Syllabus

This years course structure

Part I

Introduction to Julia and Modelling

In the first part, an introduction to the basic concepts of programming in Julia and to mathematical modelling is provided. Students will learn the Julia syntax, data types, as well as how to implement loops and functions in Julia. We will introduce core Julia libraries, too, including JuMP and DataFrames. Once these concepts are understood, we will learn how they can be used to solve problems.

Lectures

Welcome and Introduction (I)
Introduction to the course and mathematical modelling

First Steps in Julia (II)
Vectors, matrices, basic operations loops and functions

Packages and Data Management (III)
Package Management, DataFrames, reading and writing data

Modelling with JuMP (IV)
Modeling with JuMP with variables, parameters and constraints

Part II

Applied Optimization with Basic Models

In the second part, we will cover applied optimization based on basic modelling concepts. We will start with the classic capacitated lot-sizing problem and learn how to model and solve it using JuMP.

Lectures

Production Planning in Breweries (V)
A case study on beer brewing based on the classic capacitated lot-sizing problem

Minimizing Split Orders in E-Commerce (VI)
A case study in E-Commerce based on a quadratic knapsack problem

Periodic Library Routing (VII)
A case study on routing books to branches based on a capacitated vehicle routing problem

Police Districting (VIII)
A case study on police districting based on a facility location problem

Part III

Applied Optimization with Advanced Models

In the third part, we will cover more advanced optimisation models and concepts. We will start by looking into three different applied optimisation problems in crowd safety.

Lectures

Safety Planning for the Islamic Pilgrimage in Mecca (IX)
A case study on safety planning for the hajj pilgrimage based on time-dependent network flows

Passenger Flow Control in Urban Rail (X)
A case study on passenger flow control in urban rail based on time-dependent network flows

Arena Seat Planning under Distancing Rules (XI)
A case study on arena seat planning under distancing rules based on the 2-dimensional knapsack problem

Sales Force Deployment for Teams (XII)
A case study on sales force deployment for teams based on a linear programming model

Recap and Discussion (XIII)
We repeat the concepts from the course and discuss all your remaining questions