**Course Title:** Statistical Analysis of Networks

**Number of Credits:** 3

**Instructor:** Prof. Yoav Bergner

**Course Description (~250 words or less):**

This course is an introduction to the analysis and modeling of network data. Network analysis is a key tool in understanding relational data – data describing the relationships between pairs and groups of individuals, as well as the global structure of relationships. We will focus on applications to and building tools for research in the social sciences, but the methodology can be extended to other areas. Roughly speaking, the first half of the course will be used to set up the mathematical formalism and foundations for statistical analysis, and the second half will focus on different modeling approaches and applications. By the end of the course, you should have a working knowledge of basic network analysis in the R programming language and be able to use network methods to analyze your own data.

**Course Prerequisites/Expectations:**

- Some prior experience with statistics (e.g., APSTA-GE 2003) and some exposure to programming (experience with loops, functions, and data structures, e.g., at the level of NYU’s undergraduate course “Introduction to Computer Science (CSCI-UA-0101)) in any language, e.g., C, Java, Python, R);

**Course Format:** (Lecture, lab, seminar, recitation or combination)

One combined lecture and lab session each week; Fall offering

**COURSE READINGS:**

Required reading will be from:

- [Networks](#), Newman (online access through NYU library)
- [Introduction to social network methods](#), Hanneman and Riddle (free, online).
- [statnet User's Guide](#): JoSS papers on statnet

There will be a number of readings, videos, and tutorials available from the web.
Recommended texts for further reading:

Robins, *Doing social network research: Network-based research design for social scientists* – for emphasis on research design.

Jackson, *Social and Economic Networks* - for economic and game theoretic applications of networks

Wasserman & Faust, *Social Network Analysis: Theory and Methods* - for a very thorough review of network structures, prestige/centrality and other node-based measures

Watts, *Six Degrees: The Science of a Connected Age*

Statistical Analysis of Network Data, Kolaczyk (free from NYU domain).

Statistical Analysis of Network Data with R, Kolaczyk and Csardi (free from NYU domain).

**SCHEDULE (subject to change)**

**Part I (readings from Newman, H&R, and provided lecture notes)**

Week 1: Introduction and notation: motivating examples and some graph theory

Week 2: Types of networks, network data structures

Week 3: Descriptive statistics: network and node attributes

Week 4: Odds Ratios and Testing

Week 5: Mathematical models for networks. Random Graphs

**Part 2**

**Week 6: Statistical models for networks**


**Week 7: ERGM fitting and diagnostics**

Week 1: Introduction to Network Analysis

Week 2: Network Models

Week 3: Network Visualization

Week 4: Network Measures

Week 5: Community Detection

Week 6: Temporal Networks

Week 7: Social Network Analysis (SNA)

Week 8: SAOMs and application


Week 9: Latent Space Models


Week 10: Hierarchical Network Models


Week 11: Relational Event Models and Dynamics


Week 12: Diffusion in networks


Week 13: Project Presentations

Week 14: Project Presentations
Course Requirements

Evaluation for this course will be weighted as follows:

- Class participation 10%
- Homework assignments 40%
- In-class paper presentation 20%
- Final project 30%

**In-class paper presentation**: During Part 2 of the course, students, working in pairs, will be expected to present one of the papers and help lead a discussion.

**Final project**: The final project will be a report of a data analysis on a data set of the student’s choosing. Students are encouraged to use readily available network data rather than attempt to assemble networks from complex sources; a replication study of a published analysis with some extensions is acceptable.

**Academic Integrity**: All students are responsible for understanding and complying with the NYU Steinhardt Statement on Academic Integrity. A copy is available at: http://steinhardt.nyu.edu/policies/academic_integrity.

**Students with Disabilities**: Students with physical or learning disabilities are required to register with the Moses Center for Students with Disabilities, 726 Broadway, 2nd Floor, (212-998-4980 and online at http://www.nyu.edu/csd) and are required to present a letter from the Center to the instructor at the start of the semester in order to be considered for appropriate accommodation.