



# Stochastic and nonlinear methods for solving resource constrained scheduling problems

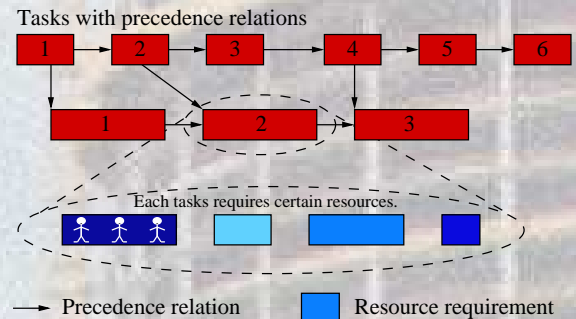
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www.math.tu-berlin.de/coga/projects/matheon/C5/



## Problem type

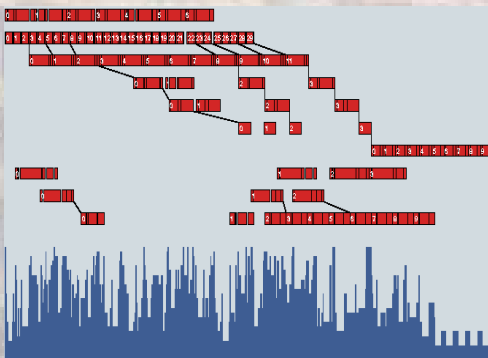
- Temporal planning of projects where each project consists of several tasks.
- Each task has a duration and requires certain limited resources (as machines, staff, tools).
- There are precedence relations between the tasks.
- Objective: find a schedule of minimum length with a feasible assignment of tasks to resources.



## Difficulties

- Solving the decision problem is NP-hard.
- Finding good lower bounds is computationally extremely expensive.
- Even LP-relaxations are hard to solve.
- Limited information during planning process: input data are not (exactly) known at the beginning.

Project schedule with resource usage



## Scheduling with limited information

- Classical models: stochastic and online scheduling model
- Stochastic online scheduling model
  - natural generalization of the two classical models
  - processing times are random variables; probability distribution revealed to a scheduler only at job arrival; no knowledge about future job arrivals.
  - performance of policies is compared against an optimal non-anticipative policy; we provide online policies with performance competitive to the results in the classic models.

## Future plan: focus on logistics

### B13: Optimization under uncertainty in logistics and scheduling

- Problems in logistics are typically very complex. In addition to temporal planning, the locations of resources play a role.
- Our theoretical insights gained within Project C5 will serve as a basis for our future research. This includes experience in
  - solving online *k*-server problems (scheduling simplified transportation requests), joint work with C3
  - modelling and handling limited information, joint work with C3 and C6

## Direct applications



Assignment of transportation requests to automated guided vehicles in the Hamburg harbor (cooperation with Hamburger Hafen and Logistik AG and MATHEON Project B8). ©HHLA



Sequencing transportation requests for slabs in the steel industry (cooperation with PSI AG and MATHEON Project B8). ©Stahl-Zentrum