Syllabus
Applied Stochastic Process
Spring 2021

Instructor:
Dr. CHEUNG Ying Lun, Room 321, Chengming Bldg., Email: cheungyinglun at cueb.edu.cn
Dr. Hou Jie, Room 331, Chengming Bldg., Email: jie_hou_cueb at 163.com

Time and Location: Friday, 1:30pm-3:20pm, Rm. 314, Shen Si Bldg

Reference Book: Edward P.C. Kao "An Introduction to Stochastic Processes", China Machine Press (ISBN: 7-111-12414-6/O·327);

Course Description: This course exposes students to essentials of stochastic process that will be most frequently applied in finance and economics. We maintain a balance between practical problem-solving skills and mathematical regularity. My rough plan is to introduce the following topics: Review of Probability Theory; Poisson Process; Brownian Motion; Option Pricing Model; Markov Process, with concentration on Poisson Process, Brownian Motion and Option Pricing Model. See the course outline for more details. There will be no required textbook as the lecture notes will be self-inclusive. The major reference book is: E.P.C. Kao's "An Introduction to Stochastic Process" which is readily available through China Machine Press. Although most of the time I will have lecture notes provided, it is very important that you take notes either on the edge of your copy of lecture notes or on your own paper. The material I covered during the class will be much more than what is on the lecture notes. The reading material is of more advanced stuff that I will occasionally delve into. Students are encouraged but not required to purchase the reference book. I will send the electronic copy of the lecture notes to students' Email addresses before each class session.

Grading: Grading is decomposed into two measurements: class attendance and assignments and the final exam. They will count toward the grade with relative importance shown in the following table.

Attendance and Assignments	30%
Presentation	30%
Final Project	40%

Assignments: There may be assignments upon completion of each major session. Students are encouraged to discuss with each other about these assignments; however they must submit their own assignments independently. Identical answers will be accepted provided that proper notes are included detailing all students involved in solving the question with their relative contribution.

Presentation: Students will be required to perform presentations in class, topics will be given in advance of the presentations.

Final Project: There will be no exams. A final project will be given in which students will apply the knowledge they gained in this class to solve problems.

Course Outline

Part I: Review of Probability Theory (2-4 lectures)

Lec 1: Examples of stochastic process; Randomness and Probability; Outcomes and events; Discrete

and continuous random variables (with examples); Probability density and cumulative density functions; Expectations and variance; Markov's theorem, Law of large numbers;

Lec 2: Transformation and generation of random variables; Moments and moment generating function; Joint and marginal distributions; Independence; Central limiting theorem; Conditional distribution; Conditional density function; Conditional probability and independence; Conditional variance;

Part II: Poisson Process (4-6 lectures)

Counting Process; Equivalence among arrival time, interarrival time and counting process; Increment-independent property of Poisson arrival; Drawing the figure of arrival events; Derivation of the distribution of Poisson process; Nonhomogenerous Poisson process; Compound Poisson process;

Part III: Brownian Motion and Markov Process (6-8 lectures)

Binomial option pricing; The Black-Scholes option pricing model; Brownian Motion; Markov property (Increment-independent); Strong Markov property; Discrete- and continuous-time Markov process; State and state space; Classification of states; Transition matrix; First passage time; Stopping time; Classification of Markov Chains; Random walk and Martingale;