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TESI DI DOTTORATO

**Il problema dell'allocazione dei prodotti nei  
magazzini: modelli matematici ed approcci  
euristici.**

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## Abstract

This thesis is aimed to investigate the warehouse management. More precisely, we study the product allocation problem (PAP), which is one of the major issues in the context of space planning warehousing.

Optimizing the space usage in a warehouse represents one of the most important issues to increase its productivity. Moreover, the optimal space management in a warehouse impacts on the efficiency of the whole part of the production and distribution logistic chain management.

Designing the space management of a warehouse implies to make different choices in order to the consumption of the available resources, that is human resources and solid infrastructures.

In the following thesis the problem concerning the allocation of several products to dedicated storage points has been studied from the formal point of view. More precisely, a tailored mathematical model has been presented, where multilevel warehouses and compatibility constraints between classes of adjacent products have been taken into account. We highlight that such constraints arise typically in practical situations in which companies operate in the field of large-scale distribution.

Since the PAP is a NP-hard problem, the research has been focused on designing and implementing three heuristic strategies to find good feasible solutions of the problem:

- the first strategy is based on the iterated local search technique, which aims to overcome the problem of local minima through a perturbation procedure able to generate a new solution from the current one, in an unexplored region of the search space;
- the second strategy comes from the rollout method, which allows to evaluate, for each stage of the system, the best solution on the basis of different scenarios;
- the latter strategy is aimed at grouping the products on the basis of their “familiar” compatibility (Family Grouping).

The experimentation carried out on several datasets allowed the identification of advantages and disadvantages of the different approaches according to the characteristics of the warehouse layout, the number of products to be allocated and the percentage of products mutually compatible.