The Hong Kong Polytechnic University
Department of Logistics and Maritime Studies
Research Seminar

Pyramid-Type Markov Processes in Blockchain with Selfish Mining Alliances

by

Prof. Quan-Lin LI
Professor
School of Economics and Management Sciences
Yanshan University

Date: 25 January 2019 (Friday)
Time: 10:30am - 11:30am
Venue: M802, Li Ka Shing Tower
The Hong Kong Polytechnic University

(Conducted in English)

Abstract:

This talk focuses on our recent research on blockchain with selfish mining alliances, which can be established as multi-dimensional pyramid-type Markov processes by means of the longest chain rule of chain-fork structure. We address several interesting issues or topics related to multi-dimensional pyramid-type Markov processes. This further sets up mathematical models and develops economic theory of blockchain. Here, we shall care for:

(1) How to study the multi-dimensional pyramid-type Markov processes, for example, stable conditions, steady-state probability, first passage time, sojourn time and so forth. Perhaps the pyramid-type Markov processes bring you to enter a queer theoretical space from such an interesting practical technology.

(2) Block reward, transaction fee and their allocation methods greatly motivate many miners in a blockchain to take shape some selfish mining alliances evolutionarily, while the selfish mining alliances will lead to various attacks on security of blockchain. As a first exploration, we provide a unified and comprehensive framework for expressing the attacks grown out of the selfish mining alliances, a physical structure of which is given a detailed observation and interpretation in terms of the pyramid-type Markov processes. This may be viewed as a key improvement in the study of blockchain mining processes. In fact, our method can be developed to analyze blochchain systems through some simple and intuitive applications of Markov decision processes and stochastic game modeling under the pyramid-type setting.

(3) We show that the pyramid-type Markov processes will play an important role in the study of blockchain systems and in the design of consensus mechanism of related distributed systems.

Bio:

Quan-Lin Li is Full Professor in School of Economics and Management Sciences, Beijing University of Technology, and Yanshan University. He received the Ph.D. degree in Institute of Applied Mathematics, Chinese Academy of Sciences, Beijing, China in 1998. His main research interests concern with Markov Processes, Queueing Theory, Stochastic Models, Matrix-Analytic Methods, Manufacturing Systems, Computer Networks, Network Security, Healthcare Systems, and Supply Chain Management.

Dr. Li has published a book: *Constructive Computation in Stochastic Models with Applications: The RG-Factorizations*, Springer, 2010; and over 60 research papers in a variety of international journals, such as, *Advances in Applied Probability, Queueing Systems, Stochastic Models, European Journal of Operational Research, Computer Networks, Performance Evaluation, Discrete Event Dynamic Systems, Computers & Operations Research, Annals of Operations Research, International Journal of Production Economics, and Computers & Mathematics with Applications.* In addition, He is in International Program Committees in the conferences of several different areas, such as, queueing systems, stochastic models, and computer networks. Also, he is a vice president of Reliability Society in Operations Research Society of China.

Please email to clare.lau@polyu.edu.hk for enquiries.

All are welcome!