Module MA-INF 1201	**Approximation Algorithms for NP-Hard Problems**		
Workload 270 h	**Credit points** 9 CP	**Duration** 1 semester	**Frequency** at least every year
Module coordinator	Prof. Dr. Marek Karpinski		
Lecturer(s)	Prof. Dr. Marek Karpinski, Prof. Dr. Norbert Blum, Prof. Dr. Rolf Klein, Prof. Dr. Bernhard Korte, Prof. Dr. Jens Vygen, Prof. Dr. Stefan Hougardy, Prof. Dr. Stephan Held		
Classification	**Programme** M. Sc. Computer Science	**Mode** Optional	**Semester** 2. or 3.
Technical skills	Introduction to design and analysis of most important approximation algorithms for NP-hard combinatorial optimization problems, and various techniques for proving lower and upper bounds, probabilistic methods and applications		
Soft skills	Presentation of solutions and methods, critical discussion of applied methods and techniques		
Contents	Approximation Algorithms and Approximation Schemes. Design and Analysis of Approximation algorithms for selected NP-hard problems, like Set-Cover, and Vertex-Cover problems, MAXSAT, TSP, Knapsack, Bin Packing, Network Design, Facility Location. Introduction to various approximation techniques (like Greedy, LP-Rounding, Primal-Dual, Local Search, randomized techniques and Sampling, and MCMC-Methods), and their applications. Analysis of approximation hardness and PCP-Systems.		
Prerequisites	**Recommended:** Introductory knowledge of foundations of algorithms and complexity theory is essential.		

Format

Teaching format	**Group size**	**h/week**	**Workload[h]**	**CP**
Lecture	60	4	60 T / 105 S	5.5
Exercises	30	2	30 T / 75 S	3.5

T = face-to-face teaching; S = independent study

Exam achievements	Oral exam	(graded)
Study achievements	Successful exercise participation	(not graded)
Forms of media		

Literature

- S. Arora, C. Lund: Hardness of Approximations. In: Approximation Algorithms for NP-Hard Problems (D. S. Hochbaum, ed.), PWS, 1996
- M. Karpinski: Randomisierte und approximative Algorithmen für harte Berechnungsprobleme, Lecture Notes (5th edition), Universität Bonn, 2007
- B. Korte, J. Vygen: Combinatorial Optimization: Theory and Algorithms (5th edition), Springer, 2012
- V. V. Vazirani: Approximation Algorithms, Springer, 2001
- D. P. Williamson, D. B. Shmoys: The Design of Approximation Algorithms, Cambridge University Press, 2011