NATIONAL TAIWAN UNIVERSITY
Department of International Business
Financial Computation

Professor Jr-Yan Wang   **Spring 2019**

Room 103, Building 2, College of Management   **Thursday 9:10-12:10**

jryanwang@ntu.edu.tw   **02-33664987**

COURSE DESCRIPTION

The discipline of Financial Computation (金融計算) or Financial Engineering (財務工程) combines four fields: finance (財務), computer science (電腦), mathematics (數學), and statistics (統計). The major goal of this course is to learn how to solve pricing problems for various derivative contracts by developing **analytic formulae (解析解)** and/or **computer programs (電腦程式)**. Specifically, the pricing methods and their mathematical fundamentals for many exotic options will be introduced in this course, such as **Asian options (亞洲式選擇權)**, **barrier options (障礙選擇權)**, **lookback options (回顧選擇權)**, **convertible bonds (可轉換公司債)**, and **rainbow options (彩虹選擇權)**.

To ensure the fluency of my lecture, I assume that students are equipped with the basic knowledge in Finance, especially that about derivatives. Therefore, students should already learn the courses of **Futures and Options** or other similar courses before. Extended from the basic knowledge, several topics will be fully studied in this course, such as the stochastic process (隨機過程), the option pricing models, various numerical techniques, the option hedging strategies, etc.

In addition, the basic ability of computer programming is required to implement the assigned homework. I provide a PowerPoint file to briefly introduced VBA, which is a highly recommended computer language for beginners. However, the time constraint does not allow me to teach computer programming in details, so students need to learn it by themselves. **Do not worry about the lack of the computer programming skill.** According to my experience to teach this course for more than 15 years, at least 80% of students never wrote a computer program before this course, but less than 1% of students failed this course.

It is my hope that students can learn many financial theories, good programming practices, advanced mathematics, and most importantly, the true meaning of the financial engineering in this course.

LECTURE NOTES AND REFERENCES

Lecture Notes: http://homepage.ntu.edu.tw/~jryanwang/ → Course Information →
Financial Computation or Financial Engineering (graduate level).

(DO NOT access CEIBA for the syllabus and lecture notes)

References:

1. Options, Futures, and Other Derivatives, by John C. Hull, 9th ed. (global ed.), 2018.

2. Financial Engineering and Computation: Principles, Mathematics, Algorithms, by Yuh-Dauh Lyuu, 2002.

3. Derivatives: The Theory and Practice of Financial Engineering, by Paul Wilmott, 1998.

4. Monte Carlo Methods in Financial Engineering (Stochastic Modelling and Applied Probability), by Paul Glasserman, 2003.

5. Introduction to Stochastic Calculus with Applications, 3rd ed., by Fima C. Klebaner, 2012.

6. Financial Calculus: An Introduction to Derivative Pricing, by Martin Baxter and Andrew Rennie, 1996.

7. Numerical Recipes: The Art of Scientific Computing, 3rd ed., by William H. Press, Saul A. Teukolsky, William T. Vetterling, and Brian P. Flannery, 2007.

8. The Complete Guide to Option Pricing Formulas, by Espen G. Haug, 2nd ed., 2007.

9. 金融工程學：金融商品創新與選擇權理論, 第三版, 陳松男, 2008.

10. C++財務程式設計, 戴天時, 2005.

HOMEWORK AND GRADING

Homework (5 computer programs)   100%

※ For each homework, students have two weeks to accomplish it.

※ On the due date, the demonstration of your program will take place in the third hour of the lecture.

※ The basic requirement is worth 80 points. One week delay of the demonstration will result in a deduction of 5 points.

※ For each homework, there are at most 3 bonuses, each of which is worth 5

additional points.

※ It is highly encouraged to discuss the homework with classmates, but DO NOT COPY programs from others. The copying behavior will result in a reduced score according to my discretion.

※ In addition to these 5 pieces of homework, there are two or three extra bonuses, each of which is worth 5 additional points for your final grades.

RULES IN CLASS

※ DO NOT DISTRACT other students from listening to my lecture, e.g., do not chat with other students when I am talking.

※ If you have any questions during my lecture, FEEL FREE to INTERRUPT me by raising your hand.

COURSE SCHEDULE

Week	Date	Topic	Reading
1	Feb. 21	Introduction of Financial Computation	Syllabus and reference books
2	Feb. 28	National Holiday (Peace Memorial Day)	No lecture
3	Mar. 7	Overview of Options	Ch 3
4	Mar. 14	Stochastic Process	Ch 1
5	Mar. 21	Stochastic Process	Ch 1
6	Mar. 28	Stochastic Process and Black-Scholes Model	Ch 1 and 2
7	Apr. 4	National Holiday (Children's day)	No lecture
8	Apr. 11	Black-Scholes Model*	Ch 2
9	Apr. 18	Binomial Tree Model*	Ch 4
10	Apr. 25	Binomial Tree Model†	Ch 4
11	May 2	Monte-Carlo Simulation* and Finite Difference Method	Ch 5
12	May 9	Monte-Carlo Simulation and Finite Difference Method†	Ch 5
13	May 16	Lookback Option*	Ch 9
14	May 23	Lookback Option and Asian Option	Ch 9 and 10
15	May 30	Asian Option*	Ch 10
16	June 6	Monte Carlo Simulation for American Options	Ch 11
17	June 13	Monte Carlo Simulation for American Options†	Ch 11

18	June 20	Interest Rate and Credit Models	Ch 12

* Homework assignment supposed   † Extra bonus assignment supposed

※ Note that the above schedule is an estimated version, I will dynamically adjust the speed of my lecture according to the feedback of students.

※ If time is enough, I will also introduce barrier options (Ch 8), non-constant volatility models (Ch 6), and the Greek letters of options (Ch 7).

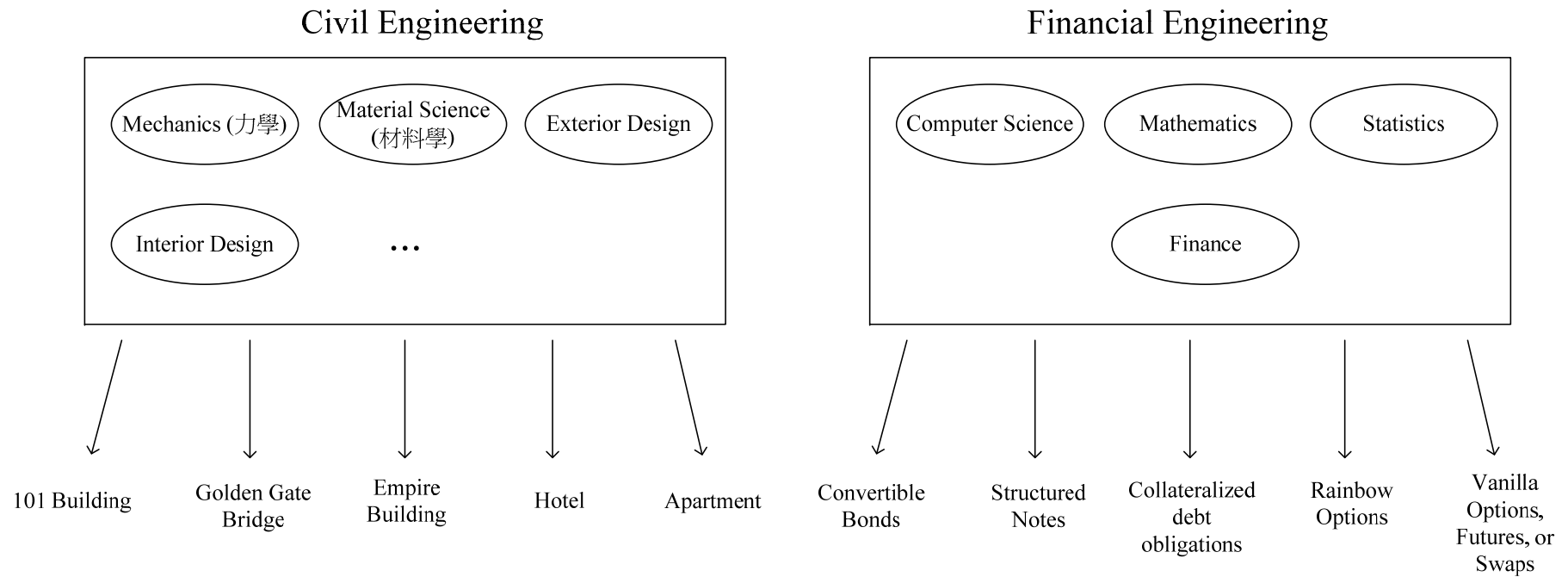## OFFICE HOURS

Tuesday 15:30-16:30 and Thursday 15:30-16:30
Room 513, Building 2, College of Management

※ It is not suggested to ask academic or programming questions in emails. The face-to-face communication is the best way to make me understand your questions and give you the most appropriate instruction to solve your problems.

※ Try to fully utilize the office hours before making an individual appointment.

TEACHING ASSISTANT

XXX   XXXXXXX@ntu.edu.tw

The reason for the name of "Financial Engineering"

Civil Engineering

Mechanics (力學)　　Material Science (材料學)　　Exterior Design

Interior Design　　…

↓　　↓　　↓　　↓　　↓

101 Building　　Golden Gate Bridge　　Empire Building　　Hotel　　Apartment

Financial Engineering

Computer Science　　Mathematics　　Statistics

Finance

↓　　↓　　↓　　↓　　↓

Convertible Bonds　　Structured Notes　　Collateralized debt obligations　　Rainbow Options　　Vanilla Options, Futures, or Swaps

※ **Common business model: Produce or create products with least costs, and sell these products with highest prices**