

Course title	Advanced Topics in Theoretical Computer Science
Subtitle	Computational Complexity and its Applications to Databases and Knowledge Representation and Reasoning
Teacher	Andreas Pieris
General abstract of the course	This course covers advanced topics in theoretical aspects of computer science. Topics falling under this module include algorithms, theory of computation, formal models, and semantics. The exact topics of the course may vary from year to year and will depend on both the research interests of the students attending it and on the instructor. Upon completion of this course, the student will have a deeper understanding on some of the latest research problems in one of the areas of theoretical computer science.
Specific abstract of the course <i>(500 characters as the general abstract would be fine)</i>	An important insight that have emerged from Theoretical Computer Science is that algorithmic problems can be classified according to how difficult they are to solve. To classify problems in this way, we need a rigorous model of computation and a theory that allows us to compare problems according to their inherent difficulty. This course is an introduction to the theory of computational complexity and standard complexity classes. Equipped with this powerful theory, we will further discuss the computational complexity of central problems relevant to databases and knowledge representation and reasoning (KRR).
List of main topics	<p>Theory of computational complexity:</p> <ul style="list-style-type: none"> • (Non-)deterministic Turing machines and reductions • Basic complexity classes: PTIME, NP, coNP, PSPACE, EXPTIME • Counting problems and the class #P • Efficient approximation schemes <p>Problems relevant to databases and KRR that will be discussed:</p> <ul style="list-style-type: none"> • Evaluation of propositional programs • Evaluation of conjunctive queries • Consistent query answering • Evaluation of first-order queries • Evaluation of Datalog queries
Expected hours of lectures	12 hours in 4 meetings, 3 hours each
Final assessment <i>(A final exam is mandatory. However, it can be organized flexibly: projects, oral exams, discussion of scientific papers, etc.)</i>	The students will choose a research paper from a given list, and present (i) a summary of the paper, and (ii) analysis and critical thoughts (discussion on follow-up papers that show how the ideas of the paper under review have influenced the field, ideas for future research directions).
Delivery period <i>(Indicate the preferred month for the course delivery)</i>	3-4-5 June or 10-11-12 June