

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

**Multi-Player Allocations in the Presence of Diminishing Marginal Contributions:
Core, Nucleolus, and Applications in Management Science**

by

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Date: 22 February 2019 (Friday)
Time: 10:30am - 11:30am
Venue: R501, Shirley Chan Building
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(Conducted in English)

Abstract:

We use cooperative game theory to investigate multi-player allocation problems under the diminishing marginal contributions (DMC) property. This property describes the law of diminishing returns in the cooperative game setting, i.e., a player's marginal contribution to a non-empty coalition decreases as the size of the coalition increases. For such problems, we develop DMC games, and derive a necessary and sufficient condition for the non-emptiness of the core, which is different from but simpler than the Bondareva-Shapley condition. Then, we obtain an analytic nucleolus solution for DMC games with a non-empty core. This is motivated by the fact that in cooperative game theory, the nucleolus possesses some desirable properties, but the lack of analytic (closed-form) solutions for the concept limits its applications in the analysis of multi-player allocation problems. We also discuss the least core value for the DMC games with an empty core. A code-sharing game, a group-buying game, and a scheduling profit game are studied to illustrate the applications of our analytic results in management science. In addition, we show the applications of our results in cooperative game theory by examining DMC games in some extant classes of coalitional games including linear programming games, bankruptcy games, clan games, matching games, and others. For some of the allocation problems that do not exhibit the DMC property, the formula for the nucleolus solution of DMC games or its modifications can be used to find a unique and stable allocation scheme in the core.

Bio:

Professor Mingming Leng is a Professor of Operations Management in the Department of Computing and Decision Sciences of the Faculty of Business at Lingnan University. He is also the Founding Director of the Master of Science Programme in eBusiness and Supply Chain management. Professor Leng holds a Ph.D. degree in Management Science/System from McMaster University's DeGroote School of Business, Canada. He is currently interested in operations and supply chain management, game theory, data analytics, and interface between operations and other disciplines. He has published a number of papers in top-tier or highly-respected journals such as *Operations Research*, *Production and Operations Management*, *Naval Research Logistics*, *IIE Transactions*, and others. Moreover, Professor Leng is a member in the Editorial Review Board of *Production and Operations Management*, and the Associate Editor for *INFOR: Information Systems and Operational Research*. In addition to academic experiences, Professor Leng has five years working experience in industry.

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

All are welcome!