

DOCTORAL (PHD) STUDIES
COURSE UNIT DESCRIPTION

Course unit title	Scientific areas	Faculty	Institute, department
Efficient Algorithms	Informatics (N 009)	Faculty of Mathematics and Informatics	Institute of Computer Science

Study method	Number of credits	Study method	Number of credits
Lectures		Consultations	2 (Autumn sem.)
Individual works	3 (Autumn sem.)	Seminars	1 (Autumn sem.)

Summary
<p>Subject of the course is devoted to doctoral students' study of efficient algorithms, research work and practical work skills. It describes a wide range of important and ever-expanding algorithmic procedures that can be used by doctoral students in Informatics, Linguistics, Economics, Science, as well as in the management of databases, computer graphics, information management, digital and symbolic calculations, other tasks. The topics include:</p> <ul style="list-style-type: none"> • Algorithms, algorithm roles in calculation, algorithm technology, asymptotic estimates (A. Juozapavičius) • Divide-and-conquer paradigm, sorting algorithms, recursive trees, recursive expressions (A. Juozapavičius) • Hash and hashing tables, advanced hashing (one-dimensional, multidimensional), grid algorithms (A. Juozapavičius) • Dynamic programming, generic algorithms, aggregate analysis (T. Meškauskas) • Multi-hierarchical structures, Red-black trees, B-trees, R-trees (A. Juozapavičius) • Heap structure, Heapsort, Binomial and Fibonacci heap structures, Union-find sets (E. Manstavičius) • Elementary graph algorithms, Minimal spanning trees (E. Manstavičius) • Shortest path algorithms, Maximum flow algorithms (E. Manstavičius) • Multi-thread algorithms, Multiple merge-sort sorting (T. Meškauskas) <p>Joining the topics there are a lot of practical tasks relevant to doctoral students' need.</p>

Main literature
1. Robert Sedgewick. Algorithms, Parts 1-4 Addison-Wesley, 1999.
2. Robert Sedgewick. Algorithms, Part 5, Addison-Wesley, 2000.
3. Dinesh P. Mehta, Sartaj Sahni. Handbook of Data Structures and Applications, Chapman & Hall/CDC, 2005. (https://www.semanticscholar.org/paper/Handbook-of-Data-Structures-and-Applications-Mehta-Sahni/c022f6c00005f72517b0eb0461498a52fdeda541)
4. Thomas H. Cormen, Charles E. Leiserson, Ronald R. Rivest, Clifford Stein. Introduction to Algorithms. The MIT Press, Cambridge, MA, 2009 (https://mitpress.mit.edu/books/introduction-algorithms-third-edition)

5. Peter Brass. Advanced Data Structures, Cambridge University Press, 2008
(<https://www.amazon.com/Advanced-Data-Structures-Peter-Brass/dp/0521880378>)

6. Algimantas Juozapavičius. Efektyvūs Algoritmai, TEV, 2009.

Lecturer(s) (name, surname)	Science degree	Main publications
Algimantas Juozapavičius	Prof.	http://www.elaba.mb.vu.lt/mif/?aut=Algimantas+Juozapavicius
Tadas Meškauskas	Prof.	http://www.elaba.mb.vu.lt/mif/?aut=Tadas+Meskauskas
Eugenijus Manstavičius	Prof.	http://www.elaba.mb.vu.lt/mif/?aut=Eugenijus+Manstavicius