NEW YORK UNIVERSITY
NYU STERN
LEONARD N. STERN SCHOOL OF BUSINESS

INFO-UB.0060 Networks, Crowds and Markets
Spring 2015
Mondays and Wednesdays, 11:00am

Professor	**Arun Sundararajan** *(with guest sessions by many others)*
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Overview

This is a course on how the social, technological, and natural worlds are connected, how technology illuminates and shapes these connections, how the study of networks sheds light on these connections, and how networks enabled by digital technologies are leading to the emergence of new institutions and market forms. While one's "social network" is now associated by many with the popularity of digitally mediated social media, we have always been creatures of our networks—whether those networks involve family, villages, tribes, or Facebook—and our socioeconomic evolution has been molded by the possibilities for exchange that they create.

The topics we will cover include: social network structure and its effects on business and culture; understanding how the structural properties of networks help us understand social capital, power, ties and closure; the propagation through networks of information, fads and disease; power laws; leveraging information networks for web search; the melding of networks, machine learning, and technology into new markets, such as "prediction markets" or the peer-to-peer markets that comprise the "sharing economy".

The class will be a combination of lectures based on the textbook and guest lectures from a small selection of well-known experts and industry leaders.

We will work our way through parts of the acclaimed textbook:
Networks, Crowds, and Markets: Reasoning About a Highly Connected World,
by David Easley and Jon Kleinberg.

http://www.cs.cornell.edu/home/kleinber/networks-book/networks-book.pdf

The textbook readings will be complemented with classic and recent research papers, as well as other articles as necessary.

Focus and interaction

This is primarily a lecture and guest-speaker based course (there are no archival cases), but student participation is an essential part of the learning process in the form of active discussion. I will expect you to be prepared for class discussions by having read the required readings and having satisfied yourself that you understand what we have done in the prior classes. You are expected to attend every class session, to arrive prior to the starting time, to remain for the entire class, and to follow basic classroom etiquette, including having all electronic devices turned off and put away for the duration of the class (this is Stern policy) and refraining from chatting or doing other work or reading during class.

I will use NYU Classes as a key means of communication. It is your responsibility to check your Lessons and Assignments (and your email) regularly, and you will be expected to be aware of any announcements within 24 hours of the time the message was sent. I will assume that you have read all announcements within a day of them posting.

I will check my email at least once a day during the week (M-F). I receive a tremendous amount of email (currently, I have over 125,000 unread messages in my Inbox), and cannot process it all daily. **Your email will get priority if you include the special tag [NCM] in the subject header and cc Sharon Kim (skim2@stern.nyu.edu)**. I sort/filter based on this tag, as well as based on human-generated cues, in order to try and prioritize student mail. I do not guarantee to be able to process your email within 24 hours but your chances are vastly improved if you use the tag.

In general, we will follow Stern default policies unless I state otherwise. This is especially important for non-Stern students to understand. I will assume that you have read them and agree to abide by them.

Class participation

The classroom discussion presents a unique opportunity for you to develop and enhance your confidence and skills in articulating a personal position, sharing your knowledge, and reacting to new ideas. All of you have personal experience with the subject matter that can enhance our understanding of it, and that we want to encourage you to share.

The grade we assign for your class participation is a careful, subjective assessment of the value of your input to classroom learning. We keep track of your contributions towards each class session, and these contributions can include (but are not restricted to) active participation in classroom group activities, raising questions that make your classmates think, providing imaginative yet relevant analysis of a situation, contributing background or a perspective on a classroom topic that enhances its discussion, and simply answering questions raised in class.

Emphasis is placed on the quality of your contribution, rather than merely on its frequency. A lack of preparation, negative classroom comments or inappropriate classroom behavior (talking to each other in class, walking in and out of class when the session is in progress, or sleeping in class, especially if accompanied by loud snoring) can lower this grade.

The Twitter hashtag for the course is **#NCM14**. This will make more sense as the course progresses.

Requirements and grading

At NYU Stern we seek to teach challenging courses that allow students to demonstrate differential mastery of the subject matter. Assigning grades that reward excellence and reflect differences in performance is important to ensuring the integrity of our curriculum. I expect that students will become engaged with this course and do excellent or very good work, receiving As and B+'s. Note that the actual distribution for this course and your own grade will depend upon how well each of you actually performs this particular semester—invariably there are students who do not put in the necessary effort and get grades below what they otherwise would expect. To guarantee that you receive an A in this course, all you need to do is

During this course, you will be assigned a set of assignments, a midterm examination and a final examination. Your midterm examination will be in-class, and your final examination will be take-home.

Assignments	150 points
Class participation	100 points
Midterm examination	125 points
Final examination	125 points
Total	**500 points**

Assignments: Each assignment will provide you with a set of instructions and guidelines. Expect to use the Web, elementary mathematics, Word, and pen/paper. Completed assignments are to be submitted electronically via NYU Classes. Answers to homework questions should be well thought out and communicated precisely, avoiding sloppy language, poor diagrams, and irrelevant discussion. In general, homework will be due at 11:59pm. Late submissions will be accepted and graded, but you will only be given credit for 50% of your score. And your carriage may turn into a pumpkin.

Grading: If you feel that a calculation, factual, or judgment error has been made in the grading of an assignment or exam, please write a formal memo to me describing the error, within one week after the class date on which that assignment was returned. Include documentation (e.g., a photocopy of class notes, section of the textbook). I will make a decision and get back to you as soon as I can. Please remember that grading any assignment requires the grader to make many judgments as to how well you have answered the question. Inevitably, some of these go "in your favor" and possibly some go against. In fairness to all students, your entire assignment or exam will be re-graded.

For students with disabilities: If you have a qualified disability and will require academic accommodation during this course, please contact the Moses Center for Students with Disabilities (CSD, 998-4980) and provide me with a letter from them verifying your registration and outlining the accommodations they recommend. If you will need to take an exam at the CSD, you must submit a completed Exam Accommodations Form to them at least one week prior to the scheduled exam time to be guaranteed accommodation.

Readings

Lecture notes: Often, I will simply teach on the whiteboard rather than using PowerPoint slides. You will be expected to flesh out any distributed material with your own note taking, and to ask questions about any material that is unclear to you after our class discussion. Depending on the direction our class discussion takes, we may not cover all material in the notes. I will post copies of any PowerPoint slides used in class on NYU Classes after the class session.

Readings: The readings in the book are required and are detailed on the class schedule on Blackboard. Other readings will be distributed for individual sessions, either in class or on the Blackboard site. (All of our supplementary readings will be posted on Blackboard.) You are responsible for reading these as well.

Schedule of topics and readings

I define the pace and sequence of topics as we go through the course. The readings for each week will be available in the **Lessons** section of NYU Classes before every session – you will find a folder for every classroom session, which will contain detailed information about the topic, pre-class readings and other useful information.

To give you an idea for how extensively we are going to delve into the book's material, here are the sections of the textbook I expect to cover through the course. I will adjust the pace at which we cover material through the semester. (Notice that what we cover is less than one half of the book, and while I encourage you to read through the advanced sections of each chapter, they will not be required.) We will have a few guest lectures (some of which will cover parts of these readings), and a list of supplementary readings.

- Chaper 2 (Graphs): 2.1-2.3
- Chapter 3 (Strong and Weak Ties): 3.1-3.3, 3.5
- Chapter 4 (Networks in their Surrounding Contexts): 4.1-4.3, 4.5
- Chapter 6 (Games): 6.1-6.6

- Chapter 8 (Modeling Network Traffic Using Game Theory): 8.1-8.2
- Chapter 9 (Auctions): 9.1-9.4
- Chapter 10 (Matching Markets): 10.1-10.4
- Chapter 11 (Network Models of Markets with Intermediaries): 11.1-11.3
- Chapter 13 (The Structure of the Web) 13.1-13.5
- Chapter 14 (Link Analysis and Web Search): 14.1-14.3
- Chapter 15 (Sponsored Search Markets): 15.1-15.4
- Chapter 17 (Network Effects): 17.1-17.6
- Chapter 18 (Power Laws and Rich-Get-Richer Phenomena): 18.1-18.6
- Chapter 19 (Cascading Behavior in Networks): 19.1-19.3
- Chapter 20 (The Small-World Phenomenon): 20.1-20.5
- Chapter 21 (Epidemics): 21.1-21.4
- Chapter 22 (Crowdsourcing and Prediction Markets): 22.1-22.9

A variety of guest speakers will provide additional insight into emerging peer-to-peer markets, and crowd-based platforms, as well as occasionally showcasing cutting-edge thinking about network science.

Additional Resources

I will post additional resources (supplementary readings, online activities, video) on Blackboard, linking them to the relevant session.

I have found the following books to be informative as references about different aspects of networks, crowds and markets. **They are not required.** However, I recommend them if you are interested in further structured reading. They are all available on Amazon.com

Barabasi, A-L. 2003. *Linked: How Everything Is Connected to Everything Else and What It Means*. http://www.worldcat.org/title/linked-how-everything-is-connected-to-everything-else-and-what-it-means-for-business-science-and-everyday-life/oclc/52315903

Barrat, A., Barthélemy, M. and A. Vespignani. 2008. *Dynamical Processes on Complex Networks*. www.cambridge.org/gb/knowledge/isbn/item1174691/

Christakis, N., and Fowler, J. 2009. *Connected: The Surprising Power of our Social Networks and How They Shape our Lives.* http://connectedthebook.com/

Gansky, L. 2010. *The Mesh: Why the Future of Business is Sharing.* http://lisagansky.com/writes

Goyal, S. 2009. *Connections: An Introduction to the Economics of Networks.* http://press.princeton.edu/titles/8538.html

Jackson, M. O. 2008. *Social and Economics Networks.* http://press.princeton.edu/titles/8767.html

Seely, T. 2010. *Honeybee Democracy*. http://press.princeton.edu/titles/9267.html

Shirky, C. 2008. *Here Comes Everybody: The Power of Organizing Without Organizations*. http://us.penguingroup.com/nf/Book/BookDisplay/0,,9780143114949,00.html

Watts, D. O. 2004. *Six Degrees: The Science of a Connected Age*. http://books.wwnorton.com/books/Six-Degrees/