Social Network Analysis: Theory and Methods
(Sociology 8412)

Zack W. Almquist
Fall Semester, 2015

Class Schedule
Lecture:  W 2:30 – 5:00 pm  Social Sciences Building 1114
URL: http://moodle.umn.edu
Note: Requires UMN login and registration in class to access.
URL: http://www.github.com
Note: Requires github login.

Professor
Name:  Zack W. Almquist
Office:  960 Social Science Building
Office Hours:  W 5:00-6:00PM
Email:  almquist@umn.edu
Telephone:  612-624-4300 (not recommended)

Course Objectives
This course is an introduction to the theory and methods employed in modern social network analysis. Specific topics covered include data-collection, node and graph-level indices, conditional uniform graph tests, network regression, network autocorrelation models, network inference, elementary exponential random graph models, and missing data models. Both descriptive and inferential approaches will be covered, with an emphasis on the use of network methods for theory testing. The approach taken to the material will be a combination of lecture, labs, homework, and reading discussions. The class will include regular homework assignments that focus on the analysis and interpretation of a variety of network data sets. By the end of the class, each student should be familiar with the most commonly employed methods in social network analysis, should have a clear understanding of the capabilities, limitations, and indications for use of these methods within typical settings, and should be competent at both applying and interpreting these methods for both
exploratory analysis and theory testing in the social network domain. Students will also be exposed to the use of the R statistical computing system for network analysis, Rstudio, and github development platforms. The student will also be given the opportunity to acquire competency in basic data management and analysis tasks within the R environment.

**Prerequisites**

Graduate level probability and statistics (including standard hypothesis testing and regression methods) is assumed, as is basic literacy in elementary scientific computing (ability to manipulate data, use command-line/scripting tools, etc.). Additional mathematical and computational background is not required, but students are expected to take initiative in learning to solve unfamiliar problems. Prior knowledge of network analysis is not assumed.

**Course Requirements**

**Computers**

It is not required that students bring their computers/laptops to lecture and lab (if one is owned), but it is highly recommended since lecture will make extensive use of the computer software R. Computer labs are available on campus, please consult with the office if you have trouble finding the various locations of campus computer labs.

**Readings**

Weekly readings assignments can be found on the course syllabus. All readings are assumed to be completed before each lecture/seminar. You are expected to read over the class notes each week and make sure you are familiar with the material as the course progresses. Questions are encouraged.

**Homework**

Homework assignments will normally be administered on a bi-weekly basis and will be due on every other Wednesday. Homework assignments are meant to achieve three results: (1) provide practice with the statistical concepts discussed in class and, and (2) provide practice with the computational and statistical programing language R and (3) provide a chance to demonstrate your mastery of material and highlight areas where more work is needed. You may work in a group, but all write-ups must be done independently. All collaborators should be appropriately cited in your write up and any detailed R code should also be provided.
Exams
To assess mastery of course material, one take-home exam will be administered over the course of the semester. The examination will cover all material presented in lecture and assigned readings. In order to prepare for exams, students are advised to keep up-to-date on reading assignments and to attend lectures regularly.

Participation
Individuals are expected to attend every course, to have completed every reading, and to participate with questions and discussion on each topic as presented. If you plan on missing any class period you are responsible for all material and for contacting the instructor in a timely manner.

Grading
\begin{itemize}
\item Participation: 20%
\item Homework: 60%
\item Exam/Project: 20%
\end{itemize}

Lectures, readings, labs, and review sessions are provided for each student’s benefit. It is the responsibility of the student to take advantage of these opportunities to acquire and demonstrate mastery of course material, so as to achieve his or her desired grade.

Letter grade assignment
\begin{itemize}
\item A 93%+
\item A- 90-92.99%
\item B+ 87-89.99%
\item B 83-86.99%
\item B- 80-82.99%
\item C+ 77-79.99%
\item C 73-76.99%
\item C- 70-72.99%
\item D 60-69.99%
\item F <59.99%
\end{itemize}
Required Texts


Readings

Be prepared to discuss all readings assigned at anytime in lecture/seminar.

Required Software

We will be using the R statistical programming language. R can be downloaded at http://www.r-project.org/.

RStudio IDE (Integrated Development Environment) is a software application which facilitates interaction with the R statistical programming language. It is often preferred to the GUI (Graphic User Interface) made available through CRAN. You can download it at http://www.rstudio.com/.

Latex is a word processor and a document markup language. It can be downloaded and installed on Windows (http://miktex.org/), OSX (https://tug.org/mactex/) or Linux (use the package manager of your choice).

A github account will be required of all students. One can register for a github account at https://github.com/. You can find information about how github works with Rstudio at http://z.umn.edu/rstudiogit, and github maintains a quite good help-system at https://help.github.com/.

Course Policies

Missing Class, etc.

It is expected that each member of the class will attend every lecture/discussion. If there is an appropriate reason to miss class it is expected that the individual will email or discuss in person with the instructor at least one week in advance. For any medical issues please see the UMN website for university policies.

Cheating, etc.

All work is assumed to be your own and all individuals are expected to follow the university policy on cheating and misconduct. If you have any questions please consult the UMN website for university policies.
Class Structure

This class meets for two and a half hours one day a week for approximately 15 weeks. Each week the course will be divided into three pieces: (1) lecture, (2) lab, and (3) discussion. Lecture will focus on introducing the key methods and theory of modern social network analysis. Lab will focus on introducing the student to network analysis in R in combination with github and Rstudio. Discussion will focus on going over the readings assigned each week. An email will be sent around each week assigning the following roles: (1) summary, (2) question, and (3) response.

Assignments

Week 1 (09/09/15): Introduction, Basic Concepts and Data Collection

- **Readings:**

- **Lab:**
  - Load networkMethods package and run the code in lab 1.

- **Homework:**
  - No homework.

Week 2 (09/16/15): Node-level Indices as Descriptives and Covariates

- **Readings:**

- **Lab:**
– Load \texttt{networkMethods} package and run the code in lab 2.

\begin{itemize}
  \item \textit{Homework:}
  \begin{itemize}
    \item Go to github and edit the homework.1.Rnw file (make sure push your edits to github regularly).
  \end{itemize}
\end{itemize}

\textbf{Week 3 (09/23/15): Network Autocorrelation Models}

\begin{itemize}
  \item \textit{Readings:}
    \begin{itemize}
    \end{itemize}
  \item \textit{Lab:}
    \begin{itemize}
      \item Load \texttt{networkMethods} package and run the code in lab 3.
    \end{itemize}
  \item \textit{Homework:}
    \begin{itemize}
      \item Homework 1 due!
    \end{itemize}
\end{itemize}

\textbf{Week 4 (09/30/15): Reciprocity, the Dyad Census}

\begin{itemize}
  \item \textit{Readings:}
    \begin{itemize}
    \end{itemize}
  \item \textit{Lab:}
    \begin{itemize}
      \item Load \texttt{networkMethods} package and run the code in lab 4.
    \end{itemize}
  \item \textit{Homework:}
    \begin{itemize}
      \item Go to github and edit the homework.2.Rnw file (make sure push your edits to github regularly).
    \end{itemize}
\end{itemize}

\textbf{Week 5 (10/07/15): Transitivity, the Triad Census}

\begin{itemize}
  \item \textit{Readings:}
    \begin{itemize}
    \end{itemize}
\end{itemize}

- **Lab:**
  - Load `networkMethods` package and run the code in lab 5.
- **Homework:**
  - Homework 2 due!

**Week 6 (10/14/15): Introduction to Random Graphs**

- **Readings:**

- **Lab:**
  - Load `networkMethods` package and run the code in lab 6.
- **Homework:**
  - Go to github and edit the homework_3.Rnw file (make sure push your edits to github regularly).

**Week 7 (10/21/15): Dyadic Mixing, Basic Blockmodels**

- **Readings:**

- **Lab:**
  - Load `networkMethods` package and run the code in lab 7.
- **Homework:**
  - Homework 3 due!
Week 8 (10/28/15): Positions, Roles, and Generalized Blockmodels

- **Readings:**

- **Lab:**
  - Load networkMethods package and run the code in lab 8.

- **Homework:**
  - Go to github and edit the homework.4.Rnw file (make sure push your edits to github regularly).

Week 9 (11/04/15): Cohesive Subgroups

- **Readings:**

- **Lab:**
  - Load networkMethods package and run the code in lab 9.

- **Homework:**
  - Homework 4 due!

Week 10 (11/11/15): Graph Correlation, QAP, and Network Regression

- **Readings:**

**Lab:**
- Load networkMethods package and run the code in lab 10.

**Homework:**
- Go to github and edit the homework_5.Rnw file (make sure push your edits to github regularly).

**Week 11 (11/18/15): Modeling Cohesive Groups in Social Space**

**Readings:**

**Lab:**
- Load networkMethods package and run the code in lab 11.

**Homework:**
- Homework 5 due!

**Week 12 (11/25/15): Multivariate Analysis of Graph Sets**

[Thanksgiving]

**Readings:**

**Lab:**
- Load networkMethods package and run the code in lab 12.

**Homework:**
- Go to github and edit the homework_6.Rnw file (make sure push your edits to github regularly).
Week 13 (12/02/15): Exponential Random Graph Models (ERGMs)

- **Readings:**

- **Lab:**
  - Load networkMethods package and run the code in lab 13.

- **Homework:**
  - Homework 6 due!

Week 14 (12/09/15): Adequacy and Degeneracy in ERG Models

- **Readings:**

- **Lab:**
  - Load networkMethods package and run the code in lab 14.

- **Homework:**
  - No homework.
Week 15 (12/16/15): Inference for partially observed networks

- **Readings:**

- **Lab:**
  - Load networkMethods package and run the code in lab 15.

- **Homework:**
  - Take home exam handed out.