

# Investigation of different objective functions in constraint-based lock allocation scheduling

jointly by Fraunhofer FOKUS and BTU Cottbus-Senftenberg  
supervised bachelor or master thesis

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Aerial view Brunsbüttel locks, Image source: Federal Waterways and Shipping Administration (WSV)

## Task

In the project "SchleusenNOK40"<sup>1</sup> funded by the Federal Ministry of Transport, Fraunhofer FOKUS is developing a constraint-based lock allocation scheduling sys-

<sup>1</sup><https://www.dbh.de/forschungsprojekte/schleusenok40/>

tem in which the allocation of up to four lock chambers with ships at both ends of the Kiel Canal at the same time is to be carried out according to different optimisation criteria. The task is characterised by the following specifics: Several lock chambers of different sizes are to be allocated by ships that are to be locked or unlocked from the canal (see picture). Simultaneous entry and exit of vessels into/out of the lock chambers on one side is not permitted for safety reasons. It should be noted that the water depths, which depend on the ebb and flow of the tide, must always be sufficient to prevent vessels from running aground. The ships are to be locked in the order of their arrival according to the first-come-first-served principle, whereby long waiting times of individual ships are to be avoided due to fairness and the locks are to be used efficiently.

In the work, different optimisation criteria and objective functions are therefore to be developed, implemented and their effects on occupancy situations, which are also to be determined, are to be examined and compared. Suitable comparison criteria, such as waiting times, utilisation of the lock chambers, but also the runtime behaviour of the optimisation when using different search strategies can also be the focus of the research and development work, depending on the type and scope of the work.

## **What we expect**

- Preparation of a Bachelor's or Master's thesis in the study programmes Computer Science, Information and Media Technology (IMT), Artificial Intelligence Technology (KIT) or Artificial Intelligence (AI).
- Programming experience with Java (the scheduling is implemented in Java).
- Willingness to acquire knowledge and skills in constraint-based programming and optimisation
- Knowledge of the basics of scientific work

## **What can you expect**

- Working in a scientific team
- Good scientific supervision of the work
- Investigation of a practice-relevant question
- Practical application of constraint-based programming

The external supervision of the thesis is usually done "virtually", i.e. using modern web conferencing systems such as MS-Teams or Zoom. A presence in Berlin is not required, but possible on request.