TOPICS ON ECONOMICS AND COMPUTATION

Spring 2018

Instructor: Sigal Oren
Algorithmic Game Theory

AI
- Survey C’10
  - Cake Cutting P’13
  - Contest Theory V’17
  - Rent Sharing GPMZ’18

Theory
- Survey R’10
- PoA R’12
- Online Advertising NW’17
- Private Data LLMS’17

Other topics
- Social Computing K’12
- Present Bias KO’18
- Bitcoin Z’15
Algorithmic Game Theory

AI

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Other topics
Algorithmic Mechanism Design (C’10, R’10)
Why were the teams trying to lose?

Tournament setup: Stage 1: 4 houses, Stage 2: knockout

The game we saw was the last game in house X, determining who is X₁ and X₂. Which house is X? A or C?
Mechanism design studies how to design rules that elicit good behavior.

- Algorithmic - the rules should be also implemented in polynomial time.

- Distinction between mechanism design without money (kidney exchange, voting) - discussed only in C’10 and mechanism design with money (auctions) discussed both in C’10 and R’10.
Two kids have a cake and a knife. They want to split the cake such that each of them will be happy. How should they split it?
Rent Sharing [GPMZ’18]

Total Rent: $1000

<table>
<thead>
<tr>
<th>Room 1</th>
<th>Room 2</th>
<th>Room 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>$600</td>
<td>$500</td>
<td>$400</td>
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<tr>
<td></td>
<td></td>
<td>Price $500</td>
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<td>$200</td>
<td>$300</td>
<td>$400</td>
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<td></td>
<td></td>
<td>Price $300</td>
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<tr>
<td>$200</td>
<td>$200</td>
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</tr>
<tr>
<td></td>
<td></td>
<td>Price $200</td>
</tr>
</tbody>
</table>

Who should get which room? How much should each tenant pay?
Contest Theory [V’17]

Designer’s Goal: maximize expected reward - effort

Organizer’s Goal: maximize the quality of the design
Algorithmic Game Theory

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  - Survey
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What do you prefer?

100$ now or 105$ in 52 weeks?

100$ in 52 weeks or 105$ in 53 weeks?
Present bias modelling: the cost of performing a task now is multiplied by a present bias factor $b>0$. 

$$b=2$$
Can Humans Solve a Coloring Problem? [K’12]

- Each participant controls the color of a node in a network.
- Each participant sees the colors of his neighbors in the network.
- After a minute each node that has a distinct color in his own neighborhood receives some reward.

Which graph is easier for humans to solve?
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Tragedy of the Commons

Price of Anarchy (R’12) captures how much does society loses from tragedy of the commons.
How does Google decide which ads to show and at which order?
A contest initiated in 2006 for the best algorithm to predict user ratings for films, based on previous ratings. The winner received one million dollars.

**Problem:** the data sets were anonymized, however researchers were able to identify users by cross referencing with movies reviews in IMDb.

**Result:** four Netflix users filed a class action lawsuit against Netflix.

**Solutions:**
1. **Differential Privacy** - a way for performing computations without leaking the information of any specific individual.
2. **This paper** - mechanisms for compensating users for their private data.
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Blockchain
Currently there are 7,168,650 bitcoins in circulation.

The conversion rate in exchange markets is about 1btc for 8.5$.

The amount of money transferred in a day is between 100k and 500k bitcoins.

Bounded amount of coins gradually enters the economy (like gold mining).
A decentralized electronic currency system developed by Satoshi Nakamoto (?) in 2009.

Currently there are ~17 million bitcoins in circulation.

The conversion rate in exchange markets is about 1btc for $10,654.16.

Between 200k and 350k daily transactions.
Communication of the ACM

- ACM - Association for Computing Machinery
- Publish journals, Organize conferences and so on. Any one with a CS degree can become a member.
- Give rewards - for example Turing award.
- CACM - A magazine that is distributed to all the members
Learn and practice the important skills of reading papers and presenting them.

A first exposure to some interesting research in the intersection between computer science and economics.
Requirements

* Every student(s) will present a paper. - 50%
* Student(s) will meet the instructor at least a week before the presentation. - 10% (default time: Monday 3pm) but other times can be arranged as well.
* Each student will submit a detailed summary including a substantial technical part (at least 6 pages) - 30%
* A the end of each lecture each student will submit a (very) short summary of the lecture - 10%
* Students are required to attend at least 10 lectures.
Timeline

* By 19/3 send the instructor, 2-3 possible papers you would like to present and optionally the name of a potential partner.

* At least two weeks before your lecture discuss the topic of the technical summary with the instructor (by email) and setup an appointment.

* A week before your lecture meet with the instructor.

* At most two weeks after you lecture email your summary.

-2 weeks -1 week +2 weeks

 schedule meet lecture Email summary
Meeting with instructor

∗ **Goal:** help you give the best lecture you can.

∗ Students need to come prepared for the meeting:
  
  ∗ Understand the paper(s) well. (any questions about the paper are welcomed before the meeting)
  
  ∗ Slides are ready.

∗ In the meeting we will go over the slides and make suggestions for improvements.
How to read a research paper

- First pass - Read the abstract and the intro. Skim through the rest of the paper, try to understand what the main ideas are.

- Second pass - Read more carefully, take notes, mark things that you want to understand better.

- You should read the paper critically.

- For more advice on reading papers look for links in the class website.
Google Scholar

Item Details:

- Title: Making decisions based on the preferences of multiple agents
- Author(s): Conitzer, Vincent
- Source: Communications of the ACM
- ISSN: 0001-0782
- Vol: 53 (3) 2010
- Page: 84
- Publisher: Association for Computing Machinery (ACM)
- DOI: 10.1145/166820.1566442

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Presentations

- For a pair of students: each talk 45 minutes. For a single student 1:15.
- Each talk should have a technical part of length at least 5 minutes.
- Please do not include in the talk movies explaining or demonstrating concepts that you should explain.
The most important thing is clarity.

Practice makes perfect - to give a good presentation you have to practice it loud at least a few times.

Remember to start with an introduction explaining what is the subject of the talk and ending with a summary repeating the new and important things you suggested.
Technical Summary

* The summary can begin with the paper you were assigned but should also include an additional related paper.

* Begin the summary with an introduction presenting the topic.

* The summary should include a technical section (e.g., a proof or an algorithm) of at least 1 page.

* Often proofs in papers skip simple steps. The goal is to write a complete proof in your own words.

* Remember to cite any resource you use and don’t copy paste sentences (this is plagiarism)