**Introduction**

Networks have come to play an increasingly important role in our understanding of a wide array of human behavior. In communication and the organizational sciences, extraordinary developments in computing and telecommunications have engendered new organizational forms based on fluid, dynamic networks. These new network forms of self-organizing are constantly evolving in dynamic communities as new network links are created, and dysfunctional ones dissolved. While many writers assert that the capability to nurture networks will differentiate dominant 21st century organizations, little is known about how this important new organizational form emerges and evolves.

This seminar is intended to review theoretical, conceptual, and analytic issues associated with network perspectives on communicating and organizing. The course will review scholarship on the science of networks in communication, computer science, economics, engineering, organizational science, life sciences, physical sciences, political science, psychology, and sociology, in order to take an in-depth look at theories, methods, and tools to examine the structure and dynamics of networks.
As with most graduate seminars, the majority of class time will be spent discussing the assigned readings. A series of laboratory exercises will provide experience with computer-based network analysis, modeling and visualization tools. Students will write a term paper advancing some theoretical, methodological or computational aspect of network science.

This course will be offered via videoconference by Northwestern University and is open to all students at CIC universities (Academic counterpart to the Big Ten) via CourseShare. All aspects of the class including lectures, discussions, and lab assignments will be coordinated across the schools.

**Prerequisites**
The course has no formal pre-requisites but will be most beneficial to students who have had an introductory statistics course covering descriptives for central tendencies and dispersion, correlation, sampling, and significance testing.

**Software tools**
The following software tools will be introduced throughout the course. They are freely available or will be made available to you for free. Unless noted, they will only run on a Windows machine. The software for the lab assignments (UCINET and NodeXL) will be installed in Tech C135 (Undergraduate PC Computing Laboratory). You can also download UCINET and NodeXL at:

Course Readings
Most readings will be posted on the Blackboard website for downloading under “Course Documents. Some of the readings are password protected. Professor Contractor will share the password that unlocks all the readings during lecture. Recurring readings will be taken from Easley & Kleinberg (E&K), Hanneman & Riddle (H&R), Wasserman & Faust (W&F), and Monge & Contractor (M&C). Students are encouraged but not expected to understand the mathematical formulae and proofs when encountered in any of these chapters.


Please plan to purchase the Monge & Contractor, Easley & Kleinberg, and Wasserman & Faust texts from your preferred vendor. Any other readings that cannot be acquired electronically will be distributed in hard copy during lecture the week beforehand.

Expectations
This course will also make extensive use of the Blackboard site for posting announcements, readings, and submitting assignments. Students are expected to check their email and the class Blackboard site regularly and notify the instructors if they are having any trouble using Blackboard. This syllabus (and any deadlines on it) is preliminary and subject to change via announcements on Blackboard. If there are any discrepancies between announcements made on Blackboard and this syllabus, follow the most recent Blackboard instructions.

Participation and preparation are essential to success in this course. Barring illness, academic obligations, or emergencies, attendance is required at every lecture. Students will be expected to have completed all the assigned weekly readings before class and be prepared to discuss the readings in depth. We welcome and encourage students to share best practices and collaborate on the lab assignments. However, students are expected to complete and submit their own lab assignments. See the statement on academic integrity below.

Evaluation
There are three requirements for the course: four network labs, one term paper, and online participation.

- **Network labs:** The four network labs will require you to conduct computational analyses on network data. Equal emphasis will be given to conducting the analysis and interpreting (and reporting) the results. The lab assignments due dates are shown below. You are free to revise these reports as often as you wish before March 16 at 9pm for full credit. (40% of final grade, 10% per lab)
  - **Lab 1:** Density & Centrality – Due January 26
  - **Lab 2:** QAP, CSS, Structural Equivalence – Due February 2
  - **Lab 3:** p*/ERGM – Due February 9
  - **Lab 4:** SIENA – Due February 16
- **Term paper**: The term paper should develop or elaborate a theory, method or application of your choice, explicitly incorporating a network perspective. A 500 word abstract/proposal is due February 23 by 9pm. It should review the relevant research literature and include a research design that tests network hypotheses or makes novel methodological or computational contributions. Papers need to be prepared according to APA 5 or the guidelines for a specific journal of your choosing. You are free to use this as an opportunity to develop a research proposal, working/conference paper, review and synthesis, or to develop ideas you have worked on in other courses. The term paper is due on March 16 by 9pm. (33% of final grade)

- **Online participation**: The online participation is an opportunity for you to provide substantive reactions to the readings for the week. These reactions should be posted online no later than 24 hours prior to the start of class (that is, by Tuesdays at 6pm CST). The reactions could include key takeaways from, extensions of, challenges to, and/or disagreements with the ideas developed in the readings. Your contribution will be evaluated on the quality of the reactions and their coverage of the breadth of readings for each session. (27% of final grade, 3% per week)

**Students with Disabilities**
If you require appropriate academic accommodations as a result of any disability, please make any requests during before the second lecture of the quarter. You are urged to register with Services for Students with Disabilities (SSD) for disability verification and for determination of reasonable academic accommodations. For more information, visit [http://www.northwestern.edu/disability/](http://www.northwestern.edu/disability/).

**Academic Integrity**
Students are expected to comply with University regulations regarding academic integrity. Academic dishonesty includes, but is not limited to, plagiarism on submitted assignments such as taking material from readings without citation or copying another student’s paper.

Failure to maintain academic integrity on an assignment will result in loss of credit for that assignment – at a minimum. Other penalties and sanctions may also apply and will be referred to the administration of either SoC or McCormick as is necessary. If you are in any doubt about what constitutes academic dishonesty, speak with an instructor before an assignment is due, or examine the appropriate University websites. Guidelines for determining academic integrity and procedures followed in a suspected incident of academic dishonesty are detailed on the following websites:

- [http://www.communication.northwestern.edu/files/ProceduresAllegedAcademicDishonesty.pdf](http://www.communication.northwestern.edu/files/ProceduresAllegedAcademicDishonesty.pdf)
- [http://www.mccormick.northwestern.edu/undergraduate/academic_integrity.php](http://www.mccormick.northwestern.edu/undergraduate/academic_integrity.php)
**Course Outline**

**Week 1, January 5: Introduction & Administrivia**

E&K 1; W&F 1; M&C 1


**Optional:**


**Week 2, January 12: Network types and local properties**

E&K 2; W&F 2-4; M&C 2 (pp. 29-44); H&R 1-3, 5


**Optional:**

H&R 16-17 – Using UCINet for multiplex & bipartite data

W&F 8 – Bipartite data


**Week 3, January 19: Network metrics**

H&R 6-13; W&F 5-7; E&K 13, 14, 18, 20


**LAB 1 ASSIGNED**

**Optional:**


W&F 9, 12 – More detail on structural, regular, & automorphic equivalence


**Week 4, January 26: Data collection**


LAB 1 DUE; LAB 2 ASSIGNED

Optional:


Week 5, February 2: Triadic census, p*/ERGM, and MTML

M& C 2 (pp. 45-77), 10; W& F 14


Optional reading:


Week 6, February 9: Computational models of network dynamics

M&C 4


LAB 2 DUE; LAB 3 ASSIGNED

Optional reading:


**Week 7, February 16: Network Optimization Models**


LAB 3 DUE; LAB 4 ASSIGNED; FINAL PAPER PROPOSAL DUE NEXT WEEK

**Week 8, February 23: Contagion, Balance, Self-Interest, & Collective Interest**

M&C 5,6; E&K 3, 5, 16, 17, 19


**FINAL PAPER PROPOSAL DUE**

Optional:


Week 9, March 2: Homophily, Proximity, & Social Support

NICO/SONIC Conference on Complexity, March 6 & 7

M&C B; E&K 4


Optional reading:


Week 10, March 9: Exchange & Dependency

M&C 7


Optional reading:


Week 11, March 16: NO CLASS

FINAL PAPER DUE
Other syllabai:

- Brockmann, D. “ESAM 495: Dynamical Processes on Networks.” Northwestern University. [http://web.me.com/zwergen/S10-495/Home.html](http://web.me.com/zwergen/S10-495/Home.html)
Other resources:

- **Academic organizations and conferences**
  - Organizational Behavior Division, Organizational Communication and Information Systems Division, Academy of Management (AoM). [http://www.aom.pace.edu](http://www.aom.pace.edu)
  - Conference on Weblogs and Social Media (ICWSM), Conference on Artificial Intelligence (AAAI), Knowledge Discovery and Data Mining (KDD), Association for Advancement of Artificial Intelligence (AAAI). [http://www.aaai.org/](http://www.aaai.org/)

- **Data sets**

- **People and Research groups**
  - **Northwestern**
    - Science of Networks in Communities (SONIC). Noshir Contractor. [http://sonic.northwestern.edu](http://sonic.northwestern.edu)
    - Amaral Lab. Luis Amaral. [http://amaral.northwestern.edu](http://amaral.northwestern.edu)
    - Research on Complex Systems. Dirk Brockmann. [http://rocs.northwestern.edu](http://rocs.northwestern.edu)
  - **Elsewhere**
    - NETLAB. Barry Wellman, University of Toronto. [http://www.chass.utoronto.ca/~wellman/](http://www.chass.utoronto.ca/~wellman/)
Other books & articles

Reviews


Network visualization


Books


*Special issues*