Program	Level	Second cycle
	Name of the program	Theoretical Computer Science

COURSE

Course title	**Advanced Algorithms and Data Structures**			
Course code	Semester	Course status	ECTS	Contact hours (L+AE+LE)
CS 480	II	Mandatory course	8	3+0+2
Lecturer				
Course Goals	To teach students advanced algorithmic concepts and randomized algorithms. Improve programming skills (C++, Java) on complex data structures and algorithms.			
Learning Outcomes	After completing this course the student must demonstrate the knowledge and ability to: - demonstrate knowledge and understanding that provides a foundation for original development and application of ideas; - they can apply their knowledge, understanding and problem-solving abilities in a wider context related to the area of the complexity of algorithms; - can integrate new knowledge from the theory of algorithms; - they can clearly and unambiguously communicate their conclusions and the knowledge and arguments that support them to experts and laymen;			

COURSE CONTENT

- Balanced trees (eg AVL trees, red-black trees, splay trees, treaps)
- Graphs (e.g., topological sorting, finding strongly connected components, matching)
- Advanced data structures (e.g., B-trees, Fibonacci heaps, Binomial heaps)
- Data structures and algorithms based on strings (eg suffix arrays, suffix trees, tries)
- Flow in the network (e.g. maximum flow [Ford-Fulkerson algorithm], max flow – min cut, maximum matching in bipartite graphs)
- Linear programming (e.g., duality, simplex method, interior point algorithms)
- Algorithms with numbers (modular arithmetic, simplicity testing, factorization of whole numbers) - Randomizing algorithms; Stochastic algorithms
- Approximate algorithms
- Amortized analysis;
- Probabilistic analysis
- Online algorithms and competitive analysis

LITERATURE

[1] Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, and Clifford Stein. Introduction to Algorithms. 3nd edition, MIT Press, 2009

[2] J. Kleinberg, E. Tardos. Algorithm Design, Addison-Wesley, 2005

[3] S. Dasgupta, C.H. Papadimitriou, U.V. Vazirani, Algorithms, McGraw-Hill, 2007

[4] Drozdek, Data Structures and Algorithms in C++, Course Technology, 2004

[5] K. Melhorn, Efficient data structures and algorithms, 3Ed , Springer, 2003.

[6] D. Knuth, The Art of Computer Programming, Vol. 1-3, Fundamental Algorithms, Addison-Wesley, Reading, MA, USA, 1997.

[7] 4. M. T. Goodrich, R. Tamassia, D. Mount, Data structures and Algorithms in C++, John Wiley and Sons, 2011.

STUDENT WORKLOAD (hours in a semester)

Lectures	45	Exercises	30	Individual work	125	T o t a l	200

GRADING			**REMARKS**
Criterion	Maximum points	Minimum points	
Midterm exams	20	10	
Prisustvo nastavi	10		
Projects	20	10	
Final exam	50	25	
T o t a l	100	55	