

**NATIONAL TAIWAN UNIVERSITY**  
**Department of International Business**  
**Financial Computation**

**Professor Jr-Yan Wang (王之彥)**

**Spring 2020**

**Room 103, Building 2, College of Management**

**Thursday 9:10-12:10**

**jryanwang@ntu.edu.tw**

**02-33664987**

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**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 regarding 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. My website provides several PowerPoint, PDF, EXCEL VBA sample files 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 nearly 20 years, a high percentage of students in this course never wrote a computer program before, 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, 10<sup>th</sup> 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, 3<sup>rd</sup> 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, 3<sup>rd</sup> 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, 2<sup>nd</sup> 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 are granted 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 results in a deduction of 5 points from the score you earn.
- ※ There are at most 3 bonuses in each homework, 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 score reduction or even a failed result according to my discretion.
- ※ In addition to these 5 pieces of homework, there are 2 or 3 extra bonuses, each of which is worth 5 additional points for your final scores in the course.

### **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	Mar. 5	Course overview VBA	Syllabus and reference books
2	Mar. 12	Stochastic Process	Ch 1
3	Mar. 19	Stochastic Process	Ch 1
4	Mar. 26	Black-Scholes Model	Ch 2
5	Apr. 2	National Holiday (Children's Day)	No lecture
6	Apr. 9	Black-Scholes Model*	Ch 2
7	Apr. 16	Overview of Options	Ch 3
8	Apr. 23	Binomial Tree Model*	Ch 4
9	Apr. 30	Binomial Tree Model <sup>†</sup>	Ch 4
10	May 7	Monte-Carlo Simulation* and Finite Difference Method	Ch 5
11	May 14	Monte-Carlo Simulation and Finite Difference Method <sup>†</sup>	Ch 5
12	May 21	Lookback Option*	Ch 9
13	May 28	Lookback Option	Ch 9
14	June 4	Asian Option*	Ch 10
15	June 11	Asian Option	Ch 10
16	June 18	Monte Carlo Simulation for American Options <sup>†</sup>	Ch 11
17	June 25	Self-studying and homework completion	Demo homework if necessary

18	July 2	Self-studying and homework completion	No lecture
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- \* 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 non-constant volatility models (Ch 6), Greek letters of options (Ch 7), and barrier options (Ch 8).

### **OFFICE HOURS**

Thursday 15:00-17:00

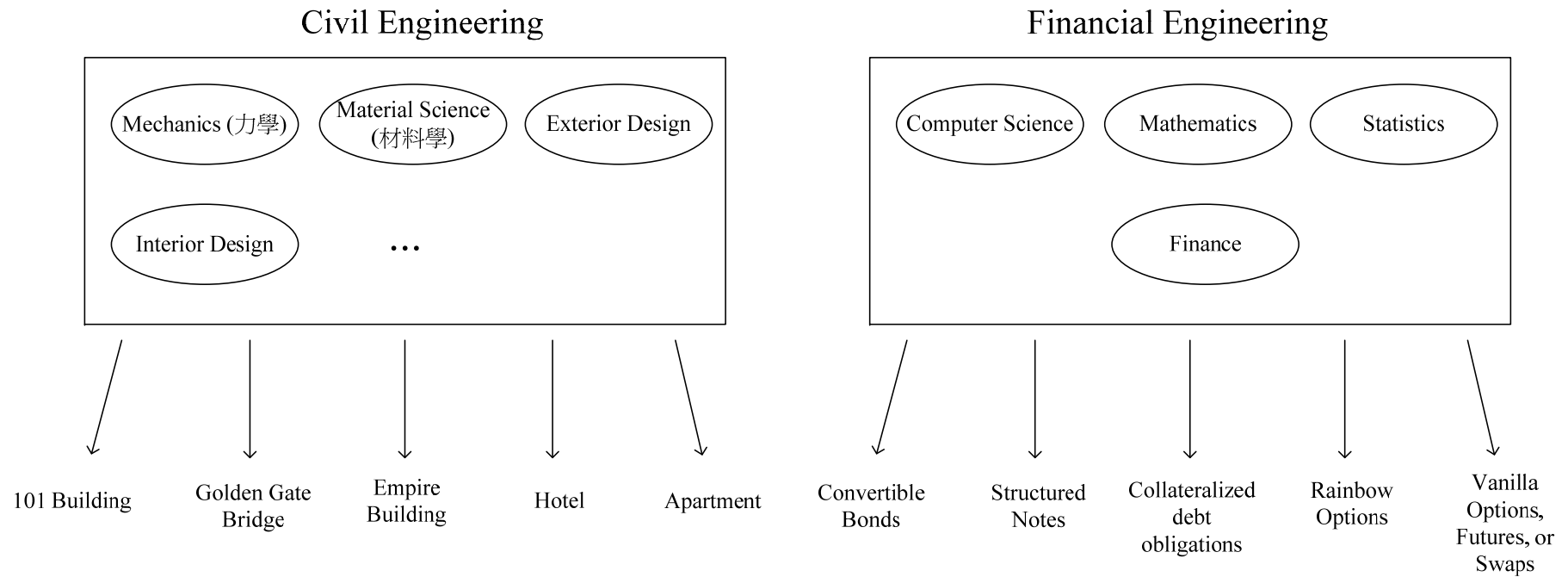
Room 712, Building 2, College of Management

- ※ 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**

徐慕華      r07724020@ntu.edu.tw

## The reason for the name of “Financial Engineering”



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