SYLLABUS

1. Information regarding the programme

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

2. Information regarding the discipline

2.1 Name of the discipline	**Cooperative Intelligent Agents**						
2.2 Course coordinator	**Prof. PhD Czibula Gabriela**						
2.3 Seminar coordinator	**Prof. PhD Czibula Gabriela**						
2.4. Year of study	**2**	2.5 Semester	**3**	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					35
Additional documentation (in libraries, on electronic platforms, field documentation)					45
Preparation for seminars/labs, homework, papers, portfolios and essays					47
Tutorship					15
Evaluations					16
Other activities:					-

3.7 Total individual study hours	158
3.8 Total hours per semester	200
3.9 Number of ECTS credits	8

4. Prerequisites (if necessary)

4.1. curriculum	
4.2. competencies	

5. Conditions (if necessary)

5.1. for the course	
5.2. for the seminar /lab activities	Laboratory with computers; high level programming language environment (.NET or any Java environement a.s.o.)

6. Specific competencies acquired

Professional competencies	• Understanding the concepts, methods and models used in MultiAgent Systems. • Understanding the principles, design and implementation of agent based systems. • Learning to conduct incipient original research in Distributed Artificial Intelligence.
Transversal competencies	• The ability to apply multiagent systems in solving real world problems. • Responsible execution of lab assignments, research and practical reports. • Application of efficient and rigorous working rules. • Manifest responsible attitudes toward the scientific and didactic fields. • Respecting the professional and ethical principles.

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

7.1 General objective of the discipline	• To present the field of Intelligent Agents as a new research and application domain of Artificial Intelligence and Distributed AI.
7.2 Specific objective of the discipline	• To introduce the student a new field of Artificial Intelligence - Distributed AI. • To allow a comparative approach of theoretical aspects in distributed and classic AI. • To induce the necessity of DAI through the study of relevant industrial and practical applications. • To present some "elementary" intelligent activities and how are they achieved by cooperative agents in multiagent systems.

8. Content

8.1 Course	Teaching methods	Remarks
1. Introduction • Distributed Artificial Intelligence • The concept of agent and intelligent agent • Applications	• Interactive exposure • Explanation • Conversation • Didactical demonstration	
2. Agents and intelligent agents (1) • Definitions, properties, taxonomies • Abstract and concrete architectures for intelligent agents • Software agents • Mobile agents, interface agents	• Interactive exposure • Explanation • Conversation • Didactical demonstration	
3. Agents and intelligent agents (2) • Application domains • Agents and Objects • Agents and Expert Systems • Agent based software engineering	• Interactive exposure • Explanation • Conversation • Didactical demonstration	
4. Agent based systems (1) • Design principles of an agent based system • Conceptual modeling using agents	• Interactive exposure • Explanation	

• Examples	• Conversation • Didactical demonstration	
5. Agent based systems (2) • Agents in complex software systems • Implementation of the agent function • Examples	• Interactive exposure • Explanation • Conversation • Didactical demonstration	
6. Multiagent systems and societies of agents • Coordination, cooperation, communication - protocols • Negotiation • Communication languages between agents • KQML, FIPA-ACL	• Interactive exposure • Explanation • Conversation • Didactical demonstration	
7. Applications of agents and MAS (1) • Intelligent agents in e-business and e-commerce • Intelligent agents in e-banking • Intelligent agents for Distributed Data Mining	• Interactive exposure • Explanation • Conversation • Didactical demonstration	
8. Applications of agents and MAS (2) • Information agents • Intelligent agents in software engineering • Ant systems	• Interactive exposure • Explanation • Conversation • Didactical demonstration	
9. Distributed constraint satisfaction problems • The problem definition • The hyperresolution based consistency algorithm • Asynchronous backtracking • Examples	• Interactive exposure • Explanation • Conversation • Didactical demonstration	
10. Distributed path finding problems • Asynchronous dynamic programming • Learning Real Time A* • Bidirectional search algorithm • Real time multiagent search algorithm • Examples	• Interactive exposure • Explanation • Conversation • Didactical demonstration	
11. Two player games in DAI • The problem • The Minimax search procedure • Minimax with alpha-beta pruning	• Interactive exposure • Explanation • Conversation • Didactical demonstration	
12. Learning in multiagent systems • Types of learning • Cooperative learning in multiagent systems • Team learning • Concurrent learning • Application domains for multiagent learning	• Interactive exposure • Explanation • Conversation • Didactical demonstration	
13. DAI research reports presentation	• Interactive exposure • Conversation	
14. DAI research reports presentation	• Interactive exposure	

	• Conversation	

Bibliography

1. Czibula, G., Sisteme multiagent în Inteligenţa Artificială Distribuită. Arhitecturi şi aplicaţii. Editura RisoPrint, Cluj-Napoca, 2006
2. Şerban, G., Pop, H.F., Tehnici de Inteligenţă Artificială. Abordări bazate pe Agenţi Inteligenţi, Ed. Mediamira, Cluj-Napoca, 2004
3. Weiss, G. (Ed.): Multiagent Systems: A Modern Approach to Distributed Artificial Intelligence, MIT Press, 1999
4. Russell, J.S, Norvig, P., Artificial Intelligence- A Modern Approach, Prentice- Hall, Inc., New Jersey, 1995

8.2 Seminar / laboratory	Teaching methods	Remarks
		The seminar is structured as 2 hours classes every second week
1. Administration of seminars. Survey of the sources of information available on Internet and Intranet	• Interactive exposure • Explanation • Conversation	
2. Survey of the sources of information available on Internet and Intranet; chosing the paper topic and scheduling the presentation.	• Documentation • Explanation • Conversation	
An agent based system (Project 1) will be developed using an open source agent development environment. The second project (Project 2) will be realized from scratch and documented. The software will have to demonstrate the use of multiple agents for some specific task.		
3. Problem definition and specification for Project 2	• Lab assignment • Explanation • Conversation	
4. Comments about the solution (problem analysis) and conceptual modeling of the problem using agents (Project 2). Demonstration of Project 1	• Lab assignment • Explanation • Conversation	
5. Design documentation for Project 2	• Lab assignment • Explanation • Conversation	
6. Design documentation for Project 2	• Lab assignment • Explanation • Conversation	
7. The electronic version of the source code, test files and any other files required to test Project 2. Project 2 demonstration	• Lab assignment • Explanation • Conversation	

Bibliography

1. Czibula, G., Sisteme multiagent în Inteligenţa Artificială Distribuită. Arhitecturi şi aplicaţii. Editura RisoPrint, Cluj-Napoca, 2006
2. Şerban, G., Pop, H.F., Tehnici de Inteligenţă Artificială. Abordări bazate pe Agenţi Inteligenţi, Ed. Mediamira, Cluj-Napoca, 2004
3. Weiss, G. (Ed.): Multiagent Systems: A Modern Approach to Distributed Artificial Intelligence, MIT Press, 1999
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1995

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 content of the discipline is consistent with the similar disciplines from other romanian universities and universities from abroad, as well as with the requirements that potential employers would have in the distributed artificial intelligence field.

10. Evaluation

Type of activity	10.1 Evaluation criteria	10.2 Evaluation methods	10.3 Share in the grade (%)
10.4 Course	• A theoretical research report on an agent based topic, based on some recent research papers should be prepared and presented	Evaluation of the research report (a written paper of about 10 pages and an oral presentation)	20%
	• The correctness and completeness of the accumulated knowledge.	Written exam (in the regular session)	40%
	• Class attendance	4 unmotivated absences are accepted, but each unmotivated absence other than those specified above are penalised	10%
10.5 Seminar/lab activities	• A software project developed using an open source agent development environment	Evaluation of the project (documentation and demonstration)	15%
	• An agent based system fully implemented, without using existing development environments.	Evaluation of the project (software implementation, documentation and demonstration)	15%
10.6 Minimum performance standards			
• Each student has to prove that (s)he acquired an acceptable level of knowledge and understanding of the Distributed Artificial Intelligence domain, that (s)he is capable of stating these knowledge in a coherent form, that (s)he has the ability to establish certain connections and to use the knowledge in solving different problems. • Successful passing of the exam is conditioned by the final grade that has to be at least 5.			

Date	Signature of course coordinator	Signature of seminar coordinator
30.04.2013	Prof. dr. Gabriela Czibula	Prof. dr. Gabriela Czibula

Date of approval

Signature of the head of department

Prof. dr. Bazil Pârv