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Applying Computational Intelligence to Optimisation Problems in a Warehouse Environment. Case Study: The Container Loading Problem

Various problems present themselves in the day-to-day running of a warehouse. One of such problems is that of optimally loading heavy rectangular palletized goods onto a larger rectangular container. This problem is equivalent to the Container Loading Problem in literature, and it is an active research area that has many practical applications in industry.

In a warehouse, this problem poses two challenges. The first is that of selecting a subset of goods from a larger set of goods such that the total weight of the selected goods is at most the maximum weight capacity of the container, and there is no separation of logically grouped goods (e.g. a customer order). The second is that of optimally packing the selected subset of goods onto the container such that the weight of the goods is distributed on the container floor, the packed goods are stable, possible lateral motion of goods during transit is minimised, and the goods are completely packed in entirety into the container. These challenges often result in the non-optimal utilisation of containers and an increase in loading time, which in turn leads to increased costs for labour and for hiring containers.

While exact mathematical methods exist for solving this problem, they are all known to be computationally feasible for only problems of very small sizes as the time required to solve them increases very quickly with problem size. In this study, we solve the problem using Computational Intelligence techniques. These techniques find near-optimum solutions to the problem very quickly while satisfying considered constraints. This leads to an optimum selection of goods, improved container utilisation and faster loading times.