

SI 301 - Models of Social Information Processing Fall 2017

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Lecture: 1040 DANA, Tuesday/Thursday 1:00 - 2:30PM

Office hours

| Day | Block 1 | Block 2 |
|------------------|-----------------------|---|
| Monday | 11am-2pm Maldeniya | 2-4pm Yuan |
| Tuesday | 9-10am Yuan | 10:30am-12:30pm Posch |
| Wednesday | 9-10am Maldeniya | 11am-12pm Romero 3340 North Quad |
| Thursday | 9-10am Yuan | |
| Friday | 9-11am Posch | 3-5pm Romero 3340 North Quad |

Or by appointment.

Unless otherwise noted above, all office hours will be held in **1277 North Quad**.

Textbook

Title: "Networks, Crowds and Markets: Reasoning about a Highly Connected World"

Authors: David Easley and Jon Kleinberg

Access: You can freely download a pre-publication version of the book at the authors' site: <http://www.cs.cornell.edu/home/kleinber/networks-book/>

Course Description

This course focuses on how social groups form, interact, and change. We look at the technical structures of social networks and explore how individual actions are combined to produce collective effects. This course introduces two conceptual models for how information flows is used in multi-person settings -- networks and games. Networks describe the structure of connections among people or documents.

They permit mathematical analysis and meaningful visualizations that highlight different roles played by different people or documents, as well as features of the collection as a whole. Games describe the actions available to different people and how each person's outcomes are contingent on the choices of others. They permit analysis of stable sets of choices by all players (equilibrium) and provide a framework for the analysis of the theoretical effects of alternative designs for markets and information elicitation mechanisms. The techniques learned in this course can provide a high level understanding of systems like Facebook, recommender systems used in sites such as Netflix, auction systems such as Ebay, and information networks used by search engines such as Google.

Learning Objectives

- Identify different types of networks and describe a network using appropriate terminology such as node, edge, and connected component.
- Describe several theories of social and information network formation such as triadic closure, structural balance, and social influence.
- Given a small network, explain how much power each node has using terminology such as node centrality, outside option, and Nash bargaining solution.
- Describe the assumptions made by the HITS and Page Rank algorithms.
- Given a small network, find and interpret the PageRank, authority score, and hub score of each node.
- Describe a few different models of information cascades on social networks and analyze how a cascade will diffuse on small networks.
- Describe the Preferential Attachment and Small-World models.
- Analyze large networks using Python's library NetworkX by applying concepts covered in the class.
- Identify the basic components of a game such as players, strategies, and payoffs.
- Analyze a game by finding and interpreting dominant strategies and pure and mixed strategy Nash equilibria.
- Identify several well-known games and real world situations that can be modeled by these games.
- Identify different types of auctions and explain how each type will incentivize bidders to behave.

Tentative weekly topics

| Week of | Topics |
|----------------|--|
| Sept 4 | Why study networks, Network connectivity, Distance, Breadth-first search, Small world experiment, Triadic closure, Clustering coefficient. |
| Sept 11 | Bridges, Strong and weak ties, Strength of weak ties, Structural holes, Homophily, Selection and social influence. |

| | |
|-------------------------------------|---|
| Sept 18 | Affiliation networks, Signed networks, Structural balance, Game theory intro |
| Sept 25 | Prisoners dilemma, Best response, Dominant strategy, Nash equilibrium definition |
| Oct 2 | Finding mixed and pure strategy Nash equilibria, Coordination games. |
| Oct 9 | Network traffic, Braess' paradox, Auctions, Bipartite graphs, Bipartite Matching Problem |
| Oct 16 Fall Break | Markets, Market clearing prices. |
| Oct 23 Midterm Week | Midterm Review. |
| Oct 30 | Network exchange experiments, Ultimatum game, Stability and balance. |
| Nov 6 | Link analysis and web search, Hubs and authorities, HITS algorithm. |
| Nov 13 | PageRank. |
| Nov 20 Thanksgiving Break | Search ads, Auctions with multiple items, Herding and information cascades. |
| Nov 27 | Popularity on the web, Degree distributions, Rich-Get-Richer model, Behavior cascades in networks |
| Dec 4 | Collective action, Decentralized search, Small World networks, Branching Processes |
| Dec 11 | Final Review. |

Grading

Grades breakdown:

Final (Wednesday Dec 20th 4-6pm): 25%

Weekly assignments: 30%

Midterm (In class on Thursday Oct 26th): 25%

Discussion section attendance and participation: 10%

Lecture attendance: 5%

Lecture i-Clicker questions: 5%

Letter grade assignment:

| | | | |
|---------------|---------------|---------------|---------------|
| [98,100] = A+ | [87, 90) = B+ | [77, 80) = C+ | [67, 70) = D+ |
| [93, 98) = A | [83, 87) = B | [73, 77) = C | [63, 67) = D |
| [90, 93) = A- | [80, 83) = B- | [70, 73) = C- | [60, 63) = D- |
| | | | [0, 60) = E |

i-Clicker Questions:

Most lectures will have i-Clicker questions. We will use answers to i-Clicker questions to track lecture attendance and participation. Your lecture participation grade will be based on a point system. You collect points by answering questions in the following way:

- 1 point for a **correct answer** if $\geq 50\%$ of students get it right.
- 2 points for a **correct answer** if $< 50\%$ of students get it right.
- 1 point for an **incorrect answer** if $< 50\%$ of students get it right.

Your lecture participation grade is:

$$\frac{P}{Q} + 0.10, \text{ where}$$

P is the number of points you have at the end of the semester.

Q is the total number of i-Clicker questions.

Lecture participation grade is capped at 100%

i-Clicker will not be used in discussions.

Free Insurance Policy:

We understand that unexpected events out of your control such as illness, job interviews, forgotten i-Clickers, and family emergencies happen. That's why we will: (i) drop two assignments with the lowest grade, (ii) allow two missed lectures without penalty, and (iii) allow two missed discussions without penalty. No explanations are required to use these "freebies".

At the same time, late assignments will not be accepted and no additional make-up opportunities will be granted. Please do not ask for extensions or exceptions.

Extra Credit

From time to time, we will offer the class extra credit opportunities. Extra credit points will be applied to the current week's assignment and scores are capped at 100%. Extra credit points are not meant to increase your grade significantly and only a small number of them will be offered. Please do not ask for additional extra credit points.

Collaborating on Assignments

We strongly encourage collaboration while working on some assignments and interpreting readings as a general practice. Active learning is effective. Collaboration with other students in the course will be especially valuable in summarizing the reading materials and picking out the key concepts. You must, however, ***write your assignment submission on your own, in your own words, before turning it in.*** If

you worked with someone on the assignment before writing it, you must list any and all collaborators on your written submission.

Plagiarism

Unless otherwise specified in an assignment all submitted work must be your own, original work. Any excerpts from the work of others must be clearly identified as a quotation, and a proper citation provided. Any violation of the School's policy on Academic and Professional Integrity will result in serious penalties, which might range from failing an assignment, to failing a course, to being expelled from the program. Violations of academic and professional integrity will be reported to UMSI Student Affairs. Consequences impacting assignment or course grades are determined by the faculty instructor; additional sanctions may be imposed by the Senior Associate Dean for Academic Affairs.

Accommodations for students with disabilities

If you think you need an accommodation for a disability, please let me know at your earliest convenience. Some aspects of this course, the assignments, the in-class activities, and the way we teach may be modified to facilitate your participation and progress. As soon as you make me aware of your needs, we can work with the Office of Services for Students with Disabilities (SSD) to help us determine appropriate accommodations. SSD (734-763-3000; <http://www.umich.edu/sswd/>) typically recommends accommodations through a Verified Individualized Services and Accommodations (VISA) form. I will treat any information that you provide in as confidential a manner as possible.