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A tool for solving stochastic dynamic facility layout problems with stochastic demand using either a Genetic Algorithm or modified Backtracking Search Algorithm

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Abstract

Facility layout problems (FLP) involve determining the optimal placement of machines within a fixed space. An effective layout minimises costs. The total material travel distance is a key indicator of the efficiency of internal logistics. Changes in demand and product mix may alter the material flow. The dynamic facilities layout problem (DFLP) takes into account changes in demand and allows for the periodic redesign of facilities. Facility redesign may reduce the material flow cost, but there is a trade-off between material flow improvements and reorganisation costs. There is a limited literature on the redesign of facilities with stochastic demand, heterogeneous-sized resources and rectilinear material flow.

The Backtracking Search Algorithm (BSA) has been used to successfully solve a range of engineering problems, but it has not previously been used to solve operations management problems or the FLP. This paper outlines novel modified Backtracking Search Algorithms (mBSAs) that solved the stochastic DFLP with heterogeneous sized resources. The combination of material flow and redesign costs were minimised. Three mBSA were benchmarked against the classical BSA and a Genetic Algorithm (GA) using eleven benchmark datasets obtained from the literature. The best mBSA generated better solutions than the GA for large-size problems. The total costs for the layouts generated by the best mBSA were significantly lower than for the conventional BSA. The modifications to the BSA increased the diversity of candidate solutions, which increased