



Advanced Algorithms and Programming

Course level: Master (M1)

Track(s): CPS2, DSC, MLDM



ECTS Credits: 4 (DSC)/ 3 (CPS2)/ 5 (MLDM)

Course instructors: Amaury Habrard (UJM, Saint- Etienne)

Education period (Dates): 1st semester **Language of instruction:** English

Expected prior-knowledge: Basics on analysis of algorithms, complexity, maths, graph theory and programming skills.

Aim and learning outcomes: Introduction of advanced analysis methods for solving difficult problems. The objective is to be able to detect hard problems and to design and program efficient solutions by dynamic programming, greedy approaches, appropriate heuristics or approximations.

Keywords: Algorithms, complexity analysis, dynamic programming, greedy, branch and bound, heuristics, approximations, programming.

Syllabus:

- Summary/recap on complexity and NP-complete problems.
- Dynamic programming: characterisation, diverse problems.
- Greedy algorithms: characterisation, diverse problems.
- Methods for solving NP-complete problems (branch and bound, graph exploration, heuristics based greedy/random/optimisation approaches)
- Laboratory sessions Programming

Organisation and timetable: Lectures (10h), tutorials (10h) and lab sessions (10h).

Form(s) of Assessment: written exam (2h, coefficient 2), practical work/project (coefficient 1)

Literature and study materials:

Reference books:

-T. Cormen, C. Leiserson, and R. Rivest, "Introduction to Algorithms," The MIT Press, 1990.

-J. Kleinberg and E. Tardos , "Algorithm Design", Pearson International Edition, 2006.

Additional books:

-D.E. Knuth, "The Art of Computer Programming," , Vols. I, II, III, Addison-Wesley, 1981

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