Syllabus
Social Science Methodology: Network Analysis
Instructor: Oliver Westerwinter
Fall Semester 2016

Time & room
Thursday, 12:15-14h in 01-U102
Exception: Thursday, 06.10
8:15-10h in 01-U102

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Office hours: by appointment

This syllabus may be subject to adjustments.

Overview and goals
Politics, and social life more generally, is about networks. People, organizations, groups, and states are connected through a range of relationships. Organizations, for example, can be linked through project collaborations, flows of financial resources, or shared members. States in the international system are related to each other through trade, military alliances, and violent conflict among others. The patterns of such relationships constitute networks. The position of actors within these networks as well as the overall structural characteristics of networks can have an important impact on the behavior of agents and other outcomes of interest for social scientists. For example, the network ties of individuals may influence their voting behavior in an election, non-governmental organizations that occupy central positions in the network of human rights organizations may be more successful in launching human rights advocacy campaigns, and states that are central in the international trade network may be less likely to engage in violent conflict.

The study of networks in the social sciences has grown rapidly in recent years. Social scientists are investigating the effects of networks on a broad range of socio-political phenomena including political participation, voting behavior, congressional voting, terrorism, revolutions, transnational advocacy campaigns, policy diffusion, alliance formation, and war. Network analysis provides a repertoire of theoretical propositions and methods to study the properties, antecedents, and consequences of networks.

This course is an introduction to network analysis. Students will learn the basic concepts and analytic techniques of network analysis and how they can be employed to study substantive socio-political phenomena. Topics covered include network data collection and management, formulation of network hypotheses, network description and visualization, and methods for making statistical inferences with and about networks. We will make use of substantive applications in various social sciences with a focus on political science and international relations. Students will be introduced to common software packages for network analysis in R. Students will engage in their own analyses, using either their own data or replication data that has appeared in published work in political science.
**Prerequisites**
A willingness to work through possibly unfamiliar material. A basic understanding of statistics, matrix algebra, and programming in R is helpful, but not required.

There is the opportunity to participate in an optional refresher for basic matrix algebra and statistics as well as an introduction to the R programming language. The refresher will take four hours and will take place on Tuesday, September 27 at 10:15-4pm in room 23-003. Please bring your own laptop to class and make sure that you install R on your laptop prior to the refresher.

**Class requirements**
Final grades will be based on:

- Term paper (60% of final grade)
- Four homework assignments (40% of final grade)
- Participation in lectures and exercises

There will be four homework assignments, each of which will contribute 10% to your final grade for this class. The homework assignments will consist of analytical problems, computer programming in R, and data analysis. The solutions of the assignments together with, where applicable, the R code needed to reproduce the results have to be submitted electronically or as hard copy at the beginning of each class at which they are due. The assignments will be available one week prior to the class at which they are due. No late homework submissions will be accepted. All submitted homework will be graded. The solutions will be partly discussed in class and comprehensive solutions will be available electronically in form of R scripts.

The homework assignments are solo exams. Thus, you always need to write and submit your own solutions. Please always make sure that you write your name on every page of your submission. Please note that the homework assignments are designed to support and deepen your understanding of the material discussed in class. They will help you to self-assess your level of accomplishment and plan your term paper project.

The term paper will contribute 60% to your final grade. It has to be submitted either as hard copy or electronically (pdf) by January 20, 2017. Late submissions will not be accepted. The term paper is expected to present a short independent empirical research project that uses the theoretical and analytical repertoire of network analysis. The maximum length of the paper is 5,000 words (including footnotes, references, etc.). The term paper is a solo exam. You are therefore expected to work on and submit your term paper project individually.

**Course website**
We use StudyNet as communication platform for the class. The course site at StudyNet can be accessed here: [https://loginpages.unisg.ch/studynet](https://loginpages.unisg.ch/studynet).
The course website at StudyNet will provide readings, homework assignments, datasets, R code and scripts, and supplementary materials.

**Computation**
The course will be taught in R. R is an open-source computing language that is widely used in statistics. You can download it for free from [www.r-project.org](http://www.r-project.org) and it is recommended that you install R on your private computer prior to the start of class. For those of you who are not yet familiar with the basics of R, the refresher in the second semester week is recommended. Tutorials and other resources to learn about the basics of R are available at [http://wiki.math.yorku.ca/index.php/R:Gettingstarted](http://wiki.math.yorku.ca/index.php/R:Gettingstarted).

**Data**
Many example datasets will be provided in order to illustrate the application of the methods discussed throughout the course. In addition, there will be ample opportunities for students to work on their own data or data in which they are interested. For the homework assignments as well as the term paper, students may either use the example data discussed in class or their own data. The example datasets that will be used in class will be available on the StudyNet website of the course.

**Textbooks**
The course will be taught without using a single textbook. The required readings in combination with the slides and R scripts provided throughout the course will be the primary teaching materials. Students who are interested in consulting a textbook in parallel to the required readings and class materials can choose from a broad variety of options with different strengths and weaknesses including:


**Schedule**
The weekly coverage might change as it depends on the progress of the class. The assigned
required and optional readings are listed in the class schedule for each session. The required readings should be completed prior to the session for which they are listed and studied carefully. In addition, it is recommended to consult the optional readings. The optional readings may prove useful to students looking for additional coverage of some of the course topics as well as for developing the topic of your term paper project. This schedule is subject to adjustments.

**September 22: Introduction: Network terminology and data**

*Required readings:*


*Optional readings:*


**September 29: Network theory and hypotheses**

*Required readings:*


*Optional readings:*

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October 06: Collecting and manipulating network data (first problem set available)

Required readings:


Optional readings:


**October 13: Network descriptive statistics (first problem set due)**

*Required readings:*


*Optional readings:*


**October 20: Self-study: Describing networks using R**

*Required readings:*


Optional readings:


October 27: Network visualization (second problem set available)

Required readings:


Optional readings:


November 17: Partitioning networks into groups (second problem set due)

Required readings:


Optional readings:


**November 24: Inferential statistics with networks (third problem set available)**

*Required readings:*


*Optional readings:*


December 01: Models of network formation (third problem set due)

Required readings:


Optional readings:


December 08: Exponential random graph models: Introduction and statistical background

Required readings:


Optional readings:


December 15: Exponential random graph models: Application and interpretation (fourth problem set available)

Required readings:


Optional readings:


December 22: Temporal exponential random graph models (fourth problem set due on December 29)

Required readings:


Optional readings:


Austria.

**Further optional readings**
The following texts may turn out helpful for students who want to deepen some of the materials covered in class and review the basics of statistical analysis and research design.

*For statistical analysis:*


*For research design:*


*For probability:*


*For matrix algebra:*


*For math background:*


For statistical analysis and programing with R:

