Econ 410
Economics of Networks
Autumn 2019 Quarter

University of Washington Department of Economics
Instructor: Alan Griffith
Version of 26 September 2019

Course Description and Goals:

This course is an advanced undergraduate course in the economics of networks. Primary aims of this course include:

1. Develop mathematical and other tools to describe and analyze data on networks, broadly defined.
2. Analyze how interaction through networks affects predictions of basic economic theory.
3. Develop and apply tools from game theory to the study of strategic interaction through networks.

The study of networks in within economics is a relatively new (and exciting!) phenomenon. Accordingly, we will be borrowing many concepts and results from adjacent fields that have been studying networks for decades (particularly sociology and computer science). However, throughout the course you should be asking yourself, "What makes this *economics*? What does *economics* as a field have to add to this analysis?" While the academic study of networks is quite multidisciplinary, tools from economics have much to add.

Prerequisites: The listed prerequisite for this course is Econ 300 or Econ (Intermediate Micro). Familiarity with the basics of game theory, constrained optimization, and matrix algebra will also be helpful, but I will provide a refresher where necessary.

Textbook:

Required The main text for this course is *The Human Network* by Matthew O. Jackson (*THN* on the syllabus). This book is written for the general public and, as such, omits many of the technical details that will be filled in during the lectures.

Optional Course material will also draw heavily on two additional references, which make excellent supplemental reading and references. The first is *Networks, Crowds, and Markets* by Easley and Kleinberg (E&K on the syllabus). This one is written from a multi-disciplinary standpoint and is fairly accessible for undergraduates. The second is *Social and Economic Networks* by Matthew O. Jackson (*SEN* on the syllabus). The level of technical detail is a bit higher than what we will be using in this course, but I will be borrowing heavily from it in the lectures.

Grading: The final grade will be calculated as follows:

Homework Assignments	30%
First Midterm	30%
Second Midterm	30%
Class Participation	10%

Readings: Readings are subject to change, as we may cover some topics more quickly or more slowly than planned. Please read the main readings as indicated. Readings marked with ** are supplementary and optional: these often are more detailed and/or more technical readings that I will discuss during the lectures but do not expect you to have read (but they may be useful if you want to dive deeper into a topic). Some of the material—particularly the theory—is difficult and technical. Try to understand the intuition behind the models and results, and come to class prepared with questions.

Math Concepts and Methods: A primary goal of this course is to develop a set of mathematical tools with which to analyze networks. Accordingly, there will be pars of lectures that review linear algebra, game theory, and other methods throughout the quarter. These are in *italics* on the syllabus.

Homework: There are six homework assignments due throughout the quarter. The homework assignments will involve a mixture of solving models and reacting to the readings and lectures from class. Some of them will be difficult, as they are intended to push your understanding. You should not be too worried if you cannot completely solve all parts of all answers. You are allowed (and even encouraged) to work with your classmates, although every student should turn in their own solutions, including showing you work in a reasonable manner.

Class Participation: Class participation is highly encouraged. This is an upper-level seminar-style class, so we will be discussing the readings at length during class. Some of the material is difficult, but do not be discouraged if you need to ask for clarification – other people probably have the same questions.

Canvas Site: We will be using a Canvas site. There will be posted all relevant course materials. I will also post lecture slides before class so that you can print them out to take notes, if so inclined.

Laptops in Class: I strongly discourage the use of laptops in class. Research has shown that people tend to retain things better if they take notes by hand. Also, I have found that they make class discussion—which we will have a lot of in this class—more difficult. I will post lecture slides before class, so that you can print them out and take notes on them if you are so inclined.

Office Hours: I will be holding office hours on Wednesday from 2pm to 4pm in Savery 345. If you are unable to make these times and would like to meet, please email me to suggest an alternative time.

Contact: The easiest way to contact me is via email. Please put "410" in the title to the email so that I will know that it is not spam. It is okay to ask simple questions over email, but if you have more complicated questions, including clarifications about concepts in the readings and lectures or about paper topics, then it is usually better to come to office hours.

Add Codes: I am fairly generous with add codes, especially for economics majors, if you can show sufficient preparation for the class. I cannot grant them beyond the space constraints imposed by classroom size, however.

Date	Topic / Theme	Readings
Thu, Sep 26	(1) Course Introduction – Why Networks? Why Economics?	Matthew O. Jackson. 2014. "Networks in the Understanding of Economic Behaviors." *Journal of Economic Perspectives* 28(4): 3-22. ** Blume et al. 2015. "Introduction to Computer Science and Economic Theory." *Journal of Economic Theory* 156: 1-13. ** Jackson, *SEN* 1 ** E&K 1.
Tue, Oct 1	(2) Describing Networks – Matrices, Paths, Degree, etc. *Basic Graph Theory* *Linear Algebra Review*	Jackson, *THN*, Chapter 1 ** E&K 2.1-2.3. ** Jackson, *SEN,* 2.2.1 – 2.2.2
Thu, Oct 3	(3) Describing Networks – Centrality, Power, Influence *Simple Combinatorics* *Eigenvalues and Eigenvectors*	Jackson, *THN*, Chapter 2 Feld, Scott. 1991. "Why Your Friends Have More Friends Than You Do." *American Journal of Sociology* 96(6): 1464-1477. ** Bonacich, Phillip. 1987. "Power and Centrality: A Family of Measures." *American Journal of Sociology* 92(5): 1170-1182. ** Jackson, *SEN* 2.4
Tue, Oct 8	(4) Describing Networks – Homophily, Clustering **Homework 1 Due**	Jackson, *THN*, Chapter 5 ** E&K 4.1-4.2. ** Jackson, *SEN* 3.2.2
Thu, Oct 10	(5) Describing Networks – Strong Ties, Weak Ties, Triadic Closure, Continuous Links	Granovetter, Mark S. 1973. "The Strength of Weak Ties." *American Journal of Sociology* 78(6): 1360-1380. Patacchini, Eleanora, and Yves Zenou. 2008. "The Strength of weak Ties in Crime." *European Economic Review* 52(2): 209-236. ** E&K 3.1 – 3.5 ** Jackson 2.2.
Tue, Oct 15	(6) Why Networks Matter – Social Learning and Diffusion	Jackson, *THN*, Chapter 3 ** Jackson 8.1-8.3. ** Jackson 2.4.1. ** Chandrasekhar, Arun, Horacio Larreguy, and JuanPablo Xandri. 2018. "Testing Models of Social Learning on Networks: Evidence from a Lab in the Field Experiment."

Thu, Oct 17	(7) Why Networks Matter – Herding Behavior and Cascades **Homework 2 Due**	Jackson, *THN*, Chapter 7 Salganik, Matthew J., Peter Sheridan Dodds, and Duncan J. Watts. 2006. "Experimental Study of Inequality and Unpredictability in an Artificial Cultural Market." *Science* 311(5762): 854-856. ** E&K 16, 19 ** Banerjee, Abhijit V. 1992. "A Simple Model of Herd Behavior." *Quarterly Journal of Economics* 107(3): 797-817.
Tue, Oct 22	(8) Why Networks Matter – Peer Effects	Christakis, Nicholas A., and James H. Fowler. 2007. "The Spread of Obesity in a Large Social Network over 32 Years." *New England Journal of Medicine* 357(4): 370-379. Cohen-Cole, Ethan, and Jason M. Fletcher. 2008. "Is Obesity Contagious? Social Networks vs. Environmental Factors in the Obesity Epidemic." *Journal of Health Economics* 27(5): 1382-1387. Cai, Jing, and Adam Szeidl. 2018. "Interfirm Relationships and Business Performance. *Quarterly Journal of Economics* 133(3): 1229-1282. ** Carrell, Scott E., Bruce I. Sacerdote, and James E. West. 2013. "From Natural Variation to Optimal Policy? The Importance of Endogenous Network Formation. *Econometrica* 81(3): 855-882.
Thu, Oct 24	(9) Why Networks Matter – Network Goods **Homework 3 Due**	Katz, Matthew, and Carl Shapiro. 1994. "Systems Competition and Network Effects." *Journal of Economic Perspectives* 8(2): 93-115. ** E&K 17.1-17.2, 17.5.
Tue, Oct 29	**FIRST MIDTERM**	
Thu, Oct 31	(10) Introduction to Game Theory, with focus on Networks *Game Theory*	Jackson, Matthew O. "A Brief Introduction to Game Theory." Sections 1.1-1.2. ** E&K 6.1-6.4, 6.9. ** Jackson, *SEN* 9.10.
Tue, Nov 5	(11) Games on Networks I – Games of Strategic Complements	** E&K 6.5. ** Jackson, Matthew O., and Yves Zenou. 2015. "Games on Networks." *Handbook of Game Theory with Economic Applications* 4: 95-163 (Sections 3-4)
Thu, Nov 7	**NO CLASS** **Homework 4 Due**	
Tue, Nov 12	(12) Games on Networks II – Games of Strategic Substitutes	Bramoulle, Yann, and Rachel Kranton. 2007. "Public Goods in Networks." *Journal of Economic Theory* 135(1): 478-494. ** E&K 6.5.

Thu, Nov 14	(13) Why Networks Matter – Networked Markets	Kranton, Rachel E., and Deborah F. Minehart. 2001. "A Theory of Buyer-Seller Networks." *American Economic Review* 91(3): 485-508. ** E&K 11.1-11.3. ** Jackson, *SEN* 10.
Tue, Nov 19	(14) Network Formation I – Random Networks *Poisson and Binomial Distributions* **Homework 5 Due**	Newman, Mark E., Duncan J. Watts, and Steven H. Strogatz. 2002. "Random Graph Models of Social Networks." *Proceedings of the National Academy of Sciences* 99(supp.1): 2566-2572. ** Jackson, *SEN* 4.1.
Thu, Nov 21	(15) Network Formation I – Growing Random Networks, "Small Worlds"	Barabasi, Albert-Laszlo, and Reka Albert. 1999. "Emergence of Scaling in Random Networks." *Science* 286(5439): 509-512. Jackson, Matthew O., and Brian W. Rogers. 2005. "The Economics of Small Worlds." *Journal of the European Economic Association* 3(2-3): 617-627. ** Jackson, Matthew O., and Brian W. Rogers. 2007. "Meeting Strangers and Friends of Friends: How Random are Social Networks? *American Economic Review* 97(3): 890-915. ** Jackson, *SEN* 5.1-5.2, 3.2.1 ** E&K 18
Tue, Nov 26	(16) Network Formation II – Matching Markets and Strategic Network Formation **Homework 6 Due**	Jackson, *THN*, Chapter 9 Roth, Alvin E., and Elliott Peranson. 1999. "The Redesign of the Matching Market for American Physicians: Some Engineering Aspects of Economic Design." *American Economic Review* 89(4): 748-780. ** E&K 10.1-10.5. ** Jackson, *SEN* 11.1.
Tue, Dec 3	(17) Network Formation II – Strategic Network Formation (cont'd) *Definitions of Equilibrium in Network Games* **Recap and Review**	Bloch, Francis, and Matthew O. Jackson. 2006. "Definitions of Equilibrium in Network Formation Games." *Int. J. Game Theory* 34: 305-318. ** Jackson, Matthew O. and Asher Wolinsky. 1996. "A Strategic Model of Social and Economic Networks." *Journal of Economic Theory* 71: 44-74. ** Bala, Venkatesh, and Sanjeev Goyal. 2000. "A Noncooperative Model of Network Formation. *Econometrica* 68(5): 1181-1229. ** Jackson 11.2-11.3.
Thu, Dec 5	**SECOND MIDTERM**	