

Course Outline

1. Document Information

Degree Program	Computer Science
Course Number	CS 539
Course Title	Agents and Multiagent Systems
Semester Hours	3
Course Coordinator	Henry Hexmoor
Revision Term	Spring 2021
Latest Revision	Spring 2021

2. Catalog Description

This is an advanced treatment of fundamental concepts in the design of intelligent autonomous agents and agent systems. Classic agent theories, architectures, algorithms, and languages are discussed. An agent-based project is an integral part of this course.

3. Textbooks

- Rothe, I. (2016). Economics and Computation. SV Publications. ISBN-9783662479032.
- Wilensky, U. (2015). Intro to Agent Based Modeling. MIT Publications. ISBN-9780262731898.

4. References

- K. Sycara, Multiagent Systems, AI 19 (2): Summer 1998, 1998, 79-92.
- Les Gasser and K. Kakugawa, MACE3J: Fast Flexible Distributed Simulation of Large, LargeGrain Multi-Agent Systems, In Proceedings of AAMAS-2002.
- M. J. Wooldridge and N. R. Jennings, "Software Engineering with Agents: Pitfalls and Pratfalls", IEEE Internet Computing 3 (3) 20-27, 1999.
- C. Sierra, N. Jennings, P. Noriega, S. Parsons (1998) "A framework for argumentation-based negotiation" in Intelligent Agents IV, M. P. Singh, A. Rao, and M. J. Wooldridge (eds.), Springer Verlag.
- J. S. Sichman and Y. Demazeau. Multi-Agent Systems Social Reasoning, in ICMAS 2000.
- T. Finin, R. Fritzon, D. McKay, R. McEntire (1994). "KQML as an Agent Communication Language", in Proceedings of the Third International Conference on Information and Knowledge Management, ACM Press.

- E. Durfee, (1991). Partial Global Planning: A Coordination framework for Distributed Hypothesis Formation, IEEE-SMC 21 (5).
- C. Harrison, D. Chess, A. Kershenbaum, 1995. Mobile Agents: Are they a good idea?, IBM Technical Report, online at: <http://www.research.ibm.com/massive/mobag.ps>.

5. Course Learning Outcomes

- An understanding of the “agent” perspective on computational systems.
- The ability to analyze distributed systems in terms of key concepts such as openness, decentralization, autonomy, and organization.
- A sense for the need to integrate multiple AI techniques when constructing intelligent agents.
- The skills to design automation solutions using multiagent system techniques and agent frameworks.

6. Assessment of the Contribution to Student Outcomes

Outcome	1	2	3	4	5	6	7
Assessed	X	X					

7. Prerequisites by Topic

Restricted to graduate standing or consent of instructor.

8. Major Topics Covered in the Course

1. Introduction
 - History: DAI, agents, MAS, system science, etc.
 - Agents: AI agents, intelligence, rationality, autonomy, adaptivity, etc.
 - Agent and system classifications: homogeneous vs. heterogeneous, Cooperative vs. self-interested, closed vs. open, etc.
 - Examples applications {6 classes}
2. Agent Models and Architectures
 - Reactive vs. deliberative agents
 - Decision theoretic (rational and bounded rational agents)
 - First order logic and deductive agents

Modal epistemic logic (mental states, intentional stance, introspection)

BDI model and PRS

Process calculi {4 classes}

3. Distributed Problem Solving

Problem/task decomposition and allocation (e.g., contract net)

Task/result sharing

Coordination methods/mechanisms: multi-agent plans, GPGP, DEC-MDP, etc.

Distributed planning {5 classes}

4. Multi-Agent Interactions (self-interested agents)

Game theory: pareto optimality, etc.

Auctions and bidding schemes

Voting schemes

Market schemes

Coalition formation

Negotiation and conflict resolution {9 classes}

5. Inter-Agent Communication

Agent languages: KQML, FIPA-ACL, etc.

Ontologies

Speech acts {3 classes}

6. Mobility and Open Systems

Mobile agents

Directory agents

Services and experts

Softbots and personal assistant agents {7 classes}

7. Organizations and Societies

Social and organizational structure

Artificial societies

Trust, reputation, commitment, etc. {2 classes}

8. Emergent Behavior

Biologically-inspired models

Simulations {2 classes}

Agent Development and Simulation Frameworks

JADE, Zeus, NetLogo {2 classes}