THE SUMMARY OF Ph. D. DISSERTATION

Major Science for Open and Environmental System		SURNAME, Firstname UMEZAWA, Masashi

Title

Properties of the Core in Minimum Cost Forest Games

Abstract

   This thesis studies problems of establishing a minimum cost network and of determining a fair cost allocation among customers. Research in cost allocation arising from networks has been mostly focused on a tree network with one supplier and many customers. Since this setting is quite restrictive for real situations, a more general framework is necessary. Kuipers [1997] formulates a general model with multiple suppliers and a network, which is not necessarily a tree. Our analysis is built on his model. Each supplier offers a different type of service to the customers, and each customer wishes to be connected with the suppliers that he needs. The characteristic function game, called minimum cost forest game, is deduced from minimum costs for constructing subnetworks. Core is considered to be a fair cost allocation, which is a widely used solution concept of cooperative game. The core of this game may be empty. Kuipers gives sufficient conditions for the game to have a nonempty core. This thesis provides more general sufficient conditions.

   By introducing an equivalence relation on the set of customers, we can obtain the unique partition of the set. Thus, it is shown that the game has a nonempty core as long as the optimal grand network is a forest which is composed of the collection of the minimum cost spanning trees on the above equivalence classes. It is further shown that, whenever the game consists of at most two equivalence classes, the core is nonempty. A network with more than two equivalence classes may have an empty core. Finally, it is shown that the same conditions are sufficient for the nonemptiness of the core when the feasibility of the network is restricted in a certain manner.