Math 418A Financial Mathematics I

Instructor: Dr. Yvonne Chueh, ASA, MAA

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Office Hours: 10:00-10:50AM Monday to Friday, please e-mail to make appointment if you can't make it to my office hour.

Description:
Actuarial financial mathematics, including the time value of money, methods of measuring interest and discount, non-contingent annuities and cash flows, and loans and amortization. Course will be offered every year (Fall).

Prerequisites:
Prerequisite: MATH 173 with a grade of C or higher.

Credits: (4)

Learner Outcomes:

Upon successful completion of this course, the student will be able to:

- Compare methods of measuring interest and discount, including effective rates, nominal rates, and variable force of interest.
- Value an investment or series of cash flows using variable force of interest.
- Value annuities-certain as of a given date, including level and variable (arithmetic and geometric) annuities and perpetuities.
- Value the outstanding balance, principal paid, and interest paid for a loan at any point in time, including loans with variable interest rates or non-level payments.
- Choose appropriate interest rates for a given problem and justify that choice.
- Communicate financial mathematics results clearly in writing.

Text: 1. Mathematics of Investment and Credit, 7th Edition, Samuel A. Broverman, Actex Academic Series
2. Course Pack

Course Objectives:

This course is required for Actuarial Science majors. As the first part of three-course sequence, it prepares students to pass SOA/CAS Exam FM. This exam is covered by the course sequence Math 418A,B,C (12 credits). After completing the entire sequence, students will be able to calculate present and future values of annuities determined by

interest rates. They will be able to apply methods of pricing investment products such as bonds and annuities as well as analyze loans and sinking funds. Students will also be able to solve interest-related problems in the actuarial professional. Students will gain understanding of financial derivatives (forwards, options, futures, swaps) and their use in risk management.

In Math 418A**, students will be able to calculate interest, present value, future value, annuity payment, annuity price, and time period required to accumulate the fund to a certain amount, as well as balance, principal and interest repayment in a loan.**

Learning Objectives:

1. Describe how to take into account the time value of money using the concepts of compound interest and discounting.
2. Show how interest rates or discount rates may be expressed in terms of different time periods.
3. Calculate the present value and the accumulated value of any annuity (a stream of equal or unequal payments) using specified rates of interest and the net present value at a real rate of interest, assuming a constant rate of inflation.
4. Define and use the compound interest functions.
5. Analyze compound interest problems.
6. Define Principal, Interest, Term of Loan, Outstanding Balance, Final Payment (drop payment, balloon payment), Amortization, Sinking Fund.
7. Given any four of term of loan, interest rate, payment amount, payment period, principal, calculate the remaining items.
8. Calculate the outstanding balance at any time point during the loan period.
9. Calculate the principal portion and interest portion of a given payment.
10. Evaluate a sinking fund.

Topical Outline:

	Topic from lecture notes handouts	Days
I	Interest Rate Measurement	
	1. The accumulation and amount functions	
	2. The effective rate of interest	
	3. Simple interest	
	4. Compound interest	
	5. Present value	
	6. The effective rate of discount	
	7. Nominal rates of interest and discount	
	8. Forces of interest and discount	
	9. Varying interest	11

II	Valuation of Annuities	
	1. Annuity-immediate	
	2. Annuity-due	
	3. Annuity values on any date	
	4. Perpetuities	
	5. Unknown rate of interest	
	6. Varying interest	10
III	Loan Repayment	
	1. Loan balance	
	2. Amortization	
	3. Sinking fund	6
	TESTING	3
	TOTAL	30

Class format

Lecture followed by in-class problem solving. For longer lectures on advanced topics, students are expected to spend extra time on their own to solve related problems. In-class problem-solving time is very limited and based on students learning. Instructor and students present their solutions of the assigned problems and answer questions raised by the instructor and the class. Class pace may be affected by student in-class participation, preliminary reading, and constant review. This is a very fast-paced class so be sure that you follow our schedule consistently.

Attendance

To achieve success in *any* mathematics class, **regular attendance is imperative**. Unlike most subjects, new topics in Financial Mathematics build on previous knowledge; failure to learn something early may haunt you throughout the course. We will do work in class occasionally, so if you missed a class you missed in-class credit.

IF YOU MISS CLASS, IT IS YOUR RESPONSIBILITY TO FIND OUT THE MATERIAL COVERED, MEMORABLE, OR ASSIGNED, AND TO ARRANGE TO PICK UP ANY ASSIGNMENTS THAT MAY BE HANDED OUT OR RETURNED!

Homework

Homework will be assigned in class and the due date will be every Friday. Working on homework is the only way most of us learn to critically analyze and "solve" problems.

Some class time will be devoted to questions on the homework. Office hours are also scheduled to provide opportunities for more in-depth discussion and solving of homework problems.

Grading policy

- Assignments and in-class problem solving (100 points; 10-15 points a week)
- Three Learning Experiences (300 points)
- Final Exam (100 points)

Total 500 points

A perfect score on both of the above categories would result in a total of 500 points. Your course grade will be determined by the percentage p of these points you earn, according the following scale.

$90 \le p$	A	$65 \le p < 77.5$	C
$89 \le p < 90$	A-	$64 \le p < 65$	C-
$87.5 \le p < 89$	B+	$62.5 \le p < 64$	D+
$80 \le p < 87.5$	B	$50 \le p < 62.5$	D
$79 \le p < 80$	B-	$p < 50$	F
$77.5 \le p < 79$	C+		

Weekly Schedule (Any change of Learning Experience schedule will be announced in class.)

Week	**Reading Assignment**
0. 9/25-9/27	1.1-1.2
1. 9/30-10/4	1.3-1.5
2. 10/7-10/11	1.6-1.7
3. 10/14-10/18	Review **Learning Experience I**.
4. 10/21-10/25	2.1
5. 10/28-11/1	2.2-2.3

6. 11/4-11/8	2.4
7. 11/11-11/15	Review **Learning Experience II.**
8. 11/18-11/22	3.1-3.2
9. 11/25- 11/29	3.3 *THANKSGIVING!!*
10. 12/2-12/6	Review **Learning Experience III .**
11. 12/9-12/13	**Final Exam**

Academic Integrity

Actuarial professionals in general, and Credential Actuaries in particular, have reputations for working hard, being objective, and having integrity.

The grading policy for all actuarial courses is based on strict compliance with WAC 106-120---STUDENT JUDICIAL CODE, especially Part II, Sub-part B, regarding ACADEMIC DISHONESTY. A student who violates this Code WILL RECEIVE A GRADE OF F IN THIS CLASS, and will be subject to further disciplinary action in accordance with University Policy (WAC 106-72-005).

Expectations for Student Conduct

Students in this class are expected to interact with students and the professor professionally. Instances of disruptive conduct, obstructive conduct, or harassment will be referred to the Dean of Student Success.

Per WAC 106-125-020, the term ``disruptive" or ``obstructive" conduct means conduct, not protected by law, that interferes with, impedes, or otherwise unreasonably hinders the normal teaching, learning, research, administrative, or other functions, procedures, services, programs, or activities of the university. The term includes disorderly conduct, breach of the peace, violation of local or university noise policies, lewd or obscene conduct, obstruction of pedestrian or vehicular traffic, tampering with student election processes, or interfering with the orderly conduct of university investigations or disciplinary proceedings, including interfering with or retaliating against any witness, party, or other participant.

The term ``harassment" means unwelcome and offensive conduct, including verbal, nonverbal, or physical conduct, that is directed at a person because of such person's protected status and that is sufficiently serious as to deny or limit the ability of a student to participate in or benefit from the university's educational program, or that creates an intimidating, hostile, or offensive environment for any campus community member(s).

Protected status includes a person's actual or perceived race, color, national origin, gender, disability, or other status protected by law.

CWU expects every member of the university community to contribute to an inclusive and respectful culture for all in its classrooms, work environments, and at campus events. As a student in this course, you are expected to treat your professors, fellow students, and other people affiliated with your work at CWU with respect, regardless of their sex, race and color, religion and creed, national origin, sexual orientation, gender identify and gender expression, disability and use of assistive devices or a service animal, and veteran or military status.