Teaching Multiagent Systems
as a Lecture Course:
Statement for AAMAS-2004 Workshop on
Teaching Multi-Agent Systems

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May 23, 2004

For the past two years, I have been giving the course "Introduction to MultiAgent Systems" (IMAS) at The Hebrew University of Jerusalem. The course is based strongly on Michael Wooldridge's textbook of the same name, and follows that syllabus closely:

Unit 1: Introduction
Unit 2: Intelligent Agents
Unit 3: Deductive Reasoning Agents
Unit 4: Practical Reasoning
Unit 5: Reactive and Hybrid Architectures
Unit 6: Multiagent Interactions
Unit 7: Reaching Agreements
Unit 8: Agent Communication
Unit 9: Working Together
Unit 10: Methodologies
Unit 11: Applications

IMAS is a two-credit course, intended for 3rd year undergraduates (seniors) and graduate students. I give a two hour lecture each week, using PowerPoint slides based on Wooldridge's original slides (with additions). There is a midterm and a final exam. There are no programming assignments. Some of the units take more than one week to cover (we have a 14-week semester, but I have not yet managed to fit in Wooldridge's Unit 12 on multiagent logics).

All of the course slides, schedule, background readings, exams, etc., can be found on the course Web site:

http://www.cs.huji.ac.il/~imas/

My main goal in teaching this course is to get students to read and understand relevant material in the field. Students are presumed to read each chapter of Wooldridge's

book before the associated lecture, and in addition to read some background article on that week's topic (generally, the assigned article is provided online at the course Web site).

In order to encourage this reading, my midterm and final exams are based closely on the assigned material and should require a close reading of that material by students in order for them to do well. The tests have a three-part structure:

1. Short definitions, to be answered in one or two sentences maximum;

2. Longer definitions, to be answered in a paragraph or two; these might include more general questions about particular systems or approaches;

3. Problems to be solved, using techniques learned (e.g., to do an analysis of a negotiation problem).

I believe the course as currently structured provides a reasonable introduction to the field. Students who are interested in doing masters or PhD research in multiagent systems get a broad overview of the area, so they at least know what the basic issues and approaches are. The course definitely does not give them in-depth knowledge of any sub-area; most units could constitute courses in and of themselves. The lack of depth can be frustrating at times ("just when we started to understand a topic, we moved on to the next"), but in an introductory course I think that's a reasonable approach to take.

In addition, as compared to many other computer science courses at Hebrew University, the IMAS course takes more of a "sociological overview" approach, putting the emphasis on informal descriptions rather than on formal techniques. We do not explain POMDPs and how to use them to model multiagent systems, or prove the convergence of learning algorithms. Again, some students find this frustrating, while others are delighted to be learning in a different way.

Students who are interested in further study in the area of MAS often take the follow-up seminar that I give the next semester, which focuses on multiagent system topics:
`http://www.cs.huji.ac.il/~aisemin/`

I found it helpful to add considerable additional material in several places to Wooldridge's slide material:

1. In Unit 3, I added more material on "classical planning", showing Green's method of constructively deriving plans from proofs;

2. In Unit 4, I spoke about the STRIPS algorithm in more detail (some students had seen some of this material in the introductory artificial intelligence class, for others it was new); I added more information about KD45 and CTL Temporal Logic; and at the end, I added a comparison between the Homer dialogue and the SHRDLU dialogue;

3. In Unit 5, I added some graphics from Brooks' 1985 paper on reactive systems, and a little additional material on Situated Automata;

4. In Unit 7, I added additional material on Task Oriented Domains, slightly restructuring the presentation;

5. In Unit 8, I added some definitions of locutionary, illocutionary, and perlocutionary acts, and a few extra slides on KIF;

6. In Unit 9, I added a large amount of new material on cooperative distributed problem solving (Hearsay II architecture, DVMT, PGP). I felt that, in retrospect, this material might better have been in an earlier unit (on agent architectures), rather than in the section on "Working Together". Wooldridge's textbook briefly talks about CDPS in Chapter 9, and I expanded on it in the same place in the course, but perhaps my expansion belonged elsewhere in the course;

7. In Unit 11 I updated a few slides about agents in internet e-commerce.

There are several clear ways of improving the course. I would actually prefer, under ideal circumstances, for there to be a programming component of the course, so that students get hands-on experience building agents and/or multiagent systems, using approaches they've read about. With a pure reading course, things remain too abstract for the students. The barriers to this are mainly logistical, but I'm interested in programming environments and problems that would be suitable.

In addition, I would prefer to spend more time on certain (formal) topics that are important in MAS, such as game theory in general, auctions in particular (which we discuss briefly), MDPs, learning algorithms, etc. However, I do not see how to go more into these topics, without losing the broad overview of the course — and there are other courses that deal with each of these topics individually. Finally, there are some topics that remain untouched by the current curriculum, e.g., topics related to dialogues and the interface between natural language research and MAS research.