy to answer your questions.
Please approach the TAs for questions before coming to me.

Reference

The primary reference will be the lecture notes given in class, which will be based on selected topics from the following texts:

- (i) Robert L. McDonald: “Derivatives Markets”, 3rd ed., Addison Wesley, 2013. (Required textbook).
- (ii) H.H. Panjer, Ed.: “Financial Economics with Applications to Investment, Insurance and Pensions”; The Actuarial Foundation, 1998.

Teaching Assistants

Five TAs will help with this course. Three of them will hold office hours.

- Dezhao Han, 2:30–3:30 Wednesdays in M3 3108. d7han@uwaterloo.ca
- Wuyang Zhang, 11:30–12:30 Thursdays in M3 3106. w12zhang@uwaterloo.ca
- Yuchen Mei, 4:00–5:00 Fridays in M3 3111. y2mei@uwaterloo.ca

This is a very large class. Please approach the TAs for questions before coming to me.

Homework

There will be three assignments. Assignments should be handed in to the instructor by the end of the class on the due day. Late assignments are not acceptable.

Midterm

One midterm is scheduled at the lecture time (tentatively) on Thursday, Feb 28.

Course Evaluation Breakdown

- (1) Assignments 10%;
- (2) Midterm 25%;
- (3) Final Examination 65%.

Course Topics and Tentative Schedule

	Time	Topics	Source
Part I	Week 1-2	<i>Options and other derivative securities:</i> overview of the key ideas, examples of applications	Chapters 2-5 and 7-9 from the textbook
Part II	Week 3-6	<i>Discrete-time models:</i> no-arbitrage pricing theory, self-financing trading strategies, the fundamental theory of asset pricing, complete and incomplete markets, pricing options in multi-period models, American and exotic options,	Lecture notes Chapters 5-6 from Panjer et al.
Part III	Week 6-8	<i>Mathematics for continuous-time models:</i> introduction to Brownian motion, stochastic integral, local properties of diffusion processes, Ito's Lemma.	Lecture notes
	Week 9-10	<i>Continuous-time models:</i> Black-Scholes model, Vanilla options, dynamic hedging, exotic options, computational issues.	Chapters 12-14 and 23 (Chapter 22 for the 2nd ed.) from the textbook
	Week 11-12	<i>Interest-rate models:</i> short-rate models (Vasicek, Hull and White) bonds prices, interest rate exotics	Lecture notes Chapter 25 from the textbook (Chapter 24 for 2nd ed.)

Notes

Course webpage: All the course materials will be posted on the D2L course webpage
<https://learn.uwaterloo.ca/>.

Attendance to classes is strongly recommended. If you missed, it is your own responsibility to get known of all the mathematical knowledge and announcements made in classes. Unless you have legitimate excuse for your absence, it will be impossible to get a copy, from the instructor afterwards,

of those course materials you missed.

Collaboration. You may discuss assignments, but you should write up solutions separately, without access to any other students' solutions, unless the assignment is specifically set as a group assignment. Rules for group assignments will be explained when they are assigned.

Requests for re-grading an exam must be made within one week after the grades have been posted on course webpage. To have your assignment/exam considered for re-grading, the assignment/exam must be written in ink. Note that the instructor reserves the right to re-grade the entire exam and raise or lower the grades originally assigned.

Missed an exam. If you missed the midterm or the final exam without a legitimate excuse, you get zero grade. If you know that you are going to be absent, you should ask the instructor in advance for the permission. Examples of an excused absence include participation in the University sponsored activities (e.g. varsity sport, debate team), observance of officially designated religious holidays, serious personal problems (illness, etc) and matters relating to students' academic training (e.g. graduate or professional school interviews). Conflicts arising from personal travel plans or social obligations do not qualify as excused absences.

Illness. If an illness prevents you from completing an examination, the University's rules stated in the Accommodation for Illness Policy will apply; see the following link

http://www.registrar.uwaterloo.ca/students/accom_illness.html.

It is your responsibility to familiarize yourself with this policy. To be excused for your absence due to illness, the student need to present a "Verification of Illness Form" filled out and signed by a physician (automatically done if you go to the campus clinic) to your instructor within 3 working days of the exam. You also need to send an email to the instructor within 24 hours of the exam to let us know that you were unable to write the exam. You should be aware that presenting the Verification of Illness Form within the above deadlines does not guarantee that you will be excused from the exam.

No make-up exams. If you missed the midterm and your absence is well excused, the weight of the midterm will be shifted to the final exam. There are no make-up midterm. If you miss the final exam and present satisfying evidence as above, a make-up exam will be given to you. You will receive a 24-hour notice by email (using the email address that you used to let us know about your absence from the exam) giving you the time and location of the make-up final exam. The make-up final exam will be scheduled at a time that does not conflict with your other exams. An INC grade is only given in very exceptional circumstances, when a student is unable to write exams in the remaining exam

period (and has documented evidence of that), had maintained an average of at least 70% in the course, and had missed no midterm.

UW Academic Policies

Persons with Disabilities: The Office for Persons with Disabilities (OPD), located in Needles Hall, Room 1132 collaborates with all academic departments to arrange appropriate accommodations for students with disabilities without compromising the academic integrity of the curriculum. If you require academic accommodations to lessen the impact of your disability, please register with OPD at the start of each academic term.

Academic Integrity: In order to maintain a culture of academic integrity, members of the University of Waterloo community are expected to promote honesty, trust, fairness, respect and responsibility.

Grievance: A student who believes that a decision affecting some aspect of his/her university life has been unfair or unreasonable may have grounds for initiating a grievance. Read Policy 70 - Student Petitions and Grievances, Section 4, <http://www.adm.uwaterloo.ca/infosec/Policies/policy70.htm>.

Discipline: A student is expected to know what constitutes academic integrity, to avoid committing academic offenses, and to take responsibility for his/her actions. A student who is unsure whether an action constitutes an offense, or who needs help in learning how to avoid offenses (e.g., 2 plagiarism, cheating) or about rules for group work/collaboration should seek guidance from the course professor, academic advisor, or the Undergraduate Associate Dean. When misconduct has been found to have occurred, disciplinary penalties will be imposed under Policy 71-Student Discipline. For information on categories of offenses and types of penalties, students should refer to Policy 71-Student Discipline, <http://www.adm.uwaterloo.ca/infosec/Policies/policy71.htm>.

Avoiding Academic Offenses: Most students are unaware of the line between acceptable and unacceptable academic behavior, especially when discussing assignments with classmates and using the work of other students. For information on commonly misunderstood academic offenses and how to avoid them, students should refer to the Faculty of Mathematics Cheating and Student Academic Discipline Policy, <http://www.math.uwaterloo.ca/navigation/Current/cheating-policy.shtml><http://www.math.uwaterloo.ca/navigation/Current/cheating-policy.shtml>.

Appeals: A student may appeal the finding and/or penalty in a decision made under Policy 70 - Student Petitions and Grievances (other than regarding a petition) or Policy 71 - Student Discipline if a ground for an appeal can be established. Read Policy 72 - Student Appeals, <http://www.adm.uwaterloo.ca/infosec/Policies/policy72.htm>.