Modelling Port Terminal Logistics

Michiel Van Lancker Emmanouil Thanos

Introduction

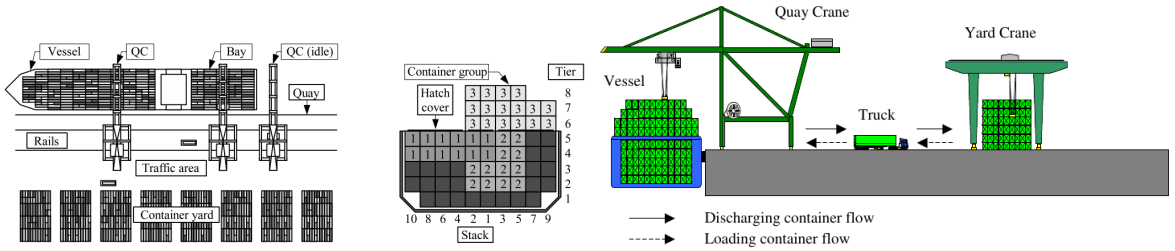
During the remainder of the lab sessions for the course *Algorithms for Decision Support* you will develop an algorithmic model for container terminals. You will work in groups of two, maintaining a single codebase in a well-structured git-repository.

Problem description

Container terminals provide essential services in the global logistics network. Often they interface between different modes of transport and thus carry a heavy responsibility: if a port terminal has to shut down its operations, the connection between marine transport and containers and continental transport to the hinterland may be severed, with potentially dire consequences for the local economy.

Incorrect stacking of containers may result in a mess at sea.

In the container terminal the transshipment (movement) of containers is performed by a variety of vehicles. Large quay cranes handle transshipment from the massive seaships[1] to the land. Smaller vehicles like reach stackers, rubber-tyred gantry cranes or automated transport vehicles handle transport between stacks of containers in the terminal. Often larger, rail-mounted gantry cranes are available, which provide a more efficient means of transshipment and which are intensively used to transship containers between temporary storage and trucks or trains.



(a) A (b) B

Figure 1: Port terminals are actively studied in academia.

You will develop the codebase required to model a container terminal. Your model will be capable of representing stackings of containers of different sizes and terminals with varying numbers of cranes, which can move freely throughout the terminal but must maintain safety distances. Additionally, the model will enable the generation of schedules for the

[1] remember the Evergreen incident

Overview of the lab sessions (provisional)

Date	Topic	Description
19/10/22	Positioning	Movements & Trajectories
09/11/22	Stacking	Stacks and IO
23/11/22	Transshipment	Combine positioning and stacking to model valid transshipments
7/12/22	Scheduling	Generate feasible transshipment schedules
21/12/22	Finalization	Wrapping up

Evaluation

You are evaluated in three different ways. Next to permanent evaluation (presence, submissions, work ethic, git repo, implementation), you will present your final result before the whole group and write a technical report about your model. Both content and communication style are graded.

Presentation (date: tba)

You will defend the final design of your model during a short presentation in front of the whole group. This presentation can take no longer than 5 minutes. Do not include problem description and context, but instead focus on important aspects of your implementation. Try to integrate a reflection on the pros and cons of your result throughout the presentation. Inclusion of some algorithmic benchmarks is a big plus.

Report (deadline 07/01/2023, 23:59)

In the report you present an analysis and critical reflection of your model. The focus of this report ought to be on your approach to modeling a container terminal. Defend important design choices and highlight some interesting aspects of your model. Keep your report compact (max. 4 pages, excluding supplementary material). It is not necessary to include a problem description. Use appropriate formatting throughout and take particular care in a clear communication of algorithms: describe them in pseudocode, using comments to further elaborate where necessary.