Lecture 1: Introduction

"Who am I? Why am I here?"

M375T/M396C: Topics in Complex Networks
January 15, 2013

Course info

- The basics

  ‣ Instructor: Ravi Srinivasan (rav@math.utexas.edu)

  ‣ Course website: http://www.ma.utexas.edu/users/rav/ComplexNetworks/

  ‣ All materials, including syllabus, solutions, etc. available through website

- We'll talk more about the course structure later

Course info

- What is this course about?

- Why should I care?

- What kind of work is involved?

- Should I take this course?

- Topics (not) to be covered

What is this course about?

- Complex networks

  ‣ "complex" ~ "social" (but could also be biological, physical, ...)

- Conceptual, analytical

  ‣ Connected to real-world questions

  ‣ Interesting mathematics

  ‣ Mix of rigor (proofs) and heuristics (simulations, scaling arguments)

Course info

- What is this course about?

- Why should I care?

- What kind of work is involved?

- Should I take this course?

- Topics (not) to be covered

Why should I care?

May 18, 2012 - Jan 14, 2013 -7.05 (-18.56%)

How is this going to turn out?
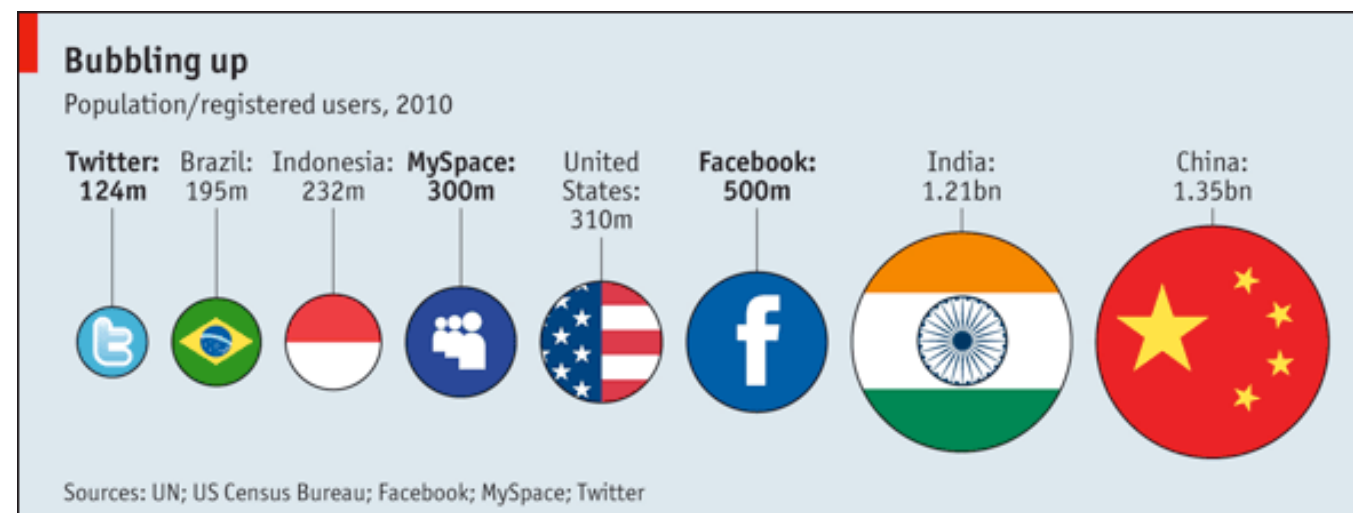
Why should I care?

- #Coincidence

Why should I care?

- Dawn of age of social computing

  ‣ Can be used to solve large, macroeconomic problems

  ‣ Energy efficiency, transportation, social mobility/inequality, decision-making, **selling you stuff**

- Availability of (too much?) data

  ‣ How many here have a Facebook account they check regularly?

  ‣ 40% increase in data per year, doubling every ~2 years (72 hours of video uploaded on YouTube every minute)

Why should I care?

- Personal information *about* users

  ‣ Online history (browsing, purchasing), sociological profile (age, gender, location, income)

- Relational information *between* users

 ‣ Connections (friends, collaborators), contacts (e-mails, IMs, phone calls)

Bubbling up
Population/registered users, 2010

| **Twitter:** 124m | Brazil: 195m | Indonesia: 232m | **MySpace:** 300m | United States: 310m | **Facebook:** 500m | India: 1.21bn | China: 1.35bn |

Sources: UN; US Census Bureau; Facebook; MySpace; Twitter

Course info

- What is this course about?

- Why should I care?

- What kind of work is involved?

- Should I take this course?

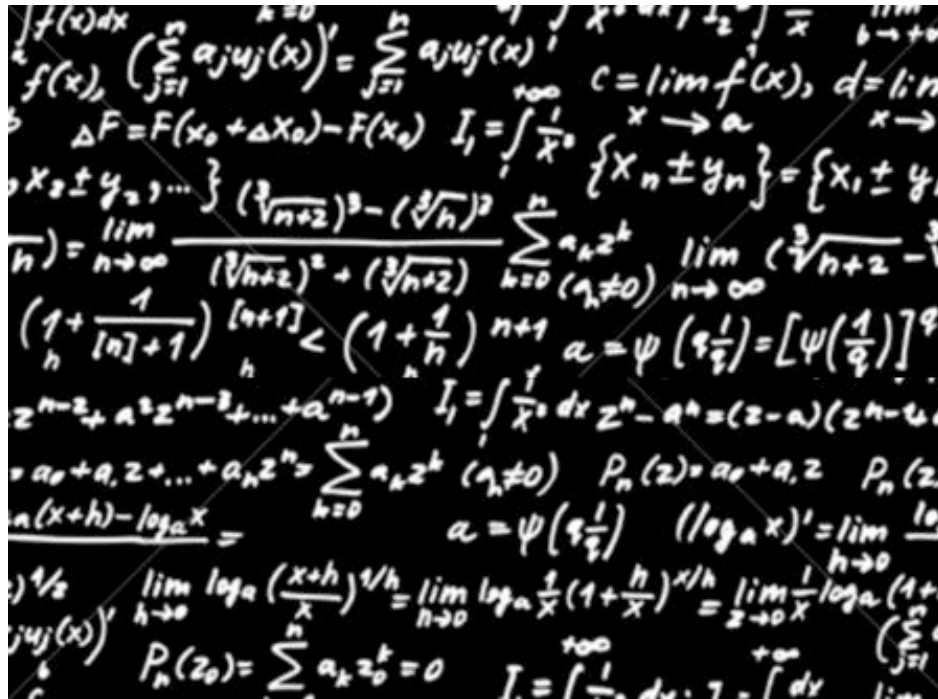- Topics (not) to be covered

What kind of work is involved?
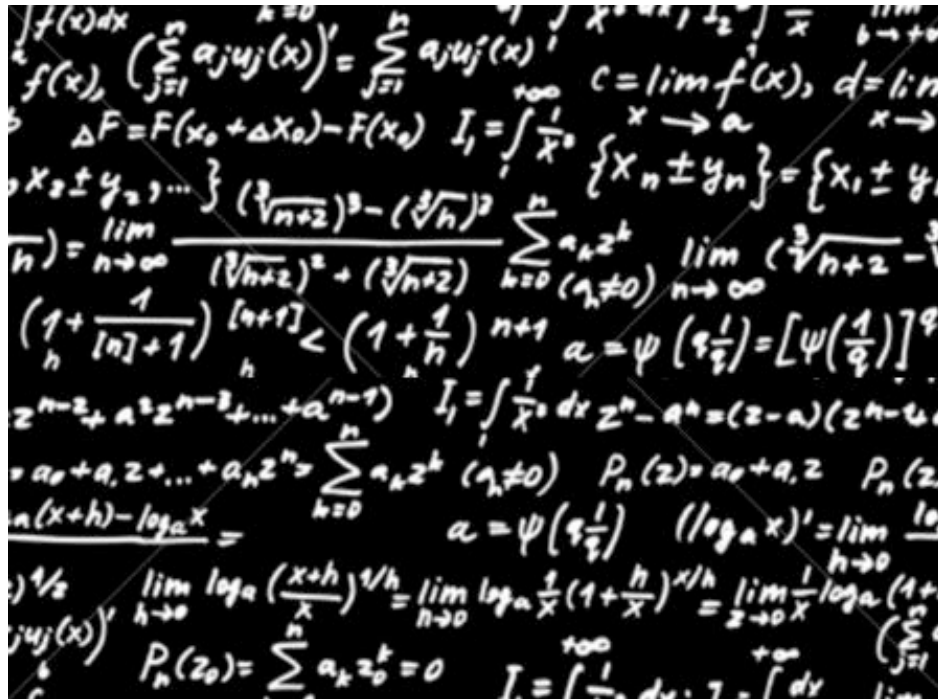
More this...

than this...

What kind of work is involved?

More this...

and this...

What kind of work is involved?

- No exams

- 50% problem sets

  ‣ Weekly or bi-weekly

  ‣ Learn together, but solutions are your own

- 20% scribing lectures (in pairs)

  ‣ Using LaTeX template, scribed notes to be posted online

- 30% final project (in at most pairs)

  ‣ Summary of research article(s) on chosen topic

What kind of work is involved?

- Programming

  ‣ Would like to incorporate some programming into HW, projects

  ‣ Are you comfortable writing code? Python?

- Grading

  ‣ Rule of thumb: hard problems, generous grading

Course info

- What is this course about?

- Why should I care?

- What kind of work is involved?

- Should I take this course?

- Topics (not) to be covered

Should I take this course?

- New, experimental course

  ‣ Should be taken for enjoyment, but will take some time and effort

  ‣ Stick around for two weeks and see how it feels

- Necessary mix of skills

  ‣ Comfortable with probability, linear algebra

  ‣ Can tolerate sophisticated arguments, consider implications

  ‣ Dealing with contradictions: How can two models predict different results?

Should I take this course?

- No textbook!

  ‣ No single source to learn material: requires discipline/self-motivation
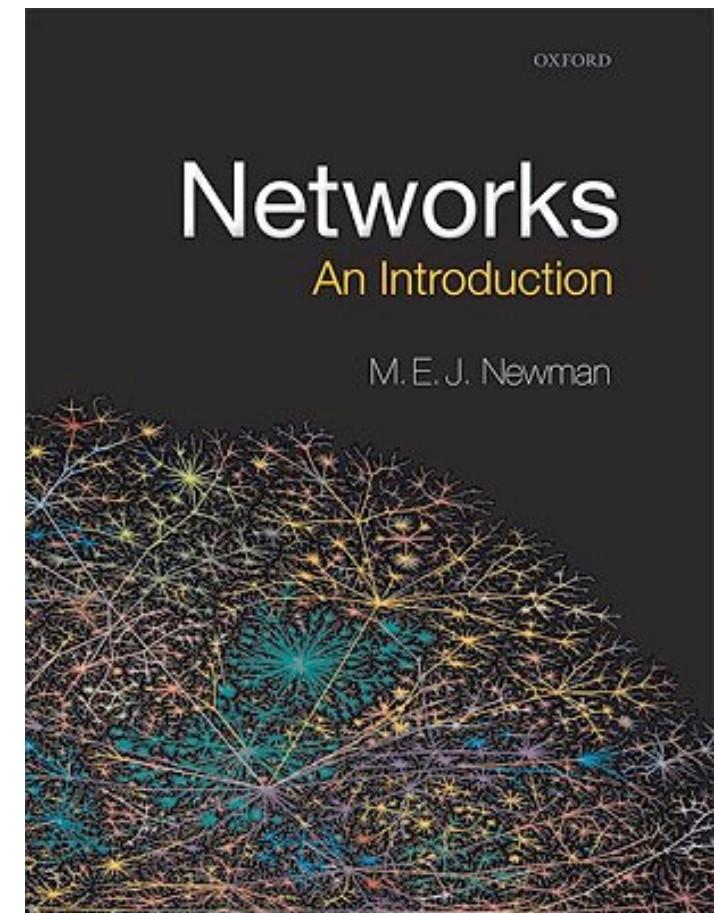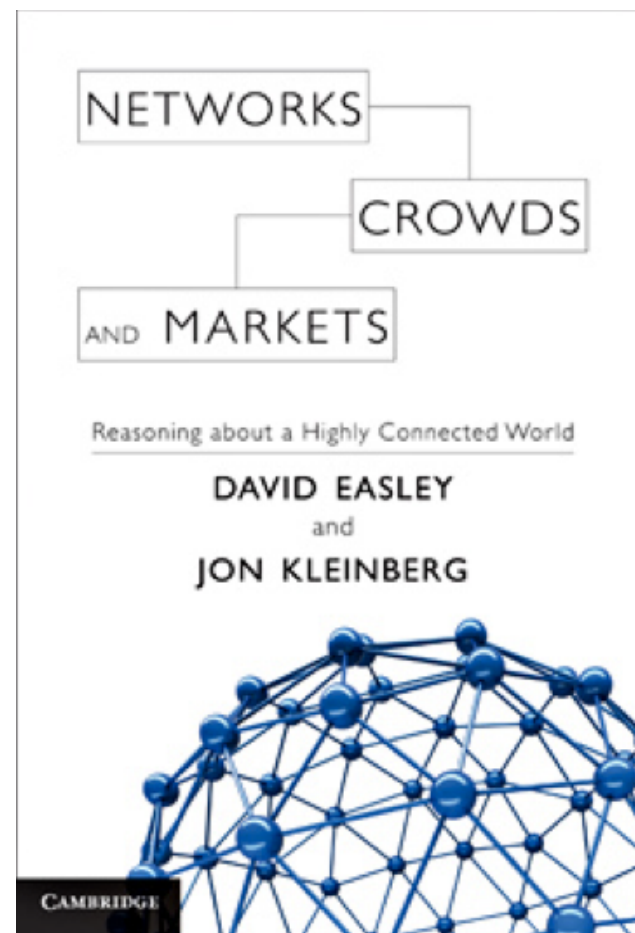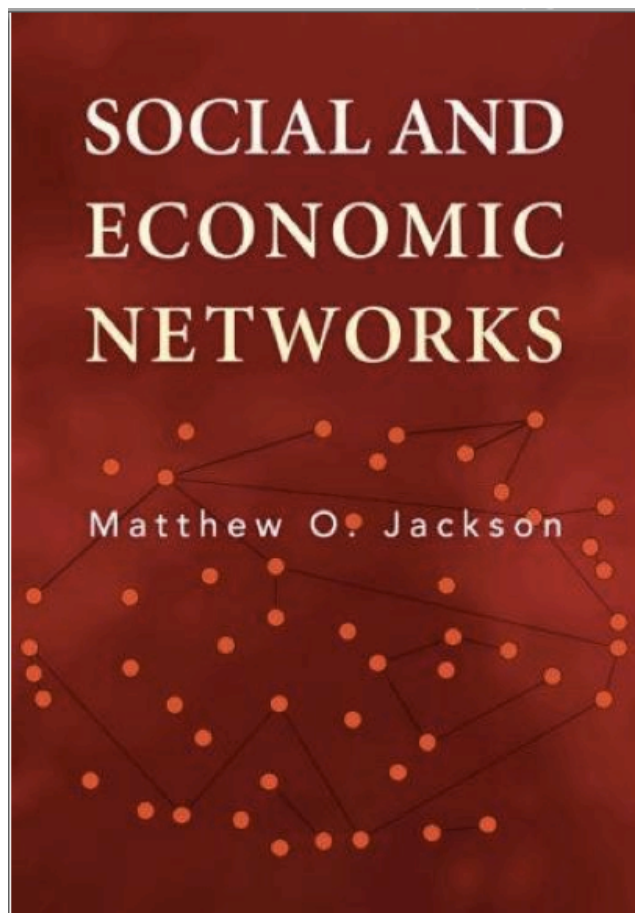
Topics (not) to be covered

- Not a programming class, or solely based on algorithms

- Not a course on game theory or machine learning

  ‣ Little time/energy to spend on these important topics, but may touch upon them tangentially

- A math course, at the end of the day

  ‣ "Worst" case: will learn some useful results in probability, linear algebra, and graph theory

Topics (not) to be covered

- Part I: Structure

  ▸ small-world, random graphs, connectedness, routing, ...

  ▸ power laws, reinforcement, PageRank/HITS

  ▸ clustering, communities, partitioning

  ▸ evolving networks, prediction

- Part II: Dynamics

  ▸ epidemics, gossip algorithms

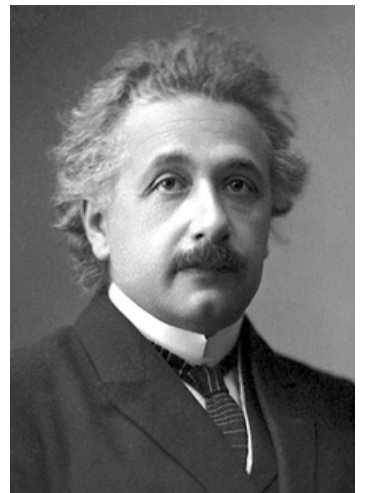 ▸ influence, greedy algorithms

  ▸ inference

- Part III: ?

Disclaimer

"The secret to creativity is knowing how to hide your sources." -A. Einstein

"Originality is nothing but judicious imitation." -Voltaire

"Let's make my life easier." -Me

- Material gleaned from similar courses taught by others

  ‣ Particularly "COMS 4995-1: Introduction to Social Networks" by Prof. Augustin Chaintreau, CS Department at Columbia University

  ‣ Full list of references and resources to be made available on class website

Disclaimer

- Class website will improve in content over the coming week(s)

- Choice of topics likely to change depending on difficulty, pace

Let's get started!