MA 373: Financial Mathematics
Spring 2024

Lecture: MA 175 on Tues/Thurs 10:30 – 11:45 AM

Office Hours: Tues/Thur 1:30 – 2:30 PM in MA 813 or via WebEx*
Homework Help Sessions: Mon/Wed 4:30 – 6:00 PM in BRNG B222 (led by TA, Nicole Sim)

Contact Information

Instructor	Sally Ray
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Course Description

This 3-credit hour course is a mathematically rigorous treatment of interest theory and will cover the learning objectives for the Society of Actuaries (SOA) Examination FM and the Casualty Actuarial Society (CAS) Examination 2. This course is also an excellent course for business or finance majors who want a deeper understanding of financial mathematics.

Communication

- *Email:* Main method of communication, please check daily
- *Brightspace:* Gradebook
- *Variate:* Homework

Textbooks

- *Required*: none
- *Optional*: Mathematical Interest Theory, First or Second Edition by James Daniel and Leslie Vaaler (ISBN 978-0-88385-754-0). Note: The first edition of Mathematical Interest Theory is exactly the same as the second edition.

  *You may access an electronic copy for free through Purdue Libraries. Link available through the class website or through the "External Links" module in Brightspace.

Calculators

You may only use calculator(s) from the following list as these are the only calculators permitted for use by the Society of Actuaries. Use of any other calculator will not be permitted.

- BA II Plus
- BA II Plus Professional
- Texas Instruments BA–35 (battery or solar–powered)
- TI–30Xa
- TI-30X II (IIS solar or IIB battery)
- TI–30XS MultiView (or XB battery).

*WebEx instructions at the back of the syllabus

You need to purchase a BA II Plus or Plus Professional for this course. Additional calculators above may be used in addition if desired. The student is expected to learn the functionality of the calculator as part of the preparation for class exams and the Exam FM/Exam 2. Some of the calculator functionality will be covered in class. Please bring your calculator(s) to each class.

Class Structure
Evaluation will be based on a combination of the following:

- *Quizzes and Tests*
    - Closed book and closed notes
    - 6 quizzes, with lowest quiz score dropped
    - 3 non-cumulative tests – 2 midterms and final
        - Midterms – 75 minutes during class
        - Final – 2 hours during finals week

- *Homework*
    - Online using Variate
    - Due Tuesdays and Fridays by 11:59 PM
    - One extension permitted – must notify in advance of original due date
    - Lowest three homework scores will be dropped

- *One-on-One Meeting*
    - One required 10-minute meeting
    - It is your responsibility to schedule this meeting. If you schedule and attend this meeting, you will earn 1% toward your final grade.
    - Google doc will be available for sign-up the first week of class.

Classroom Procedures and Attendance
This course follows Purdue's academic regulations regarding attendance, which states that students are expected to be present for every meeting of the classes in which they are enrolled. When conflicts or absences can be anticipated, such as for many University-sponsored activities and religious observations, you should inform me of the situation as far in advance as possible. For unanticipated or emergency absences when advance notification is not possible, contact me as soon as possible by email or phone.

For cases that fall under excused absence regulations, you or your representative should contact or go to the Office of the Dean of Students (ODOS) website to complete appropriate forms for instructor notification. Under academic regulations, excused absences may be granted by ODOS for cases of grief/bereavement, military service, jury duty, parenting leave, or emergent medical care. The processes are detailed, so plan ahead.

Grade Distribution
Final grades will be determined using the following weights.

University Letter Grade	
Quizzes	20%
Homework	7%
One-on-One Meeting	1%
Test 1	24%
Test 2	24%
Final	24%
Total	100%

Grading Scale
Grades will be on a plus/minus scale as follows:

Below 60	60-62.9	63-66.9	67-69.9	70-72.9	73-76.9	77-79.9	80-82.9	83-86.9	87-89.9	90-92.9	93-99.4	Above 99.5
F	D-	D	D+	C-	C	C+	B-	B	B+	A-	A	A+

Academic Integrity
Academic integrity is one of the highest values that Purdue University holds. This course follows the guidelines outlined in Brightspace concerning Academic Integrity.

If you cheat on a quiz, the penalty is a zero on the quiz and you will lose 5% of the total score for the class. The score of zero will not be dropped. If you cheat on a test, you will receive a failing grade in this class.

Students can report issues of academic integrity that they observe, either through the Office of the Dean of Students (purdue.edu/odos), call (765) 494-8778 or email integrity@purdue.edu .

Course Schedule

In order to satisfy the learning objectives and learning outcomes in the SOA syllabus, we will roughly follow the following schedule.

- Time value of money
  - Week 1 – definitions: accumulation function, simple and compound interest, effective rates of interest, and discount rates
  - Week 2 – definitions (cont): nominal rates, force of interest, inflation, reinvestment, interest rate relationships
  - Week 3 – discount factor, writing and solving equations of value , net present value
- Annuities/cash flows with non-contingent payments
  - Week 4 – definitions: annuity immediate, annuity due, perpetuity, annuity payable continuously, annuity payable m-thly
  - Week 5 – definitions (cont): arithmetic increasing/decreasing annuity, geometric annuity
  - Week 6 – solving for missing annuity component by setting up equations of value
  - Week 7 – deferred annuities, non-level annuities
- Loans
  - Week 8 – definitions: outstanding loan balance, principal, interest, term of loan, amortization, final payments (drop and balloon)
  - Week 9 – calculating outstanding loan balances and final payments (drop and balloon)
  - Week 10 – bond amortization, calculating principal and interest in a given payment
- Bonds
  - Week 11 – definitions: bond terminology, selling at a discount/premium
  - Week 12 – non-level patterns of payment, bond amortization, callable bonds
- General cash flows, portfolios, and asset liability management
  - Week 13 – definitions: yield rates, macaulay and modified duration, spot and forward rates
  - Week 14 – calculating duration and convexity
  - Week 15 – defining immunization, exact matching a set of liability cashflows

Quiz and Test Schedule						
Week	Tues	Thurs		Week	Tues	Thurs
1 – 1/8				Spring Break		
2 – 1/15		Q1		10 – 3/18		T2
3 – 1/22				11 – 3/25		
4 – 1/29		Q2		12 – 4/1		Q5
5 – 2/5		T1		13 – 4/8		
6 – 2/12				14 – 4/15		Q6
7 – 2/19		Q3		15 – 4/22		
8 – 2/26				16 – 4/29	Finals Week	
9 – 3/4		Q4		Key: Q=Quiz, T=Test		

Final Exam is Saturday, May 4th from 10:30 AM – 12:30 PM in PHYS 112.

Appendix

Use of External Resources

I am aware that there are many resources available for finding homework solutions. Some of them will give you the correct answer and others will not. Regardless, it is in your best interest to ensure that all of your work is your own since you will need to demonstrate your knowledge on quizzes and tests. Please learn from each other as you study, but make sure you independently master the material as well.

Students with Disabilities

Purdue University strives to make learning experiences accessible to all participants. If you anticipate or experience physical or academic barriers based on disability, you are welcome to let me know so that we can discuss options. You are also encouraged to contact the Disability Resource Center at: drc@purdue.edu or by phone at (765) 494-1247.

If you have been certified by the Disability Resource Center (DRC) as eligible for accommodations, you should contact your instructor to discuss your accommodations as soon as possible. Here are instructions for sending your Course Accessibility Letter to your instructor.

WebEx Instructions

I love to see you in person! However, if you prefer to meet virtually, WebEx instructions:

- Enter purdue.webex.com into your browser and search for my personal room.
- Enter your name and email address in the provided slots.
- Be sure you are using the WebEx App, not WebEx through a web browser.
- If this does not work and you are instead prompted for a Meeting Number, please use 120 451 0432. If a password is required, it is the same as the Meeting Number.
- Please click the green button to "Connect Audio and Video". Do join by video if at all possible – it's much more enjoyable when we can communicate face-to-face! Feel free to give me a call using the number on the first page of the syllabus if you have any issues connecting.

Exam FM/Exam 2 Preparation

Exam FM/Exam 2 is will be offered by the Society of Actuaries and the Casualty Actuarial Society from June 10-21. The registration deadline is May 7th. It will also be offered in August. Register here. Select "CBT" (computer-based testing) unless meet paper and pencil requirements. Notes that for CBT you will receive a pencil and paper to work the test. Exam location is selected after registration.

If you want to pass Exam FM/Exam 2, I strongly recommend that you invest 250 hours of study time for the Exam. The 250 hours would include any time spent for this class, plus additional time working as many problems as possible. A supplemental study manual (Actex or ASM) or subscription to Coaching Actuaries of Infinite Actuary is recommended.

If you plan to take the exam, Purdue will reimburse you if you pass. This is a unique program and a great opportunity to save money. To receive reimbursement, you must complete this application before you take the exam and submit according to the instructions on the form. You must also attend a one evening course here on campus. More details will be sent out later this semester.

Student Not Taking Exam FM/Exam 2

If you are not taking Exam FM/Exam 2, you only need to do the homework for the class. If you master these problems and the material, you should be successful in this course.

Diversity and Inclusion Statement

In our discussions, structured and unstructured, we will explore a variety of challenging issues, which can help us enhance our understanding of different experiences and perspectives. This can be challenging, but in overcoming these challenges we find the greatest rewards. While we will design guidelines as a group, everyone should remember the following points:

- We are all in the process of learning about others and their experiences. Please speak with me, anonymously if needed, if you have concerns about aspects of/experiences in the course.
- Intention and impact are not always aligned, and we should respect the impact something may have on someone even if it was not the speaker's intention.
- We all come to the class with a variety of experiences and a range of expertise, we should respect these in others while critically examining them in ourselves."

This course, as with every course offered at Purdue, plays a part in creating and sustaining a welcoming campus where all students can excel. There are many initiatives in math and statistics departments and supported by the university focused on this goal, and this course is designed to take advantage of those resources. Learning experiences and assignments address diversity and inclusion, not because they are "topics," but because they are necessary to prepare students to be successful in a diverse, global environment.

We strive for equity, providing equal access and opportunity, and working to maximize student potential. This requires both instructor and students to identify and remove barriers that may prevent someone from full access or full participation. You can help by:

- Contacting me, anonymously if needed, if you see a potential barrier for someone or yourself in participating fully in the class. This might be a physical barrier such as access to technology or a personal situation.
- Suggesting ways in which members of our class can support each other. Virtual study groups and discussion boards are examples, but I encourage you to be creative in your ideas.
- Getting to know each other as contributing members of our learning community. Everyone has something to contribute, and while I designed the course to take advantage of the wealth of knowledge, expertise, and experience we bring together, I cannot do it well without your participation. There are many opportunities built into this course for this type of work. It is important we do it together.

Copyright

In general, notes are "considered to be 'derivative works' of the instructor's presentations and materials, and they are thus subject to the instructor's copyright in such presentations and materials." I consider class notes, tests, and quizzes to be derivative works and therefore copyrighted. Class notes, tests, and quizzes may not be sold, bartered, or even given to websites or other resources. Examples of such websites are Course Hero, Chegg, or Quizlet.

Additional Policies and Statements

The following can be found in Brightspace under "University Policies and Statements" or "Student Support and Resources":

- Nondiscrimination Statement
- Emergency Preparedness
- Violent Behavior Policy
- Accessibility and Academic Adjustments
- Mental Health, Wellness, and Basic Needs Security