Multiagent Systems

_WS 2014/2015_

Johannes Hofbauer and Hans Georg Seedig
Purpose of today’s meeting

- Let you know more about the format of the seminar
- Introduce you to the topics and material
- Tell you about the new registration process
  - new (somewhat) centralised system for assigning students to seminars
  - students provide preferences over seminars
  - course staff provides preferences over students
  - match!
  - remaining slots are assigned manually
Suitability / Requirements

- This is a bachelor’s level seminar
- ... that is open for master students as well.
- Suitable for students from
  - Computer science
  - Mathematics
  - Business Administration
  - ...
- Requirements
  - no formal requirements
  - interest in reasoning with mathematical rigor
## Tentative Dates

<table>
<thead>
<tr>
<th>Date</th>
<th>Time</th>
<th>Talks</th>
<th>Room</th>
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<tbody>
<tr>
<td>July 2nd ✓</td>
<td>16:15 - 17:45</td>
<td>(information)</td>
<td>02.03.010</td>
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<tr>
<td>October 15th</td>
<td>14:15 - 16:00</td>
<td>(kick off)</td>
<td>02.03.010</td>
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<tr>
<td>November 5th</td>
<td>14:15 - 17:00</td>
<td>1 &amp; 2</td>
<td>02.03.010</td>
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<td>November 19th</td>
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<td>December 3rd</td>
<td>14:15 - 17:00</td>
<td>5 &amp; 6</td>
<td>02.03.010</td>
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<tr>
<td>December 17th</td>
<td>14:15 - 17:00</td>
<td>7 &amp; 8</td>
<td>02.03.010</td>
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Rough Schedule of a meeting

- First talk (up to 40 min)
- Discussions (15-20 min)
- Break (20-30 min)
- Second talk (up to 40 min)
- Discussions (15-20 min)
What you have to do in order to pass

- Attend all meetings
  - you may be absent once if you have a (very) good reason
- Write an abstract for your talk/topic and pass it around
- Give a good talk
- Read the abstracts sent to you by your colleagues before the respective talk
  - prepare questions
- Participate in discussions and feedback sessions
- Chair a session
When preparing your talk

- Read your material thoroughly
- Think about which material you want to present and discuss it with your supervisor
- Decide how you want to present the material
- Ask your supervisor if something is unclear
- (Possibly) coordinate with the student who speaks on the same day
- Think of questions you can ask the audience during the talk
- Practice your presentation several times
Abstracts

• Instead of handing in reports at the end of the term, we want you to write an abstract of your talk beforehand and give it to your colleagues so that they can prepare.

• Length: ~4 pages
  ▸ Introduction or Motivation
  ▸ Definitions and Notation (if necessary!)
  ▸ Present the main ideas you want to convey
  ▸ Give an outlook on your talk (“The talk will primarily deal with…”, “I will give details on…”, etc.)

• To be submitted one week (7x24 hours) before your talk by mail to the course staff

• Read the abstract of the other talks and prepare some questions to ask
Do I have to meet my supervisor?

- Yes, at least once to discuss what you will cover in your talk and abstract. This should be at least three weeks before your talk.
- You are invited to send your slides one week before your talk in order to receive feedback.
Tasks as a Session Chair

- Introduce the speaker and the topic
- Give time signals to the speaker: after 30, 35, and 40 minutes
- Moderate the discussion
  - think of questions to start the discussion (!)
  - make sure that everybody is involved
  - keep an eye on the time
Feedback and Discussion

- You are expected to give feedback on the talks
  - immediately after the talk, before the discussion
  - 5-10 minutes

- Discussion about the presented topic
  - technical questions, applications, implications, connections to other issues, etc.
Registration

• Email to johannes.hofbauer@mytum.de
  ‣ name
  ‣ background: program, semester, relevant lectures you had
  ‣ your three most preferred topics (1. ..., 2. ..., 3. ...)
  ‣ motivation (up to ~250 words)

• Deadline: Tomorrow (July 03) 3:00 pm !!!

• Use the matching system to rank the seminar between July 04 and July 08. You can check whether you were assigned to this seminar by July 12.

• Seminar homepage
Introduction to Multiagent Systems
Multiagent Systems

- The field of Multiagent Systems covers scenarios where multiple agents interact, cooperate or are in conflict with each other.

- Agents could be software agents on the internet, trading agents, autonomous robots, or game-playing agents.
MAS Textbook

http://www.masfoundations.org
Possible Topics From Textbook

- Chapter 3: Normal Form Games
- Chapter 4: Computing Solution Concepts of NFGs
- Chapter 5: Extensive Form Games
- Chapter 6.3: Bayesian Games
- Chapter 9: Social Choice Theory
- Chapter 10: Mechanism Design
- Chapter 11: Auctions
- Chapter 12: Coalitional Game Theory
Chapter 3
Normal Form Games

Player’s game payoffs can be represented in matrix form.

Popular examples of normal form games comprise

- Prisoner’s dilemma
- Matching Pennies
- Rock-Paper-Scissors

Compute “optimal” (and possibly mixed) strategies for each player to play. This requires the notion of equilibria.
Chapter 4
Computing Solution Concepts of Normal Form Games

Problems of different subclasses of normal form games may have different complexity

- Optimal strategies for two-player zero-sum games are easy to find
- Two-player general-sum games are more complex

Example: Compute the solution by iteratively removing dominated strategies

Advanced: Compute equilibria in general normal form games
Chapter 5
Extensive Form Games

Extensive form games can be represented as trees. In contrast to normal form games, players now pick their actions sequentially instead of simultaneously.

We distinguish between games with

- Perfect Information and
- Imperfect Information

Again, we ask for strategy equilibria and how to compute them.
Chapter 6.3
Bayesian Games

- Players have **incomplete information** on the game
- Instead: probability distributions over possible games
- Could also be seen as an extensive-form game in which nature makes the first move.
- Requires new definitions of utilities (ex post, ex interim, and ex ante)
Chapter 9
Social Choice Theory

- Setting: agents have preferences over outcomes
- A social choice function is a mapping from everyone’s preferences to a particular outcome
- Goal: how to pick such functions with desirable properties
- Study of different voting rules
- Ranking systems (such as in Google search rankings)
- May also include a study of classical results such as Arrow’s Impossibility Theorem
Chapter 10  
Mechanism Design

• Also called ‘inverse game theory’

• Design the rules of a game, so that when selfish players play it, a given objective is achieved. e.g.,
  ‣ Define the rules of a single item auction, so that each bidder submits as his bid his true valuation for the item.
  ‣ Define the rules of a voting scheme so that everyone votes truthfully.
Chapter 11
Auctions

• Different flavors, different solutions:
  ‣ Single-item: English Auction, Dutch Auction, First Price, Second Price
  ‣ Combinatorial Auctions

• Issues include the following:
  ‣ Which protocol is better for the auctioneer?
  ‣ Lying, cheating and strategic issues in auctions
Chapter 12
Coalitional Game Theory

• Basic modelling unit is the group rather than the individual player
• Model how much can players gain by acting together
• Main goal: how to share costs or profit among players in a stable and fair manner, led to many different solution concepts, for example:
  ▸ Core: no sets of players have an incentive to deviate
  ▸ Shapley value: depends on the idea of ‘marginal contribution’ to each coalition
• Different representations of coalitional games to model collective action
Other Possible Topics

- Stable Matchings
- Fair Division
- .. your interests
See you on October 15th

Seminar homepage: