



Course Specification Document

Title	Advanced Algorithms and Data Structure
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Credits	5 ECTS
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Aims	This course aims to familiarize the student with abstract data structures, in addition to providing them with the necessary skills to compare different techniques for problem-solving and algorithm design.
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Intended learning outcomes
On successful completion of this course, the student will be able to: <ul style="list-style-type: none">• Identify advanced abstract data structures (generalized trees, heaps, disjoint sets).• Comprehend and compare different techniques for algorithm design.• Recognize NP-hard problems.• Model problems as linear programs and understand solving approaches.• Familiarize himself with approximation algorithms and their role in dealing with NP-complete problems.

Syllabus
<ul style="list-style-type: none">• Generalized trees: Structure of generalized trees and operations on them.• Binary heap: Structure of binary heaps and operations on them.• Fibonacci heaps Structure of Fibonacci heaps and the operations on them.• Disjoint sets: Structure of disjoint sets and operations on them.• Introduction to algorithm design: General principles in problem-solving, divide and conquer algorithms.• Dynamic programming: General structure of dynamic programming, practical examples.• Greedy algorithms: General structure of greedy algorithms, practical examples.• NP-Complete problems: Problem classification, Reducibility, NP-complete proof.• Linear programming: Modeling problems as linear programming, solution methods for linear programs.• Approximation algorithms: Examples of problems and approximation algorithms.