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LEXIMIN ASYMMETRIC MULTIPLE OBJECTIVE DISTRIBUTED CONSTRAINT OPTIMIZATION PROBLEM

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The Distributed Constraint Optimization Problem (DCOP) lies at the foundations of multiagent cooperation. With DCOPs, the optimization in distributed resource allocation problems is formalized using constraint optimization problems. The solvers for the problem are designed based on decentralized cooperative algorithms that are performed by multiple agents. In a conventional DCOP, a single objective is considered.

The Multiple Objective Distributed Constraint Optimization Problem (MODCOP) is an extension of the DCOP framework, where agents cooperatively have to optimize simultaneously multiple objective functions. In the conventional MODCOPs, a few objectives are globally defined and agents cooperate to find the Pareto optimal solution. However, such models do not capture the interests of each agent. On the other hand, in several practical problems, the share of each agent is important. Such shares are modeled as preference values of agents. This class of problems can be defined using the MODCOP on the preferences of agents. In particular, we define optimization problems based on leximin ordering and Asymmetric DCOPs (Leximin AMODCOPs). The leximin defines an ordering among vectors of objective values. In addition, Asymmetric DCOPs capture the preferences of agents. Because the optimization based on the leximin ordering improves the equality among the satisfied preferences of the agents, this class of problems is important. We propose several solution methods for Leximin AMODCOPs generalizing traditional operators into the operators on sorted objective vectors and leximin. The solution methods applied to the Leximin AMODCOPs are based on pseudo trees. Also, the investigated search methods employ the concept of boundaries of the sorted vectors.

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Key words: leximin, preference, multiple objectives, distributed constraint optimization, multiagent, cooperation.

1. INTRODUCTION

The Distributed Constraint Optimization Problem (DCOP) lies at the foundations of multiagent cooperation (Modi et al. 2005; Petcu and Faltings 2005; Farinelli et al. 2008; Zivan 2008). With DCOPs, the optimization in distributed resource allocation including distributed sensor networks (Zhang et al. 2005), meeting scheduling (Maheswaran et al. 2004), disaster response (Ramchurn et al. 2010), and smart grids (Miller et al. 2012) is formalized using constraint optimization problems. In a conventional DCOP, a single objective is optimized. The solvers for the problem are designed based on decentralized cooperative