Political Networks

PLSC 508
Fall 2022
Time: Thursday, 9:00am–12:00pm
Location: 025 Burrowes
Bruce A. Desmarais
bdesmarais@psu.edu
Office Hours: Monday, 11–12 on Zoom
https://psu.zoom.us/j/96761647810?pwd=SkVkdVRsT2pLV0ExV1NwRmNWdjFMZz09,
Thursday 12:15–1:15 in-person, & by appointment
Office Location: 231 Pond Lab

Course Overview: A network is a set of relationships among units. The study of networks in political science, the social sciences, and beyond has grown rapidly in recent years. This course is a comprehensive introduction to methods for analyzing network data. We will cover network data collection and management, the formulation and expression of network theory, network visualization and description; and methods for the statistical analysis of networks. The course will make extensive use of real-world applications and students will gain a thorough background in the use of network analytic software. Most of the applications discussed will be drawn from political science and sociology, but this course will be relevant to anyone interested in the study of network data.

Course Objectives: The broad objectives in this course are that students will develop:

1. Fluency in the language of networks analysis; an in-depth understanding of the concepts that have proven most useful in the study of networks.
2. Awareness regarding how theory and hypotheses for networks are structured.
3. Command of network analysis software.
4. Understanding of how to explore and describe network data.
5. The ability to statistically model network data and formally test hypotheses about networks.
6. Practical experience in conducting research with network data.

Books: There is one required book for this course—Cranmer, Desmarais, and Morgan (2021). Additionally, all three of the following books make excellent references for network analysts.

Required: Referenced in syllabus as "INA". Cranmer, Skyler J., Bruce A. Desmarais, and Jason W. Morgan. *Inferential network analysis.* Cambridge University Press, 2021.

Optional:

1. Newman (2010)
2. Wasserman and Faust (1997)
3. Lusher, Koskinen and Robins (2012)

Prerequisites: This course will be accessible to students without prior training in quantitative research methods. However, students with background in basic descriptive and inferential statistics will likely get more out of the course than those who need to fill in the gaps along the way. Understanding of descriptive statistics, hypothesis testing, regression analysis, and some experience with a scripting-based statistical software will accelerate comprehension of the material.

Computing: All computing will be conducted in the `R` statistical software. We will use add-on packages, mostly from the `statnet` suite - `http://csde.washington.edu/statnet/`. It is strongly advised that students download `R` onto a laptop and bring the laptop to class every week. The course will include an introduction to `R` for those unfamiliar with the software and we will regularly walk through applications during class.

Problem Sets: There will be at least one problem set covering each of the top-level topics listed in the course schedule. Problem sets are worth 40% of the final grade.

Methods Tutorial: Each student will be responsible for presenting a detailed tutorial of one of the methods covered in the class. Worth 20% of grade.

Application Review: Each student will be responsible for writing a review of, and leading discussion for, one of the application papers. Worth 10% of grade.

Replication and Extension: Students are required to complete an original research paper. The paper should include the replication of results from at least one published study. The research paper and presentation is worth 30% of the final grade.

Grading Scale.

Grade	Lower	Upper
A	93	101
A-	90	93
B+	88	90
B	82	88
B-	80	82
C+	78	80
C	72	78
C-	70	72
D+	68	70
D	62	68
D-	60	62
F	0	60

Course Schedule: The schedule below gives the required reading. The readings listed for a particular day should be read before class time that day. The full citations for the readings can be found below in the references section.

1. **Section One:** Introduction to network data, network analysis and `R`

   8/25: Introduction to Network terminology and Network Data
   - Wasserman and Faust (1997) Chs. 1 – 2
   - Applications
     * Ward, Stovel and Sacks (2011)
     * Patty and Penn (2017)

   9/01: Making and Visualizing Networks with `R`
   - Complete this tutorial – `http://www.cyclismo.org/tutorial/R/input.html`
   - Butts (2008)
   - Fruchterman and Reingold (1991)
   - Applications
     * Wilson, Davis and Murdie (2016)
     * Montoya (2008)

2. **Section Two:** Measures of network structure

   9/8: Centrality

   - Borgatti and Everett (2006)
   - Applications
     * Gray and Potter (2012)
     * Ingold and Varone (2011)

   9/15: Network description independent exercise. No class meeting, Prof. Desmarais at EUSN

   9/22: Reciprocity and Transitivity

   - Garlaschelli and Loffredo (2004)
   - Holland and Leinhardt (1971)
   - Applications
     * Christopoulos and Quaglia (2009)
     * Tam Cho and Fowler (2010)

   9/29: Popularity

   - Barabási and Albert (1999)
   - Applications
     * McNutt (2006)
     * Carpenter (2007)

   10/6: Assortative Mixing

   - Newman (2003)
   - Applications
     * Barberá (2015)
     * Settle and Carlson (2019)

   10/13: Community Detection

   - Yang, Algesheimer and Tessone (2016)
   - Applications
     * Cruz, Labonne and Querubin (2020)
     * Naidu, Robinson and Young (2021)

3. **Section Three:** Statistical Inference with Networks

10/20: Quadratic Assignment Procedure and CUG testing,

- INA, ch. 1–2
- Applications
  - Adam, Antl-Wittenberg, Eugster, Leidecker-Sandmann, Maier and Schmidt (2017)
  - Grossmann and Dominguez (2009)

10/27: ERGM Introduction

- INA ch. 3
- Applications
  - Bratton and Rouse (2011)
  - Duque (2018)

11/03: ERGM Specification

- INA ch. 4
- Applications
  - Song (2014)
  - Box-Steffensmeier and Christenson (2014)

11/10: Latent Variable Modeling: LSM,

- INA ch. 8–9
- Applications
  - Almquist and Bagozzi (2016)
  - Breunig, Cao and Luedtke (2012)

11/17: Latent Variable Modeling: LSM extensions and AMEN,

- INA ch. 10
- Applications
  - Dorff, Gallop and Minhas (0)
  - Kim, Liu and Desmarais (2022)

4. **Section Four:** Causality and Networks

12/01: Confounding of Selection and Influence

- Shalizi and Thomas (2011)
- Leenders (2002)

- Applications
  - Ichino and Schündeln (2012)
  - Kammerer and Namhata (2018)

12/08: Causal inference with interference

- Bowers, Fredrickson and Panagopoulos (2013)
- Applications
  - Phadke and Desmarais (2019)

COVID-19 statement: Penn State has relaxed most requirements and precautions related to the COVID-19 pandemic. However, I will still be following some protocols to help minimize the risk of contracting illness during course activities. First, I plan to wear a mask while I teach. Second, I will be masking during in-person office hours. Third, for those of you who would prefer to attend office hours remotely, I will be doing one session of Zoom office hours each week. Fourth, there is no grading penalty associated with missing class. Of course, students are still responsible for the course material and work, regardless of how many class sessions are missed. If you are not feeling well, please do not hesitate to stay home. I will also note that there is no portion of the course grade that is tied to class participation.

Disability Accommodation Statement Penn State welcomes students with disabilities into the University's educational programs. Every Penn State campus has an office for students with disabilities. Student Disability Resources (SDR) website provides contact information for every Penn State campus (http://equity.psu.edu/sdr/disability-coordinator). For further information, please visit Student Disability Resources website (http://equity.psu.edu/sdr/).

In order to receive consideration for reasonable accommodations, you must contact the appropriate disability services office at the campus where you are officially enrolled, participate in an intake interview, and provide documentation: See documentation guidelines (http://equity.psu.edu/sdr/guidelines). If the documentation supports your request for reasonable accommodations, your campus disability services office will provide you with an accommodation letter. Please share this letter with your instructors and discuss the accommodations with them as early as possible. You must follow this process for every semester that you request accommodations.

Academic Integrity Statement Academic integrity is the pursuit of scholarly activity in an open, honest and responsible manner. Academic integrity is a basic guiding principle for all academic activity at The Pennsylvania State University, and all members of the

University community are expected to act in accordance with this principle. Consistent with this expectation, the University's Code of Conduct states that all students should act with personal integrity, respect other students? dignity, rights and property, and help create and maintain an environment in which all can succeed through the fruits of their efforts.

Academic integrity includes a commitment by all members of the University community not to engage in or tolerate acts of falsification, misrepresentation or deception. Such acts of dishonesty violate the fundamental ethical principles of the University community and compromise the worth of work completed by others.

Counseling and Psychological Services Statement Many students at Penn State face personal challenges or have psychological needs that may interfere with their academic progress, social development, or emotional wellbeing. The university offers a variety of confidential services to help you through difficult times, including individual and group counseling, crisis intervention, consultations, online chats, and mental health screenings. These services are provided by staff who welcome all students and embrace a philosophy respectful of clients? cultural and religious backgrounds, and sensitive to differences in race, ability, gender identity and sexual orientation.

Counseling and Psychological Services at University Park (CAPS)
(http://studentaffairs.psu.edu/counseling/): 814-863-0395

Counseling and Psychological Services at Commonwealth Campuses
(http://senate.psu.edu/faculty/counseling-services-at-commonwealth-campuses/)

Penn State Crisis Line (24 hours/7 days/week): 877-229-6400 Crisis Text Line (24 hours/7 days/week): Text LIONS to 741741

Educational Equity/Report Bias Statements Consistent with University Policy AD29, students who believe they have experienced or observed a hate crime, an act of intolerance, discrimination, or harassment that occurs at Penn State are urged to report these incidents as outlined on the University?s Report Bias webpage (http://equity.psu.edu/reportbias/)

Long-term absences statement:

Extended Absences: During your enrollment at Penn State, unforeseen challenges may arise. If you ever need to miss an extended amount of class in such a circumstance, please notify your professor so you can determine the best course of action to make up missed work. If

your situation rises to a level of difficulty you cannot manage on your own with faculty support, reach out to the Student Care & Advocacy office by phone at (814-863-2020) or email them at StudentCare@psu.edu.

References

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