

ECES 490, ECES 690: Special Topics: Financial Engineering I (Fall, 2008)  
Instructor: Steven Weber

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**Course sequence overview.** The Financial Engineering course sequence covers selected topics from finance from an engineering perspective. The goals of the course sequence are:

- Prepare students to be competitive applicants for jobs in the financial sector.
- Help students apply their math and programming skills to an area outside of electrical engineering.
- Give students the skills to make more informed decisions in their personal investments.

The course sequence will consist of three courses, roughly divided as follows:

- Fin. Eng. I (Fall, 2008): Time-value of money, portfolio management, Capital Asset Pricing Model
- Fin. Eng. II (Winter, 2009): Derivative securities, option pricing, betting strategies, auctions,
- Fin. Eng. III (Spring, 2009): Financial time-series analysis, heavy-tailed disbns, parameter estimation

Each of the courses may be taken individually, i.e., I is not a prerequisite for II, nor is II a prerequisite for III. Each course will consist of lectures twice a week (Tuesdays and Thursdays), midterm and final exams, and homework assignments due every two weeks (roughly five per term). The homework assignments will involve programming (in Java), and will focus on coding up the concepts discussed in class.

**Course description.** Financial Engineering I will cover the following topics:

- Time-value of money: why having a dollar today is worth more than having a dollar tomorrow.
- Probability review: one reason why all the stuff you learned in ENGR 361 is actually useful.
- Portfolio management: how to understand diversification, and the optimal tradeoff of risk and reward.
- The Capital Asset Pricing Model (CAPM): how to optimally balance between risky and risk-free investments.

Along the way we will also cover the basics of optimization (Lagrange multipliers) and information theory (entropy), and apply these topics to finance, specifically to portfolio management.

**Prerequisites.** Students must have taken ENGR-361: Probability and Statistics for Engineers and ECE-203: Programming for Engineers, earning a grade of C or better in each. We will *briefly* review probability as needed. Homework assignments will be done in Java. We will also *briefly* review Java programming as needed.

**Class locations and times.** Lectures will be held Tuesdays and Thursdays from 12:30-1:50pm.

Room: Randel 121

**Textbook.** Mathematics for Finance: An Introduction to Financial Engineering  
Marek Capinski and Tomasz Zastawniak, Springer Undergraduate Mathematics Series, 2003

**Class logistics.**

- *Homework.* There will be five homework assignments, each due two weeks after being assigned. Each homework assignment will involve programming concepts from class in Java. The purpose of the assignments is to help cement understanding of the lecture material and highlight practical issues in algorithm implementation.

- *Exams.* There will be a midterm and final exam. Exams will cover lecture concepts and will emphasize problem, and will be similar to problems asked on the homework assignments. The midterm exam will cover the first half of the course and the final exam will cover the second half of the course (not cumulative).
- *Vista.* I will send email to the class through Vista. I will also use Vista to post lecture notes and homework assignments and post your grades.

**Grading.** Your final course score will be computed as follows:

$$\begin{array}{rcl} \text{Homework} & 40\% & \\ \text{Midterm Exam} & 30\% & \\ \text{Final Exam} & 30\% & \end{array} \quad (1)$$

Your final letter grade will be computed from your final courses score as follows:

95	100	A
90	94	A-
87	89	B+
83	86	B
80	82	B-
77	79	C+
73	76	C
70	72	C-
65	69	D+
60	64	D
0	59	F

(2)

### Class calendar.

				<b>Lecture</b>	<b>Homework</b>
1T	Tuesday	September	23	course overview	homework 1 assigned
1R	Thursday	September	25	<b>no class</b>	
2T	Tuesday	September	30	time-value of money	
2R	Thursday	October	2	time-value of money	
3T	Tuesday	October	7	probability review	homework 2 assigned
3R	Thursday	October	9	probability review	homework 1 due
4T	Tuesday	October	14	optimization review	
4R	Thursday	October	16	optimization review	
5T	Tuesday	October	21	portfolio management	homework 3 assigned
5R	Thursday	October	23	portfolio management	homework 2 due
6T	Tuesday	October	28	review for midterm exam (by TA)	
6R	Thursday	October	30	<b>midterm exam</b>	
7T	Tuesday	November	4	capital asset pricing model	homework 4 assigned
7R	Thursday	November	6	capital asset pricing model	homework 3 due
8T	Tuesday	November	11	capital asset pricing model	
8R	Thursday	November	13	guest lecture (TBA)	
9T	Tuesday	November	18	information theory review	homework 5 assigned
9R	Thursday	November	20	information theory review	homework 4 due
10T	Tuesday	November	25	information theory and the stock market	
10R	Thursday	November	27	<b>no class</b> (Thanksgiving Holiday)	
11T	Tuesday	December	2	review for final exam (by TA)	
11R	Thursday	December	4	preview of next term	homework 5 due