Jan 16, 2001:
I will have finished lecturing on section 1 by the end of this week. Remember that classes are cancelled January 23 and 25.

The course will give a short introduction to mathematical finance (1-4), cover some of the econometric methods used in empirical finance (5-7), and look at some applications of empirical finance (8).

1. **Introduction to Interest Rate Modeling**
   J&W Chapter 3
   We look at some of the basic concepts like Financial Instruments, Yield Curve, Interest Rate Processes, and give an introduction to Interest Rate Models.
   
   - We will be working in continuous time, but in order to better understand the concepts we first look at the definitions in discrete time: gross returns, log returns, present value, zero coupon bonds, yield to maturity, term structure of interest rates, holding period returns, and forward rates. A possible text is CLM, chapter 10.
   - We then define: the continuously compounded spot rate and forward rate, the instantaneous short rate and forward rate, the money account, and look at the corresponding simple Interest rate Instruments: Libor and FRA
   - In order to understand the dynamics of interest rates we first look at the simplest possible, nontrivial, discrete time model: the binomial model. We define the concepts: arbitrage portfolio, hedging portfolio, contingent claim, complete market, martingale measure, arbitrage free price. A possible text is Bjork, Chapter 2.
   - We define the standard notation used to specify a stochastic process for interest rates: wiener process, diffusion process, drift, volatility, filtration
   - Finally we look at some examples of interest rate models

2. **Overview of the Theory of Interest Rate Models**
   Valuation and pricing of interest rate products, Equivalent Martingale Measures, The extended Vasicek model
   J&W Chapter 4

3. **Basic Modeling Tools**
   Valuation and pricing using hedging and Monte Carlo Simulation, Lattice Methods, Review of some statistical tests, Yield Curve Stripping, Densities, Kernel functions and estimators.
   J&W, Chapters 5,6,12,13
4. **Interest Rate Models**
   We review some of the common used interest arte models, like Affine Models, Market Models, HJM models, and Price Kernel Models.  
   J&W Chapter 7,8,9

5. **Modeling the Yield Curve**
   Fitting the yield curve to current data is an import task. We look at methods like Stripping the Yield Curve, fitting parameterized curves, using splines or kernel methods.  
   J&W Chapter 15

6. **Estimation Methods**
   We look at some of the methods for estimating unknown parameters of interest rate models, GMM, ML, and simulated MM (EMM) and ML.  
   J&W Chapter 17

7. **Modeling Volatility, Factor Models, Filtering approaches to estimation, GARCH models**
   We will look at estimating models with hidden variables – state variables – using either exact or an approximate technique.  
   J&W, chapters 18, 16

8. **Applications**
   We will look at some applications, such as Predictability of Asset Returns, Market Models, Economic/Equilibrium models, Foreign Exchange Market using either articles or chapters from other text books.