

Asynchronous Forward-checking for DisCSPs

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Abstract A new search algorithm for solving distributed constraint satisfaction problems (*DisCSPs*) is presented. Agents assign variables sequentially, but perform forward checking asynchronously. The asynchronous forward-checking algorithm (*AFC*) is a distributed search algorithm that keeps one consistent partial assignment at all times. Forward checking is performed by sending copies of the partial assignment to all unassigned agents concurrently. The algorithm is described in detail and its correctness proven. The sequential assignment method of *AFC* leads naturally to dynamic ordering of agents during search. Several ordering heuristics are presented. The three best heuristics are evaluated and shown to improve the performance of *AFC* with static order by a large factor. An experimental comparison of *AFC* to asynchronous backtracking (*ABT*) on randomly generated *DisCSPs* is also presented. *AFC* with ordering heuristics outperforms *ABT* by a large factor on the harder instances of random *DisCSPs*. These results hold for two measures of performance: number of non-concurrent constraints checks and number of messages sent.

Keywords Distributed CSPs · Asynchronous search · Forward-checking

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