Sports Scheduling:
An Artificial Intelligence Approach

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ABSTRACT

This thesis looks at the Traveling Tournament Problem (TTP) from the sports scheduling literature. It presents two approaches to this problem: a metaheuristic Ant Colony Optimization (ACO) approach to find good solutions in a reasonable time frame and a heuristic search Iterative-Deepening-A* (IDA*) approach to find optimal solutions.

The first approach combines ACO with constraint processing techniques in order to handle the hard constraints of the TTP. The key component is creating a framework which uses forward-checking and conflict-directed backjumping to handle the constraints while using ACO for choosing the values. This is further improved by introducing new ideas of unsafe backjumping and pattern matching for constraint propagation while incorporating an old concept of ant restarts. This approach has been found to improve on past ACO approaches to the TTP and showed results which are more competitive with state-of-the-art metaheuristic approaches.

The second approach presents a parallel version of IDA*, combining past concepts of tree decomposition and node ordering with a new idea of subtree skipping. This new idea allows for parts of the search tree to be skipped for some iterations while still guaranteeing optimality for the final solution that is found. Two additional ideas are presented. The first, called forced deepening, helps to reduce node expansion when applying IDA*-like algorithms on real-world distance problems. The second, called elite paths, helps to both improve the performance of forced deepening while also allowing for the optimal solution to be found faster during the final iteration of IDA*. The results of applying this new approach to the TTP shows that it is state-of-the-art, finding known optimal solutions in a fraction of the time of past approaches and finding new optimal solutions to some unsolved problem instances.

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