1 Background
Outperform is a Delft-based company providing a proprietary software “Outperform Planning” and associated consulting services. Our solution runs the sales and operations planning process of companies mainly in the food and beverages sector. Outperform Planning covers the entire process, starting with integration with the client’s ERP system, continuing with forecasting demand, as well as planning and scheduling the supply response using optimization techniques and finishing with re-integrating the solution back into the client’s ERP system. We are an international company with customers around the world and team members in Germany, UK, Moldova, United States and South Africa.

2 Assignment
The focus of this master thesis in cooperation with the Delft Institute of Applied Mathematics (DIAM) will be on one of the algorithms used for planning; a branch-and-bound algorithm called Heuristic Planning (HP). HP takes the given inputs like current inventory, customer demands and firm planned supplies, it identifies inventory violations like unmet demand and misses of a safety inventory target of finished goods at customer facing warehouses. Based on user-defined priorities, HP tries to resolve these violations one by one by branching over all possible supply responses, e.g., different transport modes, resources, bills of materials, supply days, and quantities, until the violation is resolved, or the responses have been exhausted. It recursively iterates over resulting violations on intermediate warehouses, plants, intermediate products, and raw materials. Evaluating the partial solution during the calculations allows for bounding, storing unsuccessful tries allows for pruning the branch-and-bound structure. The exact structure of the supply chain is dependent on the specific client’s data; the number of locations to consider can vary from 1 to roughly 30, the number of products can be in the range of several 1,000s.

The speed of the algorithm and, partly, its solution quality are determined by two sequences. On the one hand, a user defines a priority per product to force the algorithm to plan high priority products first, but for products with same user priority, it is up to the algorithm to choose a sequence. On the other hand, for each individual product, it is totally up to the algorithm to determine a sequence for the different supply responses for resolving the respective product’s inventory violations. If the algorithm can skip options that turn out to be infeasible, it saves unnecessary computation time. For instance, when supply responses for products are planned after many other products have already used up a lot of production capacity, finding an appropriate “slot” can be quite time consuming. On other hand, skipping options that could lead to good solutions should be avoided.

The desired result is a machine learning algorithm that provides better sequences both for supply responses of individual products as well as for products with same user-defined priority, such that the HP algorithm speeds up and still produces solutions of at least same quality.

3 Student profile
- Master student with background in Operations Research and Machine Learning
- Interest in the sales and operations planning realm and preferably also affinity with the food and beverages industry
- Good programming skills, ideally in C# and SQL
- Excellent command of English, written and spoken
- Self-motivated way of working

4 Procedure
Please send your resume and grade list to Claas Hemig at claas.hemig@outperformplanning.com