

## SYLLABUS

### 1. Information regarding the programme

1.1 Higher education institution	<b>Babe Bolyai University</b>
1.2 Faculty	<b>Faculty of Mathematics and Computer Science</b>
1.3 Department	<b>Department of Computer Science</b>
1.4 Field of study	<b>Computer Science</b>
1.5 Study cycle	<b>Bachelor</b>
1.6 Study programme / Qualification	<b>Computer Science</b>

### 2. Information regarding the discipline

2.1 Name of the discipline	<b>Artificial Intelligence</b>						
2.2 Course coordinator	<b>Associate Prof. Crina Grosan</b>						
2.3 Seminar coordinator	<b>Associate Prof. Crina Grosan</b>						
2.4. Year of study	<b>2</b>	2.5 Semester	<b>4</b>	2.6. Type of evaluation	<b>E</b>	2.7 Type of discipline	<b>Compulsory</b>

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

3.1 Hours per week	4	Of which: 3.2 course	2	3.3 seminar/laboratory	1 sem+ 1 lab
3.4 Total hours in the curriculum	56	Of which: 3.5 course	28	3.6 seminar/laboratory	28
Time allotment:					hours
Learning using manual, course support, bibliography, course notes					28
Additional documentation (in libraries, on electronic platforms, field documentation)					14
Preparation for seminars/labs, homework, papers, portfolios and essays					28
Tutorship					7
Evaluations					20
Other activities: .....					-
3.7 Total individual study hours	70				
3.8 Total hours per semester	153				
3.9 Number of ECTS credits	6				

### 4. Prerequisites (if necessary)

4.1. curriculum	<ul style="list-style-type: none"> <li>Graph Theory, Data Structures and Algorithms</li> </ul>
4.2. competencies	<ul style="list-style-type: none"> <li>Average programming skills in a high level programming language</li> </ul>

### 5. Conditions (if necessary)

5.1. for the course	<ul style="list-style-type: none"> <li></li> </ul>
5.2. for the seminar /lab activities	<ul style="list-style-type: none"> <li>Laboratory with computers; high level programming language environment</li> </ul>

## 6. Specific competencies acquired

<b>Professional competencies</b>	<ul style="list-style-type: none"> <li>• An introduction to the field of AI.</li> <li>• Acquire the basic notion, techniques and algorithms of AI.</li> <li>• The background for advanced AI courses.</li> </ul>
<b>Transversal competencies</b>	<ul style="list-style-type: none"> <li>• Ability to apply AI techniques to different real life problems</li> <li>• Ability to model problems in an interdisciplinary field</li> </ul>

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

7.1 General objective of the discipline	<ul style="list-style-type: none"> <li>• Ability to understand and use the basic AI algorithms and principles.</li> <li>• Ability to model real life problems as AI problems and find optimal solutions to them</li> </ul>
7.2 Specific objective of the discipline	<ul style="list-style-type: none"> <li>• Acquire the knowledge about the main classes of soft computing algorithms, the basic notions of game theory and knowledge base reasoning.</li> </ul>

## 8. Content

8.1 Course	Teaching methods	Remarks
1. Introduction to AI	Exposure: description, explanation, examples, discussion of case studies	
2. Problem solving as search Problem spaces Uninformed search Breadth first search Depth first search Limited depth first search Iterative-deepening search Uniform cost search	Exposure: description, explanation, examples, discussion of case studies	
3. Problem solving as search Informed search Heuristic search Best-first search Greedy A* algorithm A* variants	Exposure: description, explanation, examples, debate, dialogue	
4. Local search Simulated annealing Hill climbing	Exposure: description, explanation, examples, discussion of case studies	
5. Game playing Minimax search Alpha-beta pruning	Exposure: description, explanation, examples, proofs	
6. Knowledge representation and reasoning	Exposure: description,	

Knowledge based systems	explanation, examples, proofs, debate, dialogue	
7. Rule based systems Uncertainty management in rule based systems.	Exposure: description, explanation, examples, discussion of case studies	
8. Fuzzy systems	Exposure: description, explanation, examples	
9. Neural networks Single layer neural networks Perceptron model	Exposure: description, explanation, examples, discussion of case studies	
10. Neural networks Multi-layer neural networks Backpropagation learning	Exposure: description, explanation, examples, debate	
11. Hopfield networks Self organizing maps	Exposure: description, explanation, examples, discussion of case studies	
12. Evolutionary computation Evolutionary algorithms	Exposure: description, explanation, examples, discussion of case studies	
13. Evolutionary Computation Evolutionary strategies Evolutionary programming Genetic programming	Exposure: description, explanation, examples, discussion of case studies	
14. Swarm intelligence Particle swarm optimization Ant Colonies optimization	Exposure: description, examples, discussion of case studies, live demo	
Bibliography GROSAN, C., Abraham, A., Intelligent Systems: a modern approach, Springer Verlag GERMANY, 2011 PATRIDGE, D., Artificial Intelligence. Applications in the future of software engineering, Ellis Harwood Series in A.I., John Wiley & Sons, New York 1986. RICH, E. Artificial Intelligence, Mc.Graw Hill, 1989. WINSTON, P., Inteligenta artificiala, Ed.Tehnica, 1980. GOLDBERG, D. E., Genetic Algorithm. Addison-Wesley, Reading, 1989.		
8.2 Seminar	Teaching methods	Remarks
1. Introduction to AI: A Turing and it's role, the Darmouth College Conference	Explation, dialogue, case studies	The seminar is structured as 2 hours classes every second week
2. Informed, Uninformed, Local search	Dialogue, debate, case studies, examples, proofs	
3. Games	Dialogue, debate, case studies, examples, proofs	
4. Fuzzy systems: construction	Dialogue, debate, case studies, examples	
5. Neural networks: example and applications	Dialogue, debate, case studies, examples	
6. Genetic algorithms: examples and problem solving	Dialogue, debate, case studies, examples	
7. Swarm intelligence examples and applications	Dialogue, debate, case studies, examples	
Bibliography 1. GROSAN, C., Abraham, A., Intelligent Systems: a modern approach, Springer Verlag GERMANY,		

2011		
2. RUSSELL, S., J., NORVIG, P., Artificial intelligence: A modern approach, N.J. Prentice Hall/Pearson Education, 2003		
8.3 Laboratory	Teaching methods	Remarks
1. Task: Discuss the main principles of AI, first research publications and contributions	case studies, dialogues	
2. Task: Implement a search algorithm, given from a list of projects	case studies, testing	
3. Task: solve (implemnet and test) a game, given from a list of projects	case studies, testing	
4. Task: implement a fuzzy sistem	case studies, testing	
5. Task: implement a neural network and test it for a given problem	case studies, testing	
6. Task: implement a genetic algorithm and test it for a given problem	case studies, testing	
7. Task: implemnet a swarm intelligence algorithm and test it for an optimization problem	case studies, testing	
Bibliography		
1. GROSAN, C., Abraham, A., Intelligent Systems: a modern approach, Springer Verlag GERMANY, 2011		
2. RUSSELL, S., J., NORVIG, P., Artificial intelligence: A modern approach, N.J. Prentice Hall/Pearson Education, 2003		

**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**

<ul style="list-style-type: none"> <li>• The course follows the scheme and structure used by the most important universities in USA and Europe;</li> <li>• The course exists in the studying program of all major universities in Romania and abroad;</li> </ul>
--

**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 AI domain; - apply the course concepts - problem solving	Written exam (there will be two written exams)	60%
10.5 Seminar/lab activities	- be able to implement the algorithm described in the course and discussed during the seminars	-Lab assignments	40%
10.6 Minimum performance standards			

➤ At least grade 5 (from a scale of 1 to 10) at both written exams and laboratory work.

Date                      Signature of course coordinator                      Signature of seminar coordinator

..... Associate prof. Crina Grosan                      Associate Prof. Crina Grosan

Date of approval                      Signature of the head of department

.....