SYLLABUS

1. Information regarding the programme

1.1 Higher education institution	**Babeş Bolyai University**
1.2 Faculty	**Faculty of Mathematics and Computer Science**
1.3 Department	**Department of Computer Science**
1.4 Field of study	**Computer Science**
1.5 Study cycle	**Master**
1.6 Study programme / Qualification	**Computer Science**

2. Information regarding the discipline

2.1 Name of the discipline	**Evolutionary Algorithms**						
2.2 Course coordinator	**Prof.PhD. Dumitru Dumitrescu**						
2.3 Seminar coordinator	**Prof.PhD. Dumitru Dumitrescu**						
2.4. Year of study	**1**	2.5 Semester	**2**	2.6. Type of evaluation	**E**	2.7 Type of discipline	**Compulsory**

3. Total estimated time (hours/semester of didactic activities)

3.1 Hours per week	3	Of which: 3.2 course	2	3.3 seminar/laboratory	1 sem
3.4 Total hours in the curriculum	42	Of which: 3.5 course	28	3.6 seminar/laboratory	14
Time allotment:					hours
Learning using manual, course support, bibliography, course notes					20
Additional documentation (in libraries, on electronic platforms, field documentation)					10
Preparation for seminars/labs, homework, papers, portfolios and essays					23
Tutorship					7
Evaluations					20
Other activities:					-

3.7 Total individual study hours	80
3.8 Total hours per semester	150
3.9 Number of ECTS credits	6

4. Prerequisites (if necessary)

4.1. curriculum	
4.2. competencies	Average programming skills

5. Conditions (if necessary)

5.1. for the course	

6. Specific competencies acquired

Professional competencies	🕐 Knowledge, understanding and use of basic concepts of EMCO
Transversal competencies	🕐 Ability to apply multicriteria optimization problems to different real life problems 🕐 Ability to model phenomena using multicriteria optimization problem

7. Objectives of the discipline (outcome of the acquired competencies)

7.1 General objective of the discipline	an introduction to the field studied. the basic notion, techniques and algorithms. the background for advanced courses.
7.2 Specific objective of the discipline	application of EA optimization models/techniques.

8. Content

8.1 Course	Teaching methods	Remarks
Principles of evolutionary computation. Basic and related models. Structure of an evolutionary algorithm	Exposure: description, explanation, examples, discussion of case studies	
Genetic algorithms. Problem representation and fitness function. Canonical genetic algorithm.	Exposure: description, explanation, examples, discussion of case studies	
Selection – selection pressure; takeover time; standard schemes.	Exposure: description, explanation, examples, debate, dialogue	
Selection – proportional selection; premature convergence; scaling mechanisms; rank-based selection	Exposure: description, explanation, examples, discussion of case studies	
Selection – binary tournament; q-tournament; elitism; steady state EAs; Michalewicz selection; Boltzmann selection	Exposure: description, explanation, examples, proofs	
Variation operators for binary encoding; Variation operators for real-valued encoding	Exposure: description, explanation, examples, proofs, debate, dialogue	
Hybridisation – specific representation; hybridisation	Exposure: description, explanation, examples, discussion of case studies	
Parameter setting and adaptive Gas; adaptive fitness of a search operator	Exposure: description, explanation, examples	

Adaptive representation –messy genetic algorithms, delta coding; diploidic representation	Exposure: description, explanation, examples, discussion of case studies	
Population models and parallel implementations - niching methods; fitness sharing; island and stepping stone models;	Exposure: description, explanation, examples, debate	
Population models and parallel implementations - multiple solutions: crowding; fine-grained diffusion models; coevolution; multiple population models	Exposure: description, explanation, examples, discussion of case studies	
Evolution strategies – introduction. (1+1) strategy; standard mutation; Cauchy perturbations;	Exposure: description, explanation, examples, discussion of case studies	
Evolutionary programming – sequential machine model; function optimization; Cauchy perturbation.	Exposure: description, explanation, examples, discussion of case studies	
Search and optimization using evolutionary algorithms.	Exposure: description, examples, discussion of case studies, live demo	

Bibliography

DUMITRESCU,D.,B Lazzerini,Evolutionary Computation, CRC Press, New York, Boca Raton, 2000

DUMITRESCU, D.,Principiile Inteligentei artificiale, Editura Albastra, Cluj,2000.

DUMITRESCU, D.,Algoritmi genetici si strategii evolutive. Aplicatii in Inteligenta Artificiala, Editura Albastra, Cluj,2000.

DEB, K., Multiobjective optimization using Evolutionary Algorithms, Wiley, 2001.

GOLDBERG, D. E., Genetic Algorithm. Addison-Wesley, Reading, 1989.

MICHALEWICZ, Z., Genetic Algorithms + Data Structures = Evolution Programs, Springer, Berlin, 1992.

8.2 Seminar	Teaching methods	Remarks
1. Genetic algorithms. Problem representation and fitness function. Canonical genetic algorithm. -problems	Explation, dialogue, case studies	The seminar is structured as 2 hours classes every second week
2. Selection – proportional selection; premature convergence; scaling mechanisms; rank-based selection	Dialogue, debate, case studies, examples, proofs	
3. Selection – binary tournament; q-tournament; elitism; steady state EAs; Michalewicz selection; Boltzmann selection -problems	Dialogue, debate, case studies, examples, proofs	
4. Variation operators for binary encoding Variation operators for real-valued encoding -problems	Dialogue, debate, case studies, examples	
5. Parameter setting and adaptive Gas; adaptive fitness of a search operator -problems	Dialogue, debate, case studies, examples	
6. Population models and parallel implementations - niching methods; fitness sharing; island and	Dialogue, debate, case studies, examples	

stepping stone models;		
7. Evolutionary programming – sequential machine model; function optimization; Cauchy perturbation.	Dialogue, debate, case studies, examples	

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DUMITRESCU,D.,B Lazzerini,Evolutionary Computation, CRC Press, New York, Boca Raton, 2000

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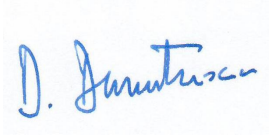
9. Corroborating the content of the discipline with the expectations of the epistemic community, professional associations and representative employers within the field of the program

- The course exists in the studying program of all major universities in Romania and abroad;
- The content of the course is considered important in the introduction to Evolutionary Algorithms

10. Evaluation

Type of activity	10.1 Evaluation criteria	10.2 Evaluation methods	10.3 Share in the grade (%)
10.4 Course	- know the basic principle of the domain; - apply the course concepts - problem solving	Written exam	50%
10.5 Seminar/lab activities	- be able to implement course concepts and algorithms - be able to make a practical project during the semester	-Practical project -documentation -portofolio -continous observations	50%
10.6 Minimum performance standards			
➢ At least grade 5 (from a scale of 1 to 10) at both written exam and laboratory work.			

Date Signature of course coordinator Signature of seminar coordinator



Prof.PhD. Dumitru Dumitrescu

Date of approval	Signature of the head of department
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