Course name: **Evolutionary algorithms & search strategies**		
Field of study: **Computer science**	Type of study: **Full-time**	Sourse code: **CIDM1_02**
Course characteristics: **Mandatory within the additional content**	Level: **Second (M.Sc.)** **Computational Intelligence and Data Mining**	Year: **I** Semester: **I**
Type of classes: **lectures, laboratories, project**	Hours per week: **2 lect, 2 lab, 1 proj**	ECTS points amount: **5 ECTS**

COURSE GUIDE

AIMS

A1. Introducing the students to the evolutionary algorithms and search strategies.

A2. Obtaining by the students the practical skills in the field of evolutionary algorithms and search strategies.

PREREQUISITES

1. Knowledge of mathematics and basics of computer science.
2. Basic knowledge of probability theory and mathematical statistics.
3. Basic knowledge in the field of optimization theory.
4. Basic knowledge and skills in the field of computer programming.
5. Ability to use different sources of information and technical documentation.
6. Ability to work independently and in a group.
7. Ability to correctly interpret and present their own activities.

LEARNING OUTCOMES

EK 1 – Students will possess basic theoretical knowledge in the field of evolutionary algorithms and search strategies.

EK 2 – Students will possess knowledge about different types of evolutionary algorithms.

EK 3 – Students will know how to apply evolutionary algorithms to different problems.

EK 4 – Students will be familiar with applications of evolutionary algorithms in hybrid intelligent systems.

EK 5 – Students will be able to solve various optimization problems, working independently and in a group.

EK 6 – Students will be able to present results of their work, with correct interpretation, using proper sources of information and documentation.

CONTENT

Lectures		**Hours**
Lect. 1	Introduction to the basic genetic algorithm	**2**
Lect. 2	Optimization problems and search strategies	**2**
Lect. 3	Different types of evolutionary algorithms	**2**
Lect. 4	Applications of evolutionary algorithms	**2**

Lect. 5	Encoding and genetic operators	**2**
Lect. 6	Fitness functions	**2**
Lect. 7	Selection methods	**2**
Lect. 8	Mutation and crossover	**2**
Lect. 9	Convergence of the genetic algorithm	**2**
Lect. 10	Parameters of the evolutionary algorithms	**2**
Lect. 11	Evolution strategies	**2**
Lect. 12	Evolutionary programming	**2**
Lect. 13	Genetic programming	**2**
Lect. 14	Swarm intelligence and other optimization techniques	**2**
Lect. 15	Evolutionary algorithms in hybrid intelligent systems	**2**
Laboratories		**Hours**
Lab. 1	Software overview	**2**
Lab. 2	Basic genetic algorithm in MATLAB	**2**
Lab. 3	Optimization problems in MATLAB	**2**
Lab. 4	Modifications of the basic genetic algorithm	**2**
Lab. 5	Genetic algorithm in EXCEL	**2**
Lab. 6	Evolutionary algorithms in VBA	**2**
Lab. 7	Various applications of evolutionary algorithms	**2**
Lab. 8	Traveling salesman problem	**2**
Lab. 9	Example of multi-objective optimization	**2**
Lab. 10	Example of optimization with constraints	**2**
Lab. 11	Example of scheduling problem	**2**
Lab. 12	Application to neural network learning	**2**
Lab. 13	Genetic programming in LISP	**2**
Lab. 14	Evolution strategies in MATLAB	**2**
Lab. 15	Evolutionary programming	**2**
Projects		**Hours**
Proj. 1	Sorting by use of an evolutionary algorithm	**1**
Proj. 2	Resource allocation problem solved by an evolutionary algorithm	**2**
Proj. 3	Knapsack problem solved by an evolutionary algorithm	**2**
Proj. 4	Class schedule created by use of an evolutionary algorithm	**3**
Proj. 5	Job shop scheduling problem solved by an evolutionary algorithm	**2**
Proj. 6	Bin packing problem solved by an evolutionary algorithm	**2**
Proj. 7	Routing with constraints problem solved by an evolutionary algorithm	**3**

TEEACHING TOOLS

1. – lectures using multimedia presentations
2. – blackboard and chalk or whiteboards and pens
3. – laboratory guides and tutorials
4. – reports from laboratory activities (paper and electronic versions)
5. – computer stations with software

LITERATURE

1. Michalewicz Z., Genetic Algorithms + Data Structures = Evolution Programs, Springer, 1992.
2. Goldberg D.E., Genetic Algorithms in Search, Optimization, and Machine Learning, Addison-Wesley, 1989.
3. Davis L. (Ed.), Handbook of Genetic Algorithms, Van Nostrand Reinhold, New York, 1991.
4. Mitchell M., An Introduction to Genetic Algorithms, The MIT Press, 1996.
5. De Jong K., Evolutionary Computation: A Unified Approach, The MIT Press, 2006.

6. Fogel D.B., Evolutionary Computation: Towards a New Philosophy of Machine Intelligence, IEEE Press, New York, 1995.
7. Koza J.R., Genetic Programming: On the Programming of Computers by means of Natural Evolution, MIT Press, Massachusetts, 1992.
8. Beyer H.-G., Theory of Evolution Strategies, Springer-Verlag, 2001.
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TEACHERS

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