MEMORY OPTIMIZED PHEROMONE STRUCTURES FOR MAX-MIN ANT SYSTEM

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Abstract: Ant Colony Optimization is a meta-heuristic for solving hard combinatorial optimization problems. It is a constructive population based approach inspired by the social behavior of ants. In our research, we are focused on the parallel/distributed computing on massively parallel systems. More precisely, we want to adjust Max-Min Ant System (one of Ant Colony Optimization algorithms) for these systems. Traditionally, a matrix is used to store the pheromone information. If we want to solve large instances, this is a very memory consuming solution. In this paper, we propose a different approach. We do not use the matrix to store the pheromone information. Instead, ant trails that are normally incorporated into this matrix are stored during the computation and just some parts and only in time when they are really needed are assembled. Proposed solution was implemented in C++. The implemented solution was tested on large symmetric instances of Traveling Salesman Problem. In these experiments, we were able to compute results with a comparable quality and even faster than with the traditional approach while using only a portion of the original memory.

Key words: *Max-Min Ant System, memory optimized pheromone structures, distributed memory systems, C++*

1. Introduction

Ant Colony Optimization (ACO) [7] is a class of meta-heuristic algorithms for solving hard combinatorial optimization problems. It is a constructive population based approach inspired by the social behavior of ants. It was successfully used to solve different problems. Traveling Salesman Problem (TSP) [7, Chapter 3] can be used as an example of such problem. TSP is one of the well-known NP-hard problems. It seems that there is no exact method to compute a solution of such problems in a reasonable amount of time. Still, computer scientists and

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