Network Science, PhD

Website (http://www.networkscienceinstitute.org)

David Lazer, PhD
Distinguished Professor
College of Social Sciences and Humanities and College of Computer and Information Science

Network Science Program
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617.373.5884 (fax)
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The PhD program in network science aims to enhance our understanding of networks arising from the interplay of human behavior, sociotechnical infrastructures, information diffusion, and biological agents. This is an intrinsically multidisciplinary activity, with members of the network science community representing a wide range of fields including computer science, information science, complexity, physics, sociology, communication, organizational behavior, political science, and epidemiology. This is an interdisciplinary doctoral program focused on training students in network science across several colleges—including the College of Science, the College of Computer and Information Science, the College of Social Sciences and Humanities, Bouvé College of Health Sciences, the College of Engineering, and the College of Arts, Media and Design—with several research areas, including computational sciences, information sciences, health and life sciences, social sciences, and theoretical physics. See other collaborating colleges' catalog sections for possible concentration courses.

Course work is dependent on a student's area of research and subject to prior approval by their faculty advisor. Required course work includes the following: three foundational courses in network science—Complex Networks and Applications (PHYS 5116); Network Science Data (PHYS 7331); and Social Networks (POLS 7334)—at least one supplemental course in network science—Network Science Data 2 (PHYS 7332); Social Networks (POLS 7334); or Data Mining Techniques (CS 6220)—12 semester hours of elective course work defined by their area of research; and two research courses with core faculty of the program. A minimum of 32 credit hours of course work is required, though the graduate program committee may recommend additional course work based on student research interests.

Satisfactory progress in the program will be ongoing and formally evaluated at the end of both the first and second years of the program. Students are expected to maintain a cumulative GPA of 3.000 or better in all course work. Students are not allowed to retake courses. A student who does not maintain the 3.000 GPA, or is not making satisfactory progress on their dissertation research, may be recommended for termination by the graduate program committee.

Each student will have one primary research advisor from the network science doctoral program faculty.

Students will be expected to select their research advisor by the end of the spring semester of their second year in the program.

The dissertation committee consists of at least four members: the dissertation advisor, one additional network science doctoral program faculty member, one member expert in the specific topic of research (can be from outside the university), and one additional tenured/tenure-track faculty member from the concentration department/conferring college. The dissertation advisor must be a full-time tenured or tenure-track member of the Northeastern University faculty. Students may repeat the comprehensive examination once if they are unsuccessful.

Degree Candidacy
A student is considered a PhD candidate upon completion of all required course work with a minimum cumulative GPA of 3.000, satisfactory completion of the qualification exam, and satisfactory completion of the comprehensive exam.

Qualifying Examination
The qualification exam will be an oral examination of the material during the students' course work. The exam will be an hour in length and consist of questions selected by network science faculty who comprise the qualifying examination and dissertation committee. Students will receive 50 to 80 potential questions, which they must be prepared to answer, one month before the exam. The exam will consist of a subset of these questions. The qualifying exam will be offered twice annually, in the fall and spring term. All students are required to initially sit for the exam in the fall, typically in their third year of the PhD program. Students who do not pass the qualifying exam on their first attempt are expected to retake the exam in the spring term. Students may sit for the qualifying exam no more than twice.

Students who fail to complete the qualifying examination but who have completed all the PhD program's required course work with a cumulative GPA of 3.000 or better will be awarded a terminal Master of Science in Network Science degree. Note that no students will be admitted directly into the network science program for receipt of a master's degree.

Comprehensive Examination
Students must submit a written dissertation proposal to the qualifying examination and dissertation committee. The proposal should identify relevant literature, the research problem, the research plan, and the potential impact on the field. A presentation of the proposal will be made in an open forum, and the student must successfully defend it before the qualifying examination and dissertation committee. The comprehensive exam must precede the final dissertation defense by at least one year.

Dissertation Defense
A PhD student must complete and defend a dissertation that involves original research in network science. The dissertation defense must adhere to the College of Science policies.

Program Requirements
Complete all courses and requirements listed below unless otherwise indicated.

Milestones
Annual review
Qualifying exam
Dissertation committee
Dissertation proposal
Dissertation defense

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Qualifying exam
Dissertation committee
Dissertation proposal
Dissertation defense
Core Requirements

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Hours</th>
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<tbody>
<tr>
<td>PHYS 5116</td>
<td>Complex Networks and Applications</td>
<td>4</td>
</tr>
<tr>
<td>PHYS 7331</td>
<td>Network Science Data</td>
<td>4</td>
</tr>
<tr>
<td>PHYS 7335</td>
<td>Dynamical Processes in Complex Networks</td>
<td>4</td>
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</tbody>
</table>

Choose one of the following: 4
- PHYS 7332  Network Science Data 2
- CS 6220  Data Mining Techniques
- POLS 7334  Social Networks

Research

Complete the following (repeatable) course twice: 1-4
- NETS 8984  Research

Specializations

Choose one of the following specializations or 12 semester hours of elective course work from the electives course list:

- Computer Science (p. 2)
- Political Science (p. 2)
- Epidemiology (p. 2)
- Physics (p. 2)
- Math (p. 2)
- Electives (p. 2)

**COMPUTER SCIENCE**

Choose three from the following: 12
- CS 6140  Machine Learning
- CS 6220  Data Mining Techniques
- CS 6240  Large-Scale Parallel Data Processing
- CS 7800  Advanced Algorithms

**POLITICAL SCIENCE**

- POLS 7200  Perspectives on Social Science Inquiry 4
- POLS 7201  Research Design 4
- POLS 7202  Quantitative Techniques 4

**EPIDEMIOLOGY**

- PHTH 5202  Introduction to Epidemiology 3
- PHTH 5224  Social Epidemiology 3

Electives: Choose two from the elective course list below. 6-8

**PHYSICS**

Choose three from the following: 12
- PHYS 5318  Principles of Experimental Physics
- PHYS 7305  Statistical Physics
- PHYS 7731  Biological Physics 1
- PHYS 7321  Computational Physics

**MATH**

Choose three from the following: 12
- MATH 7233  Graph Theory
- MATH 7375  Topics in Topology
- MATH 7733  Readings in Graph Theory

**ELECTIVES**

Complete a minimum of 12 semester hours of elective course work related to your area of research. Common electives include the following:

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>NETS 7341</td>
<td>Network Economics</td>
<td>4</td>
</tr>
<tr>
<td>NETS 7345</td>
<td>The Practice of Interdisciplinary Scholarship</td>
<td>4</td>
</tr>
<tr>
<td>NETS 7350</td>
<td>Bayesian and Network Statistics</td>
<td>4</td>
</tr>
<tr>
<td>NETS 7983</td>
<td>Topics</td>
<td>4</td>
</tr>
<tr>
<td>NETS 8941</td>
<td>Network Science Literature Review Seminar</td>
<td>2</td>
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<tr>
<td>MATH 7233</td>
<td>Graph Theory</td>
<td>4</td>
</tr>
<tr>
<td>CS 5800</td>
<td>Algorithms</td>
<td>4</td>
</tr>
<tr>
<td>CS 6140</td>
<td>Machine Learning</td>
<td>4</td>
</tr>
<tr>
<td>CS 7180</td>
<td>Special Topics in Artificial Intelligence</td>
<td>4</td>
</tr>
<tr>
<td>CS 7295</td>
<td>Special Topics in Data Visualization</td>
<td>4</td>
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<tr>
<td>PHYS 7337</td>
<td>Statistical Physics of Complex Networks</td>
<td>4</td>
</tr>
<tr>
<td>PPUA 5301</td>
<td>Introduction to Computational Statistics</td>
<td>4</td>
</tr>
</tbody>
</table>

**Dissertation**

Complete one of the following (repeatable) course twice:
- NETS 9990  Dissertation

**Program Credit/GPA Requirements**

32 total semester hours required
Minimum 3.000 GPA required