Course webpage
https://docs.google.com/document/d/1VgiEzjb6AMoFThTIjSAPLtWwEbrBW_qAhjtStF5t-LQ/edit?usp=sharing

BUS403
예습 및 선행학습 불필요. 쓸데없이 시간 낭비 하지 마세요.
중학교 수준의 수학으로도 충분합니다. 수학보다 직관과 상상력이 중요합니다.
재무에 관한 사전지식 전혀 필요 없습니다.
중요한 사항은 한국어로 복습합니다.
리포트 토픽은 본인이 제안할 수도 있고 교수로부터 받을 수도 있습니다.
학점은 절대평가 입니다.

Only term paper will determine your grade. There won't be any exam at all.
No prior knowledge on finance or mathematics is required.
The class topics can be changed on the request of students.

Textbooks and materials

- https://class.coursera.org/fe1-001/lecture
- https://class.coursera.org/fe2-001/lecture
- Fixed Income Securities: Valuation, Risk, and Risk Management, Pietro Veronesi (University of Chicago, Booth School of Business), January 2010, ©2011 (slides)
- (sub) 자본시장법

Weeks and schedule (very preliminary. will be updated shortly)

1. Class introduction (Martingale 1)

Ou-Yang Hui and Hua He's note (note1, note2)

2. Thanksgiving day
3. Martingale 2

Ou-Yang Hui and Hua He's note (note1, note2)
Cronqvist, H., & Siegel, S. (2014). The genetics of investment biases. Journal of Financial Economics, 113(2), 215-234.

4. Veronesi ch02 (2.1-2.3); Continuous time some basics (link; very good, but many errata)

http://en.wikipedia.org/wiki/Flipped_classroom

Student presentation: Veronesi ch02 (2.1-2.3; pp29-43) 김민령
Bring one page proposal for your term paper by next class
Listen week 1 at https://class.coursera.org/fe1-001/lecture
Ou-Yang Hui and Hua He's note (note1, note2)

5. Sigma algebra, measure, information structure

Ou-Yang Hui and Hua He's note (note1, note2)
Discussion week 1 at https://class.coursera.org/fe1-001/lecture
HW: Listen week 2 at https://class.coursera.org/fe1-001/lecture

6. Veronesi ch02 (2.4-2.5; 조연정); Veronesi ch02 (2.8; 이태훈)

Listen week 2 at https://class.coursera.org/fe1-001/lecture
Ou-Yang Hui and Hua He's note (note1, note2)
HW: Listen week 2 (2.6-2.7) at https://class.coursera.org/fe1-001/lecture

7. Veronesi ch03 (3.2; Felix)

Binomial option pricing model: replicating portfolio
Ou-Yang Hui and Hua He's note (note1, note2)
HW: Listen week 3 (3.1-3.4) at https://class.coursera.org/fe1-001/lecture

8. 0926 Veronesi ch03 (3.3-3.4; Niklas)

Binomial option pricing model: risk neutral valuation
Ou-Yang Hui and Hua He's note (note1, note2)
HW: Listen week 3 (3.5-3.8) at https://class.coursera.org/fe1-001/lecture

9. 1001 Veronesi ch03 (3.7; 유정빈)

Ou-Yang Hui and Hua He's note (note1, note2)
HW: Listen week 4 (4.1-4.3) at https://class.coursera.org/fe1-001/lecture
Mathematical constant; natural logarithm
Multi step binomial tree (wikipedia)
Bring your laptop

10. 1003 National Foundation Day

11. Multi step binomial tree (wikipedia); Binomial Model (option and futures)

HW: Listen week 4 (4.5-4.8) at https://class.coursera.org/fe1-001/lecture
Mathematical constant; natural logarithm

12. 1010 Veronesi ch04 (4.1; 조연정)

Ou-Yang Hui and Hua He's note (note1, note2)
Binomial Model (option and futures): Dividend
Binomial tree example for interest rate derivatives
HW: Listen week 5 (5.1-5.4) at https://class.coursera.org/fe1-001/lecture

13. 1015 Veronesi ch05 (5.1-5.2; 김민령)

Excel VBA

Binomial Model (option and futures): Dividend

Binomial tree example for interest rate derivatives

Inputs

- σ: Volatility
- S: Current stock price
- K: Strike price
- T: Time to maturity (years)
- r: Risk free rate
- q: Dividend rate (per year)

Outputs (Excel Example)

- $c = e^{-rT}[FN(d_1) - KN(d_2)]$: price of European call option
- $p = e^{-rT}[KN(-d_2) - FN(-d_1)]$: price of European put option
- $$d_1 = \frac{\ln(F/K) + (\sigma^2/2)T}{\sigma\sqrt{T}}$$
- $$d_2 = \frac{\ln(F/K) - (\sigma^2/2)T}{\sigma\sqrt{T}} = d_1 - \sigma\sqrt{T},$$
- $F=Se^{(r-q)T}$.

VBA for Black Scholes Model

14. 1017 Veronesi ch05 (5.3-5.4; 이태훈)

Excel VBA Practice for Binomial Model (option and futures)

VBA for binomial tree model

15. 1022 Veronesi ch06 (6.1; Niklas)

Forward Price and Futures Price

Generating random variables: rand(), randbetween(a, b), normsinv(rand()),...

Brownian Motion

Geometric Brownian Motion and Stock Prices

16. 1024 Veronesi ch06 (6.2; Felix)

Arrow Debreu Securities @Binomial Model (option and futures)

17. 1029 Arrow Debreu Securities @Binomial Model (option and futures)

Generating random variables: rand(), randbetween(a, b), normsinv(rand()),...
Brownian Motion
Geometric Brownian Motion and Stock Prices

18. 1031 Veronesi ch08 (8.1-8.2 김민령)

Simulating stock price
Computing VaR: We will conduct a 1-day and 10-day VaR (95%, 99%) analysis using the Monte Carlo simulation method. Let us simply assume that 10-day VaR is simply 10^0.5 times the 1-day VaR.

> Definition 1: Given a confidence level α in (0,1), the Value-at-Risk of a portfolio at α over the time period t is given by the smallest real number k such that the probability of a loss over a time interval t greater than k is α.
>
> Example: Suppose a hypothetical bond portfolio has a "one-day VaR at a confidence level of 5% of $10 million." This means that over a typical one-day period, the bond portfolio will lose $10 million or more only 5% of the time.

19. 1105 Homework day
20. 1107 한양대학교 전체교수회의
21. 1112 Veronesi ch08 (8.3 조연정)

Simulating stocks and derivatives prices in risk neutral world
VBA simulation and option pricing

22. 1114 Example 8.2 (p.298; Niklas)

Pass-through securities

23. 1119 Simulating correlated random variables (Cholesky decomposition with VBA)

24. 1121 Example 8.3 and Effective Duration (p.301) (조연정)

Simulating correlated random variables (Cholesky decomposition with VBA)

```
Sub multiasset()
rf = 0.01 'risk free rate
T = 2 ' time to maturity (year)
v1 = 0.3 'volatility of 1st asset
v2 = 0.2 'volatility of 2nd asset
rho = 0.1 'correlation between two assets
simn = 10 ^ 5 ' # of simulation
```

```
sumv = 0
For i = 1 To simn
    u0 = WorksheetFunction.NormSInv(Rnd)
    u1 = WorksheetFunction.NormSInv(Rnd)
    u2 = rho * u1 + (1 - rho ^ 2) ^ 0.5 * u0
    'u1 and u2 are correlated with rho
    ret1 = (rf - v1 ^ 2 / 2) * T + v1 * T ^ 0.5 * u1
    ret2 = (rf - v2 ^ 2 / 2) * T + v2 * T ^ 0.5 * u2
    gret1 = Exp(ret1) 'gross return from asset 1 by investing in 1 dollar
    gret2 = Exp(ret2)
    optionv = max(gret1, gret2, 0.9)
    sumv = sumv + optionv
Next i
optionv_final = Exp(-rf * T) * (sumv / simn)
Cells(1, 1) = optionv_final
End Sub

Function max(a, b, c)
    If a > b And a > c Then
        max = a
    ElseIf b > a And b > c Then
        max = b
    Else
        max = c
    End If
 End Function
```

Brownian Motion
Geometric Brownian Motion and Stock Prices
Convertible bond

25. 1126 Example 8.4 (김민령)
Check this term paper format (DUE 03 DEC)
Simplico; Real option note

“DUE DATE FOR TERM PAPER” 20141209 09:00 (submit your term paper to

Final Due Date: 20141220 09:00 (submit your term paper to

* Please use APA format for your references. See the following example.
* Kang, H. G., Joo, H. H., & Cho, J. (2014). Brand-size complementarity in the choice of retail stores. *Applied Economics Letters*, *21*(6), 413-416.
* The other part of your paper should follow the guideline below.
* http://aom.org/publications/amj/styleguide/
* If you cite a paper in the body of the text like (Kang, Joo and Cho, 2014), this should be specified in the reference list at the end of the paper.
* If an article is in the reference list, it should be mentioned at least once in the main body.
* Sample and further guideline
* If you do not follow this format guideline correctly, your grade will be downgraded by two.
* this term paper format

26. 1128 Example 8.5 + TBA Market (Felix)

Simplico
Real option note
Computing Implied Volatility

NOTE: Optimization and solver using VBA

```
Sub solverexample()
SolverReset
SolverOptions precision:=0.0001
SolverOk SetCell:=Cells(9, 2), MaxMinVal:=2, _
  ByChange:="B6:B7", Engine:=2, EngineDesc:="GRG Nonlinear"
SolverAdd cellRef:=Range("B6"), relation:=3, formulatext:=5
SolverAdd cellRef:=Range("B7"), relation:=1, formulatext:=5
SolverSolve userfinish:=False
End Sub

'SolverAdd cellRef:=Range("G26"), relation:=3, formulatext:=0.01479165
'SolverAdd cellRef:=Range("B6:B7")
```

27. 1203 Veronesi ch08 (8.4 이태훈)

Black Scholes Formula Excel Illustration
Computing Implied Volatility
VBA function for Black-Scholes Formula

28. 1205 Estimating volatilities: GARCH(1,1), etc. https://www.dropbox.com/s/qqtfnfv8cmzlf6v/garch_FF.xlsm. Maximum Likelihood Estimation (MLE1; MLE2 (stern); MLE3)
29. 1210 Estimating volatilities: EGARCH(1,1) and GJR-GARCH(1,1), etc. https://www.dropbox.com/s/qqtfnfv8cmzlf6v/garch_FF.xlsm. Maximum Likelihood Estimation (MLE1; MLE2 (stern); MLE3)

30. 1212 Estimating volatilities: EGARCH(1,1) and GJR-GARCH(1,1), etc. https://www.dropbox.com/s/qqtfnfv8cmzlf6v/garch_FF.xlsm. Maximum Likelihood Estimation (MLE1; MLE2 (stern); MLE3)Kang, Hyoung Goo and Kim, Y. Han (Andy) and Lee, Jong Kyu, Can Big Data Predict the Behavior of North Korea? (September 3, 2014). Available at SSRN: http://ssrn.com/abstract=2490693 or http://dx.doi.org/10.2139/ssrn.2490693 (NK Slides).

31. Fama-MacBeth regression: Fama, Eugene F.; MacBeth, James D. (1973). "Risk, Return, and Equilibrium: Empirical Tests". Journal of Political Economy 81 (3): 607–636. JSTOR 1831028. Booth and Fama (1992)
32. Fama-MacBeth regression: Fama, Eugene F.; MacBeth, James D. (1973). "Risk, Return, and Equilibrium: Empirical Tests". Journal of Political Economy 81 (3): 607–636. JSTOR 1831028.
33. Kyle Model
34. Fama-French (2012)

References

- Merton continuous time finance
- Jean-Pierre Danthine's intuitive continuous time finance
- Continuous time some basics (link; very good, but many errata)
- Kim SH, Kang H. 2014. A New Strategy using Term-structure Dynamics of Commodity Futures. Financial Research Letters.
- Piazzesi Affine Term structure models
- Cox, Ross and Rubinstein 1979
- http://www.ems.bbk.ac.uk/for_students/msc_finEng/math_methods/

Forthcoming
* Chap14: Interest rate models in continuous time
* Chap15: NO ARBITRAGE AND THE PRICING OF INTEREST RATE SECURITIES
* Ch27 Martingale measures (BSM formula)
* Ch28 Interest rate derivatives: standard market models
* Chap17: RISK NEUTRAL PRICING AND MONTE CARLO SIMULATIONS
* Chap19: NO ARBITRAGE MODELS AND STANDARD DERIVATIVES
* Chap11: RISK NEUTRAL TREES AND DERIVATIVE PRICING (excel)

- Ch09: One Step Binomial Trees (excel)
- Ch10: Multi-Step Binomial Trees

* Chap19: NO ARBITRAGE MODELS AND STANDARD DERIVATIVES

Papers

- Bansal, Harvey and Dahlquist (2004; http://ssrn.com/abstract=594845)
- Hansen and Richard (1987 Econometrica)
- Disclosure and agency conflict: Evidence from mutual fund commission bundling, Roger M. Edelen, Richard B. Evans, Gregory B. Kadlec, Journal of Financial Economics, Volume 103, Issue 2, February 2012, Pages 308–326
- Fama-MacBeth regression: Fama, Eugene F.; MacBeth, James D. (1973). "Risk, Return, and Equilibrium: Empirical Tests". Journal of Political Economy 81 (3): 607–636. JSTOR 1831028.
- Booth and Fama (1992)
- Kyle Model
- Fama-French (2012)
- Scientific Background on the Sveriges Riksbank Prize in Economic Sciences in Memory of Alfred Nobel 2013

cf
Actuarial Science: www.utstat.utoronto.ca/sjaimung/courses/sta2502/main.htm
Continuous time some basics (link; very good, but many errata)
R and efficient frontier: http://www.calculatinginvestor.com/2011/06/07/efficient-frontier-1/
http://www.idsc.ethz.ch/Courses/stochasticsystem
Stopping time http://www.columbia.edu/~ks20/stochastic-I/stochastic-I-ST.pdf
Optional stopping theorem:
http://www.columbia.edu/~ks20/