論文の内容の要旨

論文題目　High-level Planning and Scheduling of Multiple Intelligent Agents in Warehouse Management
(倉庫管理における複数知的エージェントの高レベルプランニングとスケジューリング)

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The problem of picking orders in a warehouse using multiple agents is addressed. High-level planning and scheduling strategies are proposed to solve the problem. The input is a set of customer orders made on a warehouse and the output is a picking schedule for the agents.

A fast multistage strategy is proposed for situations where there is a need to derive good solutions quickly. The approach decomposes the problem into a planning phase where efficient picking routes are constructed and then equitably distributed to the agents, and a scheduling phase which aims to minimize delays that lengthen the picking time. For situations when more time is available, metaheuristic schedulers based on tabu search and simulated annealing are proposed that can obtain higher quality solutions. Basic neighborhood operators are augmented by a novel local search procedure specifically designed to minimize the overall picking time.

The proposed methods are evaluated against a reference scheduler that is widely used in practice. Extensive simulations are conducted using real and randomly generated data instances. The experiments reveal that the proposed multistage and metaheuristic schedulers improve the solution of the reference significantly. Between the proposed schedulers, the metaheuristic schedulers attain much higher quality solutions but at the expense of longer calculation times.

An online extension to the problem is also considered, wherein random orders arrive while the static ones are still being picked. Real-time schedulers are proposed that recalculate the total schedule every time a random order is added.

Similarly, the proposed online schedulers are evaluated against an online

version of the static reference scheduler and against adaptations of existing algorithms in online scheduling literature. Experiments indicate that the proposed online schedulers are competitive and attain moderate improvement over the reference, on the average, as long as the system does not become completely random.