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論文要旨

THESIS SUMMARY

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Department of		
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Student's Name		

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指導教員 (主) :	武藤滋夫
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要旨 (英文 800 語程度)

Thesis Summary (approx.800 English Words)

Traditionally, game theory has developed almost entirely from introspection and theoretical concerns, whilst in this dissertation, we pay a particular attention to the application of game theory in three multi-agent negotiation problems: minimum cost spanning tree, data envelopment analysis (DEA), and partner selection in airline alliances, where the first two problems assume for an abstract agent.

In Chapter 1, we begin with the introduction of the field-oriented literature and motivation, as well as some background knowledge and concepts of game theory to be used in our analysis.

In Chapter 2, we have presented the decentralized solution of the MCST problem and finalized its characterization. We treat the MCSE problem as a particular extension for the MCST problem and do not make a distinction specifically between them. The decentralized solution is a generalization of the Borůvka's rule and particularly appealing when considering the MCST problem under the game-theoretic framework: each connected component constructs links in a greedy pattern yielding the MCST. The characterization constitutes of six main properties: Eff, MC, FSC, ET, Loc and USI, respectively. USI describes the primary difference between the decentralized solution and any centralized solution, which allows us to distinguish a decentralized cost allocation rule from a centralized one. It is also the property defining the cost sharing aspect in the decentralized solution based on the degree of decentralization at each stage.

In Chapter 3, we have improved the DEA min game proposed by Nakabayashi and Tone [2006] by re-assigning the total weight for the coalition members and developed a more natural, super-additive cooperative game scheme for this kind of problem. We first introduce a strategic form DEA game with the average weights over all players regarding each criterion; then define the TU DEA game based on the definition of the strategic form game, and study its properties and solutions. By applying the constant-sum property, we give the sufficient and necessary condition for the inessentiality of the TU DEA game, which is also the condition for a non-empty core. We next define the Shapley value and nucleolus in our new scheme, and also prove that the allocations by these two concepts coincide with each other in the 3-player setting. On showing that the core is empty in most TU DEA games, we proceed to NTU DEA game, and mainly focus on proving the existence of α -core following Scarf's theorem and giving a condition for a non-empty β -core. The final section analyzes the equilibria for the strategic form DEA game, in case players are not allowed to form any coalition during the DEA process. One main result in this section is the condition under which the coalition-proof Nash equilibrium is uniquely determined.

The service quality rating data for the three big airline alliances suggests the need to understand the impact of service quality during the alliance formation. Chapter 4 proposes a framework studying service quality's effects on the selection of a partner airline. In particular, we model the optimal strategy decision process by a three-stage analysis framework. In the first stage, analyze the pre-alliance equilibria that each airline manages its own market in a non-cooperative fashion so as to maximize its expected profit. In the second stage, analyze the alliance equilibria under different cooperation schemes assuming a particular profit allocation rule. In the third stage, verify the collective rationality and stability to finalize the decision process. We have discussed about airlines' optimal strategy in three types of pre-alliance markets. In a Monopoly-Monopoly market, the cooperation is always bringing more

profit for both airlines, and thus forming an alliance is the optimal strategy for both airlines. In a Monopoly-Duopoly market, with the premise such that each airline's service quality has reached a certain level, if the pre-alliance service quality differentiation is high, the airline in the monopoly market will cooperate with the one with the same service quality; otherwise, it will choose a cooperation pattern of service quality and price competitiveness combination. The optimal strategy for airlines in a Duopoly-Duopoly market is similar to that of the Monopoly-Duopoly case. These three main insights can be corroborated by airlines of the three big alliances, i.e., China Airlines and Eva Air. Basically airlines prefer to play with the one with the same service quality level. When the service quality of the airlines in the whole market does not differ too much with each other, the trend becomes a combination of service quality and price competitiveness.

Chapter 5 closes our dissertation with some concluding remarks and the future extension work.

備考：論文要旨は、和文 2000 字と英文 300 語を 1 部ずつ提出するか、もしくは英文 800 語を 1 部提出してください。

Note: Thesis Summary should be submitted in either a copy of 2000 Japanese Characters and 300 Words (English) or 1 copy of 800 Words (English).