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Syllabus for B BUS 459: RISK MODELING
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1. Course Description

The course is an introduction to probability theory and basic risk modelling. Its goal is to help students understand the theoretical foundations of modern financial economics and risk management. The main theme is the allocation and pricing of risk. We analyze what motivates economic agents to trade, how they can manage their risky endowments and how financial assets are used for investment decisions, to hedge risk. We also analyze how insurance premiums, as well as stocks, bonds, and option prices are determined. The emphasis will be on theoretical issues rather than the institutional details of insurance markets and securities trading, but we will also apply the ideas to some real-world examples and relate the material to current financial news and problems relevant to the practitioner. The goal is to provide you with a solid understanding of the basic principles of choice under uncertainty, as well as the analytical and quantitative tools necessary to be successful in the modern financial world.

The first part of the course is an introduction to basic probability theory, covering univariate random variables, expectations, moments, covariance, conditional probabilities and Bayes rule.

The second part of the course introduces students to the theory of choice under uncertainty by presenting the expected utility theory and its applications to optimal portfolio selection, risk management and insurance, as well as arbitrage pricing.

Finally, the third part of the course illustrates how the arbitrage pricing theory and the time value of money can be used to price stocks and other derivative securities. We will talk here, briefly, about interest rate models, pricing bonds, annuities and basic derivative securities (futures and forwards, options).

Learning Objectives

By the end of the course, the students will be able to:

- Compute probability distribution functions and cumulative distribution functions for a variety of discrete and continuum random variables.
- Use the concepts of expected value, variance and covariance to evaluate the risk of various financial instruments and insurance contracts.
- Determine the equilibrium allocation of risk across economic agents and their portfolio holdings, given prices and preferences.
- Use the principle of no arbitrage to determine equilibrium prices of financial assets and insurance liabilities.
- Asses the risk and determine the price various financial derivatives.

2. Prerequisites

B BECN 300: Quantitative Methods in Economics.

Knowledge of calculus and linear algebra, as well as familiarity with Excel is required.

3. Course Materials

The course will be based mostly on my lecture notes and the following
Textbook: Eeckhoudt, Gollier, and Schlesinger: "*Economic and Financial Decisions under Risk*"

Other useful texts:

- Simon French: *Decision Theory: An introduction to the mathematics of rationality.*
- Wayne and Winston: *Introduction to Probability Models: Operations Research, vol. II.*
- Bodie, Z., A. Kane and A. Marcus, *Investments*.

Calculator: You will need a simple calculator that handles exponents and logarithms.

Course website: https://canvas.uw.edu

A copy of the syllabus will be available online. Material from lectures, as well as important announcements will also be posted on the website; it is your responsibility

to visit it frequently. The homework assignments will be available for downloading on the class homepage. The homepage also provides links to some useful web sites related to Economics.

4. Homework Assignments

There will be six homework assignments, which will be posted on the class webpage. Their due dates will be clearly specified. Solutions will be posted on the due date. No late assignments are accepted. If you miss one homework, the average of the other homework sets will be applied towards the missed homework.

Homework will consist of problems and data exercises. In order to receive credit on homework questions all intermediate steps must be shown (if you provide a correct answer without explaining how you derived it, you will get only a low partial credit). Excel will be needed to solve some of the problems.

You can work with some of your classmates to derive solutions to homework assignments, as long as each of you has a fair contribution. If you choose to form a study group with some of your classmates, you still have to write and submit the homework individually, and acknowledge the help you received. You should also be able to reproduce (with ease and without any help) the solution you submitted. Keep in mind that homework assignments are the best preparation for the exams. A superficial approach to homework will most certainly be reflected in low exam scores.

5. Exams

There will a midterm and a final exam. Both exams are closed-book, but you can bring one regular size (i.e., 8x11in) sheet of notes (one side for the midterm, two sides for the final).

The midterm is scheduled for April 25th during regular class hours. Individual requests to modify the date of the exam will not be accepted. In exceptional cases (such as a medical emergency), if the midterm must be missed for a documented excuse, the student can reschedule the exam. If proper documentation is not provided, the student will get a score of 0 for the missed midterm.

The final exam will be a two-hour written exam consisting mostly of exercises directly related to the material covered in class and similar to those solved in the homework assignments. It will be comprehensive and account for 40% of your final numerical score.

You need to bring a simple calculator that handles exponents and logarithms for all the exams.

6. Grading

The final numerical score will be the weighted average of the scores obtained on the homework assignments, the two partial exams and the final exam. The weights are defined as follows:

- 25% for homework assignments,
- 35% for the midterm,
- 40% for the final exam.

Class participation is strongly encouraged. Students who enhance the quality of the class discussion can also receive up to 3% bonus points towards the final grade.

7. Course Access and Accommodations

Access and Accommodations: Your experience in this class is important to us, and it is the policy and practice of the University of Washington to create inclusive and accessible learning environments consistent with federal and state law. If you experience barriers based on disability, please seek a meeting with DRS to discuss and address them. If you have already established accommodations with DRS, please communicate your approved accommodations to your instructor at your earliest convenience so we can discuss your needs in this course.

Disability Resources for Students (DRS) offers resources and coordinates reasonable accommodations for students with disabilities. Reasonable accommodations are established through an interactive process between you, your instructor and DRS. If you have not yet established services through DRS, but have a temporary or permanent disability that requires accommodations (this can include but not limited to; mental health, attention-related, learning, vision, hearing, physical or health impacts), you are welcome to contact DRS at (425) 352 5307 or rlundborg@uwb.edu. You will need to provide documentation of your disability as part of the review process.

8. Academic Integrity

Plagiarism, cheating or any kind of fraud will not be tolerated. Students are expected to read, know, and strictly uphold the academic integrity standards specified in the Student Conduct Code for the University of Washington (WAC 478-120-010-145). You are strongly encouraged to read the campus academic integrity policy.

University of Washington Bothell students are expected to maintain the highest standards of academic integrity and behavioral conduct. Students, faculty, and staff are asked to ***report*** whenever misconduct is observed or suspected. When in doubt regarding a possible infringement of the code, ask for guidance before acting.

Tentative Course Schedule

Week	Topics
1	Probability spaces, conditional probabilities and Bayes rule.
2	Univariate random variables, expectation, variance, covariance, moments. Density and cumulative distribution functions.
3	Choice under uncertainty. Expected utility theory, risk aversion and certainty equivalents.
4	Applications to insurance decisions and valuation of insurance liabilities.
5	Application to static portfolio choice. Markowitz portfolio selection theory.
6	CAPM: derivation and empirical testing.
7	Complete versus incomplete financial markets and arbitrage pricing.
8	Interest rates. Bond pricing. Forward rates. Discounted cash flow model and Gordon growth model..
9	Introduction to derivatives. Pricing futures and forwards.
10	Put and call options. Put-call parity formula. Using the binomial tree to price options: portfolio replication versus risk-neutral valuation.