

Network Science, PhD

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 various fields including computer science, information science, complexity, physics, sociology, communication, organizational behavior, political science, and epidemiology. This doctoral program trains students in network science across several colleges—the College of Social Sciences and Humanities, the College of Science, the Khoury College of Computer Sciences, and the Bouvé College of Health Sciences. See other collaborating colleges' catalog sections for possible elective courses.

Coursework depends on a student's area of research and is subject to prior approval by their faculty advisor. Required coursework includes 20 semester hours of core courses in network science, plus an additional 20 semester hours of courses relevant to the students' area of research. A minimum of 40 semester hours of coursework is required, though the graduate program committee may recommend additional coursework based on student research interests.

Annual Review

A review of satisfactory progress will be ongoing and formally evaluated at the end of the program's first and second years. Students must maintain a cumulative grade-point average of 3.000 or better in all coursework. Students are not allowed to retake courses. A student who does not maintain a 3.000 GPA, or is not making satisfactory progress on their dissertation research, may be recommended for dismissal by the graduate program committee.

Each student will have a primary dissertation advisor from the network science doctoral program faculty. The dissertation advisor should be selected by the end of the program's second year's spring semester.

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.

Alternate Course Path

Students have the option to complete core coursework in their first year of study. This curriculum pathway is mandatory for students whose admitting advisor is located outside of the Boston campus and elsewhere in the Northeastern network.

Qualifying Examination

The qualification exam is an oral examination of the material covered in the core curriculum. The exam will be an hour long and consist of questions selected by network science faculty. Students will receive between 50 to 80 questions to review for one month before the exam—a subset of which will make up the exam.

All students are required to sit for the exam in the fall, typically in their third year of the PhD program. Students who fail to pass the qualifying exam on their first attempt are expected to retake it in the spring term.

Students following the alternate path may take the exam at the end of the first academic year, upon completion of the required core courses.

Students may only take the qualifying exam twice.

Dissertation Proposal

Students must submit a written dissertation proposal to the dissertation committee. The proposal should identify relevant literature, the research problem, plan, and the potential impact on the field. The proposal will be presented in an open forum before a public audience and the dissertation committee, followed by questions from noncommittee members. The written proposal must be given to committee members at least two weeks before the oral presentation. After the presentation, the student will meet with the dissertation committee to address any concerns raised in either the written proposal or the presentation. The comprehensive exam must precede the final dissertation defense by at least one year.

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 coursework with a minimum cumulative GPA of 3.000, satisfactory completion of the qualification exam, and satisfactory completion of the comprehensive exam.

Dissertation Defense

A PhD student must complete and defend a dissertation involving original network science research. The dissertation defense must adhere to the dissertation policies of the College of Social Science and Humanities (<https://cssh.northeastern.edu/resources/theses-and-dissertations/>).

Students who have completed required coursework with a cumulative GPA of 3.000 or better may be eligible to receive an MS in Network Science degree. In addition, students who do not qualify for the doctoral degree, but who have completed required coursework with a cumulative GPA of 3.000 or better, may be eligible to receive a terminal MS in Network Science degree. Note that no students will be admitted directly into the MS in Network Science to pursue a master's degree.

Program Requirements

- Concentrations and course offerings may vary by campus and/or by program modality. Please consult with your advisor or admissions coach for the course availability each term at your campus or within your program modality.
- Certain options within the program may be *required* at certain campuses or for certain program modalities. Please consult with your advisor or admissions coach for requirements at your campus or for your program modality.

Complete all courses and requirements listed below unless otherwise indicated.

Milestones

Annual review
 Qualifying exam
 Dissertation committee
 Dissertation proposal
 PhD candidacy
 Dissertation defense

Core Requirements

Code	Title	Hours
NETS 5116	Network Science 1	4
NETS 6116	Network Science 2	4
NETS 7332	Machine Learning with Graphs	4
NETS 7334	Social Networks	4
NETS 7335	Dynamical Processes in Complex Networks	4

Specializations

Complete 20 additional semester hours in one of the following specializations or another course of study with written approval from your advisor.

- Computer Science (p. 2)
- Epidemiology (p. 2)
- Math (p. 2)
- Physics/Theory (p. 3)
- Social Science (p. 3)
- Independent (p. 3)

COMPUTER SCIENCE SPECIALIZATION

Code	Title	Hours
CS 5800	Algorithms	4
CS 6140 or CS 6220	Machine Learning Data Mining Techniques	4

EPIDEMIOLOGY SPECIALIZATION

Code	Title	Hours
PHTH 5202	Introduction to Epidemiology	3
PHTH 6202	Intermediate Epidemiology	3

MATH SPECIALIZATION

Code	Title	Hours
CS 5800	Algorithms	4
MATH 7233	Graph Theory	4

PHYSICS/THEORY SPECIALIZATION

Code	Title	Hours
MATH 7233	Graph Theory	4
PHYS 7321	Computational Physics	4

SOCIAL SCIENCE SPECIALIZATION

Code	Title	Hours
NETS 7350	Bayesian and Network Statistics	4
NETS 7360	Research Design for Social Networks	4

INDEPENDENT SPECIALIZATION

Code	Title	Hours
Students must choose two courses related to their research area with approval from their advisor.		6–8

ELECTIVES LIST

Code	Title	Hours
Select from the list below to complete the remaining 12–14 semester hours for the coursework requirement. Courses outside this list may be approved by the student's advisor.		12–14

CS 5800	Algorithms	
CS 6120	Natural Language Processing	
CS 6140	Machine Learning	
CS 6220	Data Mining Techniques	
CS 7180	Special Topics in Artificial Intelligence	
CS 7260	Visualization for Network Science	
CS 7295	Special Topics in Data Visualization	
MATH 7233	Graph Theory	
MATH 7243	Machine Learning and Statistical Learning Theory 1	
NETS 7341	Network Economics	
NETS 7350	Bayesian and Network Statistics	
NETS 7976	Directed Study	
NETS 7983	Topics	
PHYS 7305	Statistical Physics	
PHYS 7321	Computational Physics	

Dissertation

Code	Title	Hours
<i>Precandidacy</i>		
NETS 8986	Research	

Students should register for NETS 8986 between completion of the qualification exam and proposal defense.

Dissertation

NETS 9990	Dissertation Term 1	
NETS 9991	Dissertation Term 2	

Dissertation Continuation

Following completion of NETS 9990 and 9991, registration in the following is required each semester until the dissertation is completed:

NETS 9996	Dissertation Continuation	
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Program Credit/GPA Requirements

40 total semester hours required

Minimum 3.000 GPA required

Plan of Study**Typical Plan of Study**

Year 1			
Fall	Hours	Spring	Hours
PHYS 5116		4 NETS 6116	4
Two specialization courses		8 NETS 7334	4

		One elective course		4
		12		12
Year 2				
Fall	Hours		Spring	Hours
NETS 7332		4	NETS 7335	4
One elective course		4	One elective course	4
		8		8
Year 3				
Fall	Hours		Spring	Hours
NETS 8986		0	NETS 8986	0
		0		0
Year 4				
Fall	Hours		Spring	Hours
NETS 8986		0	NETS 9990	0
		0		0
Year 5				
Fall	Hours		Spring	Hours
NETS 9991		0	NETS 9996	0
		0		0

Total Hours: 40

Alternate Plan of Study

Year 1				
Fall	Hours		Spring	Hours
PHYS 5116		4	NETS 6116	4
NETS 7332		4	NETS 7334	4
One elective course		4	NETS 7335	4
		12		12
Year 2				
Fall	Hours		Spring	Hours
Two specialization courses		8	Two elective courses	8
		8		8
Year 3				
Fall	Hours		Spring	Hours
NETS 8986		0	NETS 8986	0
		0		0
Year 4				
Fall	Hours		Spring	Hours
NETS 8986		0	NETS 9990	0
		0		0
Year 5				
Fall	Hours		Spring	Hours
NETS 9991		0	NETS 9996	0
		0		0

Total Hours: 40