I043	**Bioinformatics**	L	S	E	ECTS
		2	0	2	6

Course objectives. To introduce the problems of DNA and RNA sequencing in bioinformatics along with their algorithmic solutions. Students will solve problems which involve a large amount of real world data using efficient algorithms and appropriate data structures.

Course prerequisites. Data structures and algorithms I and II. Applied mathematics for computer science or Combinatorial and discrete mathematics.

Syllabus.

1. Introduction. Biological background. RNA, DNA and proteins. Chromosomes. Genes. Exons and introns. Transcription. Translation. Splicing. Alternative splicing. Methods for DNA analysis.
2. Restriction mapping. Partial digest problem. Brute force solution. Efficient solution.
3. Motif finding problem. Alignment matrix and consensus string. Search trees. Brute force solution. Branch-and-bound solution.
4. Greedy algorithms.
5. Dynamic programming algorithms.
6. Divide-and-conquer algorithms.
7. Graph algorithms.
8. Combinatorial pattern matching. BLAST.

EXPECTED LEARNING OUTCOMES

No.	EXPECTED LEARNING OUTCOMES
1.	To demonstrate the knowledge and understanding which can serve as the foundation for developing and application of the original ideas.
2.	To apply the knowledge, understanding and skills in a broad variety of problems in the field of bioinformatics.
3.	To integrate new knowledge in the field of bioinformatics.
4.	To be able to present conclusions and findings to the experts and laymen based on the knowledge and experience.
5.	To apply the acquired skills onto further education in this field.

COUPLING OF THE LEARNING OUTCOMES, TEACHING PROCESS ORGANIZATION AND THE EVALUATION OF THE TEACHING OUTCOMES

TEACHING PROCESS ORGANIZATION	ECTS	EXPECTED LEARNING OUTCOMES **	STUDENT ACTIVITY *	EVALUATION METHOD	SCORE	
					min	max

Lecture attendance	1	1-5	Class atendance, discussion, solving the problems individually and in a team	Lists with signatures, observing the activity during the lectures	0	0
Homework	1	1, 3-5	Solving the problems individually	Grading	20	30
Student seminar	2	1, 3, 4	Preparation for the written exam	Grading, discussion	30	50
Student project	2	1-5	Solving a real life problem individually	Grading, discussion	0	20
TOTAL	6				50	100

Teaching methods and student assessment. During lectures students will be presented with the problems in bioinformatics as well as their algoritmhic solutions. Excersises will be held both in auditorium and computer laboratory with the focus on programming in C++ programming language. Lecture and excersise attendance is mandatory. Written exam will be held after all the lectures and excersises. Positive scores on the seminars, which students hold during the semester, can be used as a substitute for the written exam. Students may improve their grades by writing given pieces of homework and doing the final project.

Can the course be taught in English: Yes.

Basic literature:

1. P.A. Pevzner, N.C. Jones, An Introduction to Bioinformatics Algorithms (Computational Molecular Biology), The MIT Press, 2004.

Recommended literature:

1. M.S. Waterman, Introduction to Computational Biology - Maps, Sequences and Genomes, CRC Press, 1995.
2. D. Gusfield, Algorithms on Strings, Trees and Sequences: Computer Science and Computational Biology, Cambridge University Press, 1997.