DM811 (5 ECTS - 2nd Quarter)

Heuristics and
Local Search Algorithms for
Combinatorial Optimization

Heuristikker og
Lokalsøgningsalgoritmer for
Kombinatorisk Optimering

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Problem Solving in Human Mind

Cognitive Psychology:

- investigates the internal mental processes of thought

- cognition as being essentially computational in nature

Information Processing Theory:

▶ search: generate problem states in the problem space using transition operators to go from initial state to final state

▶ restrictions imposed by human processing system (limited short term memory and speed)

▶ heuristic rules: move towards the goal

▶ progress monitoring

Course Contents

Heuristic algorithms: compute, efficiently, good solutions to a problem with no guarantee of optimality.
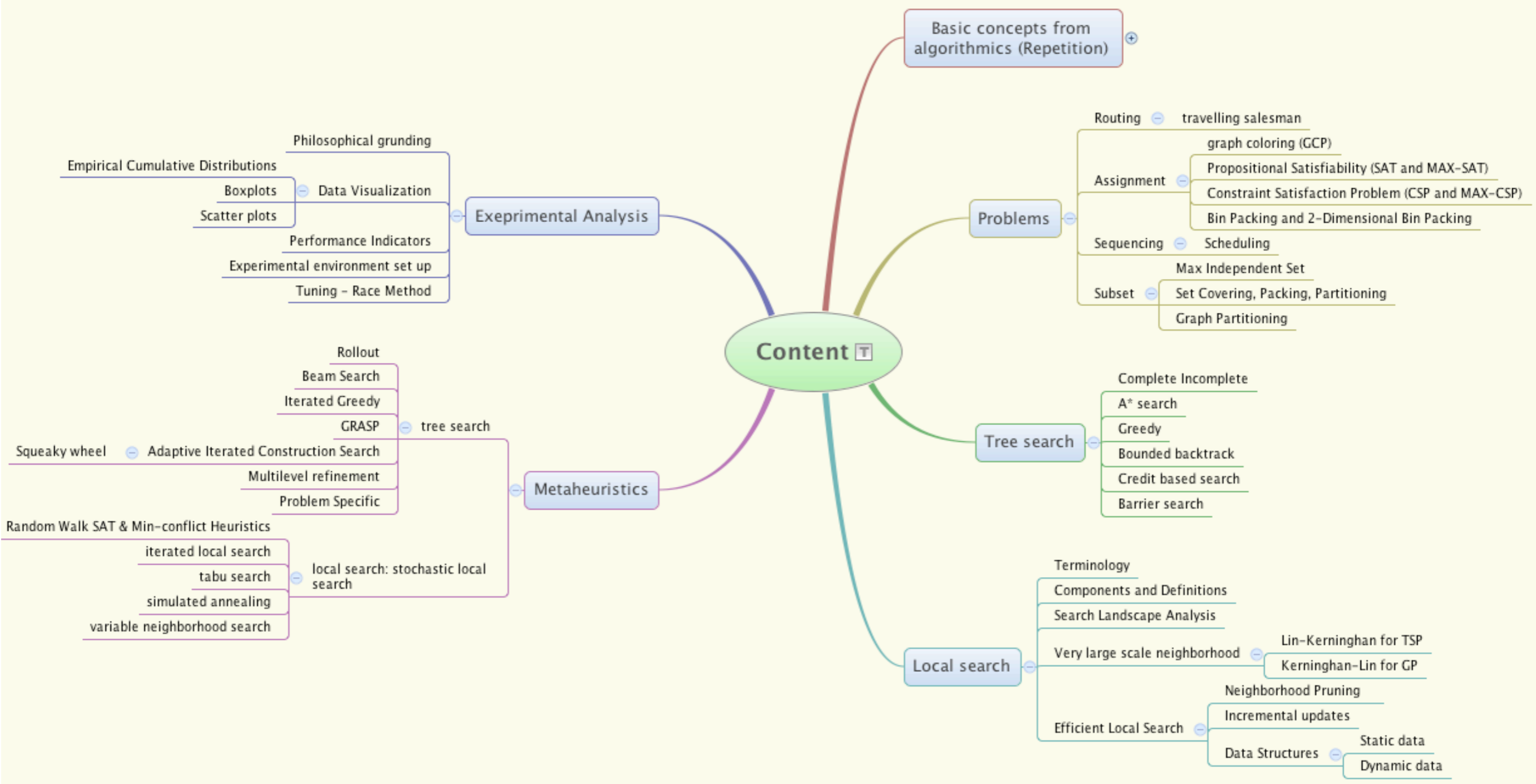
Heuristic Algorithm Engineering
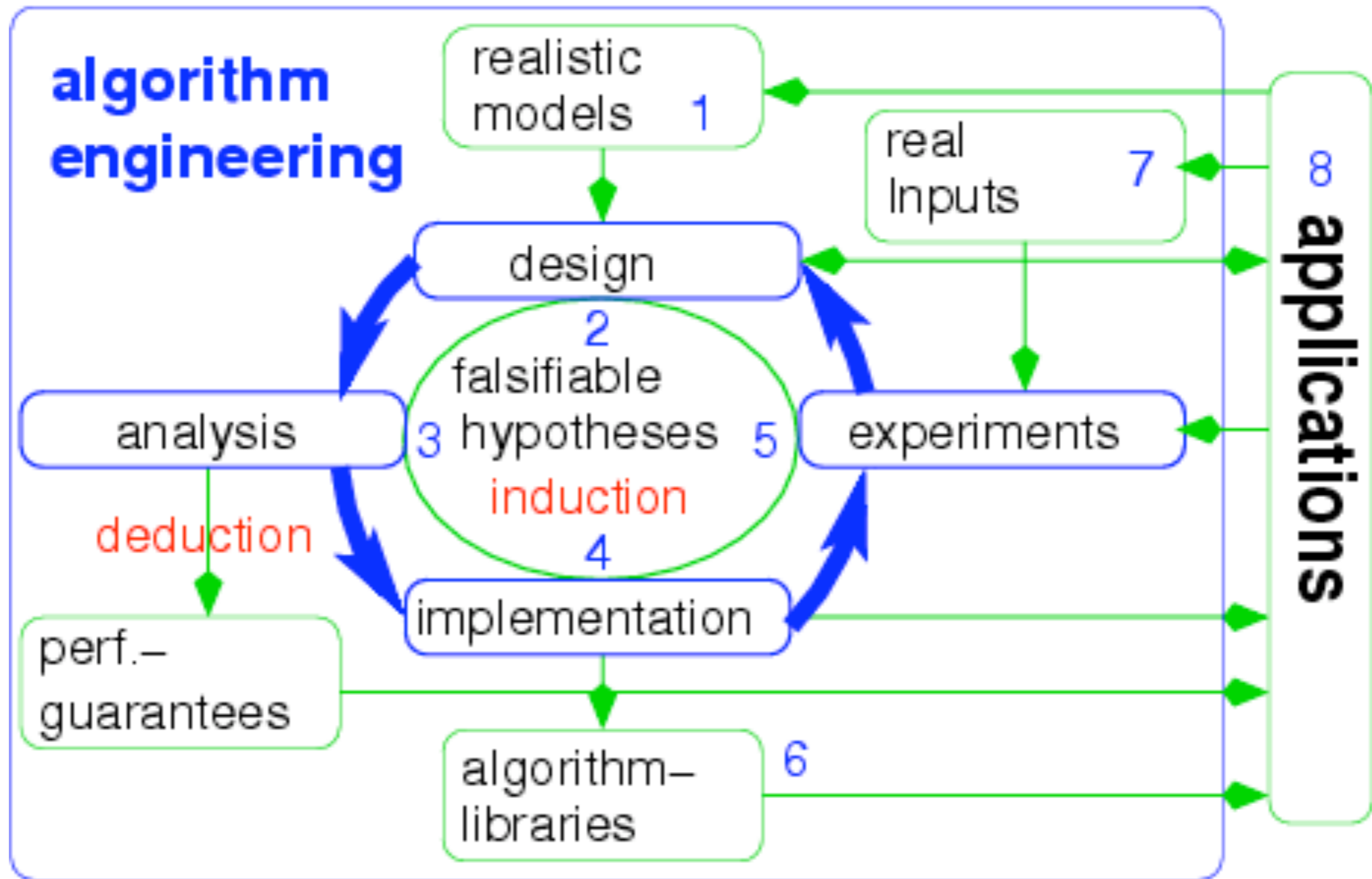
Aims of the course

Learn to solve combinatorial optimization problems:

▶ understand the problem

▶ design a solution algorithm

▶ implement the algorithm

▶ assess the program

▶ describe with appropriate language

14 lectures + running assignments

Prerequisites

✓ DM507 - Algorithms and data structures

✓ DM502, DM503 - Programming A and B

Final Assessment (5 ECTS)

▸ Individual project:

- Design, implementation and experimental analysis of heuristics for a given problem

- Performance matters!

- Deliverables: written report + program

▸ Internal examiner

Course Material

▶ No textbook. Excerpts from several books:

- *Theoretical Aspects of Local Search. Michiels, W.; Aarts, E. & Korst, J. Springer Berlin Heidelberg, (2007).*

- *Constraint-Based Local Search, P. Van Hentenryck and L. Michel. The MIT Press (2005).*

- *COMET User Manual.*

- *...*

▶ Supplementary articles

▶ Slides

▶ www.imada.sdu.dk/~marco/DM811

Comments from Former Students

Comments from Former Students

- DM811 is a **great course** but you should also expect an exam-project which has a heavy workload.
- Fortunately the course is quite fun to work with.
- Be aware that the workload is 100% confused, and it WILL demotivate you beyond belief.
- It is an **interesting course** with a lot of thinking outside the box, which also makes it hard.
- Cool course. Prepare your self for a lot of work. Some of the hardest ETCS..
- It is a challenging course, but seems **very relevan**t, and the things you learn can be used in many other connections.
- It is an **interesting course** and you will do well if you like (and is good at) programming
- I think it is a **nice course**. The general theories in the course are not complicated to understand, but it takes time to transform the ideas to something one can use in a specific problem. Be aware of the course requires a lot of programming. **If you want to work on optimizations in the future this is definitely a course you would gain a lot from**!
- **It is a course that uses a lot of knowledge from other courses**, so you have to be aware of this. Otherwise you will have a hard time. I think the course is OK, but the content is not as concrete as you know it from previous courses. It is (most of the time) taught on examples. You have to have qualified programming skills otherwise you will have a hard time passing the exam.
- I would **recommend this course** to you as **it is a very different way of thinking from normal programming**. It is one of the first courses where **you need to be creative**, and not just follow a certain set of rules. This is one of the parts that makes it hard, too.
- I think you should take DM811 if you are interested in learning some new approaches to optimization problems. However, you should note that it is a programming heavy course, so coding should not come hard to you.