SOCIAL NETWORK ANALYSIS (G4062)
Tuesday 10:10am-12:00pm Location: 327 Seeley W. Mudd Building (Lecture)
Tuesday 12:10pm-1:00pm Location: 252 Engineering Terrace (Lab)

Gregory M. Eirich
gme2101@columbia.edu
Office Hours in 807A IAB: TBD
Teaching Assistant: Adam Obeng (Sociology)

Course Goals

The goal of this course is to introduce students to the main methods, models and concepts behind social network analysis. Over the last few decades, social scientists increasingly have investigated how people's relationships with others affect their health, wealth and popularity, among other things. With the growth of the Internet and on-line communities and social media sites, there is more (and more varied) social network data than ever. In this course, we will learn how to think about, analyze and visually display social network data. The literature on networks has grown to such a degree that it would be impossible to cover all of it in one semester, but we will focus mostly on the core concepts; how they can be incorporated into traditional regression models; and practicing the analyses ourselves.

Only basic mathematics skills (like algebra) and a basic knowledge of regression are assumed.

Another important goal of the course is to teach students how to manipulate, analyze and visualize network data themselves using statistical software. We will mainly use the program R for most of the software work. There will be a lab section each week, **which is optional**, that will be devoted to using these software programs to practice commands. If someone cannot attend lab, there will be copies of the code used in lab for them to practice on at their convenience.

Course Expectations

Attendance and Class Participation. Your attendance and participation are necessary at every meeting.

Exams. We will have two take-home exams. They will include short answer and longer answer questions. They make up the bare majority of your total grade.

Homework. Occasional homework problems will be assigned as the semester progresses. It is expected that you will do your homework. It will be graded.

Lab Assignments. Students will have 3 large lab reports due throughout the semester. They will be based on writing up the results of performing the commands learned from the lectures. Specific instructions, format and deadlines will be given as the semester progresses. Again, attendance at the lab section of the class will not be necessary to complete the lab assignments.

Plagiarism and Academic Dishonesty: Students must do all their work within the boundaries of acceptable academic norms. See the Academic Honesty page of the CU website regarding college policy on plagiarism and other forms of academic dishonesty - http://www.columbia.edu/cu/history/ugrad/main/handbook/academic_honesty.html.

Students found guilty of plagiarism or academic dishonesty will be subject to appropriate disciplinary action, which may include reduction of grade, a failure in the course, suspension or expulsion. This includes lab reports – if they are copied from another student, severe penalties may be applied.

Late Assignments. Students will lose points for handing in late assignments, at the discretion of the instructor and teaching assistant.

Textbooks. We will use 2 main required book for this course:

- Knoke, David, and Song Yang. 2008. *Social network analysis* (2nd edition). Sage. ISBN: 978-1412927499
- Prell, Christina. 2011. *Social network analysis: History, theory and methodology*. Sage. ISBN: 978-1412947152

- (*Recommended*: Easley, David, and Jon Kleinberg. 2010. *Networks, crowds, and markets: Reasoning about a highly connected world.* Cambridge University Press. ISBN: 978-0521195331. (A complete pre-print version of this text is available here: http://www.cs.cornell.edu/home/kleinber/networks-book/))

Additional Materials. Other articles and materials will be distributed via Courseworks that cover additional topics in more depth.

Grade Distribution. The distribution of the parts for your grade is as follows:

Two Exams = 50%
Computer Labs = 35%
Attendance, Participation, and HW = 15%

Changes: There may be adjustments in the scheduling of assignments, exams, and classrooms. Changes will be posted on Courseworks along with other announcements.

Proposed Course of Lectures

I. Preliminary Considerations

January 19 - **A Sampling of Topics**
January 26- **Introduction -** Nodes, Ties and Groups; Networks 1.0 (Prell 7-18, 59-83; Knoke & Yang 1-50)

II. Ego Networks

February 2 - **Ego-Networks I**: Measures of Size, Density, and Tie Strength (Closeness) (Knoke & Yang 53-55; Prell 118-122)
February 9 - **Ego-Networks II:** Measures of Network Diversity (Knoke & Yang 55; Prell 118-150); Data, Sampling Issues, and Comparisons to Whole Networks; Making Ego-Nets from Whole Networks; Reach; **Dyads**: Homophily (Easley & Kleinberg 4.1-4.2; Prell 129-131, 134-140; Knoke & Yang 13)
February 16 - **Triads**: Balance and Transitivity (Prell 140-148; Knoke & Yang 13-14; Easley & Kleinberg, Sections 3.1-3.2, 5.1-5.4) *vs*. Structural Holes (Prell 122-125; Easley & Kleinberg, Section 3.5) and Brokerage

(Prell 125-128)

III. Complete Networks

February 23 - **Complete Networks I**: Measures of Density (Knoke & Yang 53-56); Centrality: Degree, Betweenness, Closeness (Knoke & Yang 56, 23-68; Prell 96-109, 112-116), Eigenvector, Beta/Bonacich (Prell 109-112); and Prestige (Knoke & Yang 69-70); Revisit Ego Network Centrality (Knoke & Yang 70-72)

March 1 - **Complete Networks II**: Statistical Inference using Network Data (Prell 199-120; Knoke & Yang 96-102) and Distance (Easley & Kleinberg, Sections 2.2-2.3; Knoke & Yang 60-61; Prell 171-173)

March 8 - **Complete Networks III**: Finding Groups I (Prell, 151-155)

March 15 - Spring Break!

March 22 - **Complete Networks IV**: Finding Groups II (Prell 156-165; Knoke & Yang 72-76; Easley & Kleinberg, Section 3.6)

March 29 - **Complete Networks V:** Affiliation/Bipartite Networks (Knoke & Yang 103-108; Prell 16-18; Easley & Kleinberg, Section 4.3); Clustering and Small Worlds (Prell 173; Easley & Kleinberg, Section 3.1 and Ch. 20)

April 5 - **Complete Networks VI**: Positions, Roles and Equivalence (Prell 175-196; Knoke & Yang 76-78, 85-96)

IV. Extensions and Advanced Techniques

April 12 - Visualization (Prell 83-86; Knoke & Yang 79-85); and Simulations (Prell 49-50; Easley & Kleinberg, Section 4.5)

April 19 - Networks over Time (Prell 215-219; Easley & Kleinberg, Section 4.4; More TBA)

V. Final Thoughts

April 26 - Wrapping Up