Elements of Network Science: CptS 580-04/EE 582-03 – Syllabus

Course information
Semester: Spring 2016
Meeting times and location: Tu-Th 12:00–13:15, Sloan 233
Course website: http://www.eecs.wsu.edu/~assefaw/CptS580-04

The course website will be used to post relevant course material, including this syllabus, and course related resources. Additionally, the online portal OSBLE (https://osble.org) will be used for posting lecture material, assignments, announcements, and messages; and for handling student submissions and instructor feedbacks.

Instructor information
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Office hours
Tentative office hours: Tuesdays 2:00–3:00pm, or by appointment.

Course description
This 3 credit, graduate-level course introduces fundamental elements of the emerging science of complex networks, with emphasis on social and information networks. Students will learn about mathematical and computational methods used to analyze networks, models used to understand and predict behavior of networked systems, and theories used to reason about network dynamics. Students will also be exposed to current research in the field, and they will be given an opportunity to explore a chosen topic through a semester project.

Topics to be covered include:

- **Network structure and modeling**: Graph theory essentials, Basic network properties, Random graphs, Centrality, Similarity, Homophily, Signed networks.
- **Network algorithms**: Link analysis (PageRank, Hubs and Authorities), Spectral analysis, Community identification.
- **Network dynamics**: Cascading behaviors, Information diffusion and contagions, Influence maximization, The Small-world phenomenon, Kleinberg’s Decentralized Search model.
- **Temporal networks**: models and algorithms for analysis of time-varying networks.

Learning outcomes
At the conclusion of the course students should be able to:

- Explain basic metrics and measures used to characterize networks
- Analyze a network using the various measures and a suitable network analysis software tool
- Discuss the strengths and weaknesses of random graph models
- Understand and apply key algorithms for node ranking, community identification, and network comparison
- Understand and apply models and theories used to reason about cascading behaviors, information diffusion, contagion, and decentralized navigation in networks
- Understand and explain the interdisciplinary nature of the area of network science
- Critique research papers in the area
- Apply knowledge gained in the course to carry out a project and write a scientific report
Audience
The course is suitable for graduate students in computer science, engineering, sociology, economics, mathematics, physics, and related fields.

Prerequisites
No formal prerequisites, but students are expected to have basic knowledge of algorithms (equivalent to completing an undergraduate algorithms course), some programming experience (e.g. in Python or R), and familiarity with basic linear algebra (e.g. solution of linear systems and eigenvalue/vector computation) and statistics.

Course work
The course consists of lectures (twice a week, 75 min each), and involves three assignments and a semester project. A semester project could take one of several forms: analysis of an interesting dataset using existing methods and software; comparison of existing methods and software tools in the context of a specific application; implementation of a new method; exploration of a chosen research topic. Each project will have required submissions at two different stages (project proposal and final report) and will culminate with an oral presentation in class. Guidelines for writing the proposal and the final report will be provided.

Students are encouraged to work in teams of two for the semester project. Assignments, on the other hand, are to be completed and submitted individually.

Grading
- Project: 50% (Critique paper 5%, Project proposal 5%, Presentation 10%, Final report 30%)
- Assignments: 40%
- In-class quizzes: 5%
- Class participation: 5%

Letter grades: A (93–100%), A- (90–92.99%), B+ (87–89.99%), B (83–86.99%), B- (80–82.99%), C+ (77–79.99%), C (70–76.99%), C- (67–69.99%), D (60–66.99%), F (less than 60%).

Grading scale may be adjusted depending on class average.

Course material
There is no required textbook for the course. Lecture notes, readings and related resources will be posted at the course website or the OSBLE page of the course as the course proceeds.

The following book will be used as a frequent reference:

Other related references include:

Software
The graph analysis package igraph will be used as the primary software resource.
## Schedule

See Table 1 for a weekly schedule of topics and assignments.

## Policies

### Conduct

Students are expected to maintain a professional and respectful classroom environment. In particular, this includes:

- silencing personal electronics
- arriving on time and remaining throughout the class

You may use any non-disruptive personal electronics during class.

### Correspondence

All class related correspondence with the instructor will be made via OSBLE. I will get an email notification when a message is sent to my Inbox or posted to the Dashboard, and will do my best to respond promptly. Students are encouraged to choose their OSBLE settings so that they get emails notifications when messages are sent or posted.

### Missing or late work

Submissions will be handled via the OSBLE page of the course. Students are expected to submit assignments and reports by the specified due date and time. Submissions turned in up to 48 hours late will be accepted with a 10% grade penalty per 24 hours late. Except by prior arrangement, missing or work late by more than 48 hours will be counted as zero.
Academic integrity

Academic integrity will be strongly enforced in this course. Any student who violates the University’s standard of conduct relating to academic integrity will receive an F as a final grade in this course, will not have the option to withdraw from the course and will be reported to the Office of Student Standards and Accountability. Cheating is defined in the Standards for Student Conduct WAC 504-26-010 (3). You can learn more about Academic Integrity on the WSU campus at http://conduct.wsu.edu. Please also read this link carefully EECS Academic Integrity Policy. Use these resources to ensure that you do not inadvertently violate WSU’s standard of conduct.

Safety on campus

Washington State University is committed to enhancing the safety of the students, faculty, staff, and visitors. It is highly recommended that you review the Campus Safety Plan http://safetyplan.wsu.edu/ and visit the Office of Emergency Management web site http://oem.wsu.edu/ for a comprehensive listing of university policies, procedures, statistics, and information related to campus safety, emergency management, and the health and welfare of the campus community.

WSU classroom safety

Classroom and campus safety are of paramount importance at Washington State University, and are the shared responsibility of the entire campus population. WSU urges students to follow the “Alert, Assess, Act” protocol for all types of emergencies and “Run, Hide, Fight” response for an active shooter incident. Remain ALERT (through direct observation or emergency notification), ASSESS your specific situation, and act in most appropriate way to assure your own safety (and the safety of others if you are able).

Please sign up for emergency alerts on your account at MyWSU. For more information on this subject, campus safety and related topics, please view the FBI’s Run, Hide, Fight video (https://www.fbi.gov/about-us/cirg/active-shooter-and-mass-casualty-incidents/run-hide-fight-video) and visit the WSU safety portal (https://faculty.wsu.edu/classroom-safety).

Students with disabilities

Reasonable accommodations are available for students with a documented disability. If you have a disability and need accommodations to fully participate in this class, please either visit or call the Access Center (Washington Building 217; 509-335-3417) to schedule an appointment with an Access Advisor. All accommodations MUST be approved through the Access Center. For more information, consult the webpage http://accesscenter.wsu.edu/ or email at Access.Center@wsu.edu.

Important dates and deadlines

Students are encouraged to refer to the WSU academic calendar often to be aware of critical deadlines throughout the semester. The academic calendar can be found at http://registrar.wsu.edu/academic-calendar.

Weather policy

For emergency weather closure policy, consult: http://alert.wsu.edu.

Changes

This syllabus is subject to change. Updates will be posted on the course website.