**OR688/SYST688: Financial Engineering -
Introduction to Derivatives and Risk Management**

Fall 2012

George Mason University
Department of Systems Engineering and Operations Research

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Course Description: This course introduces derivatives and risk management in financial engineering. Financial engineering is a cross-disciplinary field which relies on mathematical finance, numerical methods, and computer simulations to make trading, hedging, and investment decisions, as well as facilitating the risk management of those decisions. This course will introduce basic concepts of options, futures, and financial derivatives markets. It will also cover a broad range of derivatives products and discuss how risks are managed in financial institutions. While mathematics is indispensable in financial engineering, this course will try best to focus on the concepts and ideas of finance, while limiting the math within a scope acceptable to most students in engineering.

Prerequisites: Graduate standing (Undergraduate engineering math: Calculus, probability theory, and some basic computer programming skills. Some background in financial markets would also be helpful, but not necessary.)

Textbooks:

Required:
  1. John. C. Hull, "*Options, Futures, and Other Derivatives*," 8th edition, Prentice-Hall, 2011.

Recommended References:
  2. Salih N. Neftci, "*Principles of Financial Engineering*," Academic Press, 2004.
  3. Mark S. Joshi, "*The concepts and practice of mathematical finance*," Cambridge University Press, 2004.
  4. David G. Luenberger, "*Investment Science*," Oxford University Press, 1997.
  5. Martin Baxter and Andrew Rennie: "*Financial Calculus: An Introduction to Derivative Pricing*," Cambridge University Press, 1996.

Optional Readings:
6. Emaneul Derman, "*My Life as a Quant: Reflections on Physics and Finance,*" Wiley, 2004.
7. William Poundstone, "*Fortune's Formula,*" Hill and Wang, 2006.
8. Burton G. Malkiel, "*A Random Walk Down Wall Street: The Time-Tested Strategy for Successful Investing,*" Norton, 2011.
9. Michael Lewis, "*The Big Short,*" Norton, 2010.
10. Nassim Taleb, "The Black Swan: The Impact of the Highly Improbable," Random House, 2010.

Assignments and Exams:

There will be five hand-in assignments during the semester, a mini term project, as well as a mid-term exam and a final exam, both in-class. The exams will not be open book. However, you will be permitted a two-sided "cheat sheet" with notes and/or formulae.

Grading:

The assignments, mini project, and exams constitute 25%, 20%, 25% and 30% of the grades respectively.

Schedule:

Unit #1:   Introduction; Chapters 1-2
Unit #2:   Futures and Hedging Strategies; Chapters 3-5
Unit #3:   Securitization and the Credit Crisis; Chapter 8
Unit #4:   Properties of Options; Chapters 10, 12
Unit #5:   Review of standard products and models; Chapters 14,16,17,19
Unit #6:   Binomial Trees and Monte Carlo Simulation; Chapters 12, 20
Unit #7:   Mid-term exam
Unit #8:   Value at Risk; Chapter 21
Unit #9:   Estimating volatilities and correlations; Chapter 22
Unit #10:   Credit risk; Chapter 23
Unit #11:   Credit derivatives; Chapter 24
Unit #12:   Bond derivatives; Sections 26.4, 28.1
Unit #13:   Energy and commodity derivatives; Chapter 33
Unit #14:   Real options; risk and return; Chapter 34
Unit #15:   Review of Course; Term project presentation
Unit #16:   Final exam