COMPUTER SCIENCE (PHD)

Computer Science and Engineering Department (https:// engineering.nyu.edu/academics/departments/computer-science-andengineering/)

NYSED: 85150 HEGIS: 0701.00 CIP: 11.0101

Program Description

We have a thriving PhD program with many full-time PhD students hailing from all corners of the world. Most full-time PhD students have scholarships that cover tuition and provide a monthly stipend. Admission is highly competitive. We seek creative, articulate students with undergraduate and master's degrees from top universities worldwide. Our current research strengths (https://engineering.nyu.edu/academics/ departments/computer-science-and-engineering/research-computerscience/) include data management and analysis, cybersecurity, computer games, visualization, web search, graphics, vision and image processing, and theoretical computer science.

This degree program offers interested students opportunities to do their research abroad, under the supervision of faculty at NYU Shanghai (https://shanghai.nyu.edu/academics/graduate/computer-science-phdprogram/) or NYU Abu Dhabi (https://nyuad.nyu.edu/en/academics/ graduate/global-phd-student-fellowships/global-phd-student-fellowshipin-computer-science.html).

Urban Science Doctoral Track

The optional Urban Science Doctoral Track (https://engineering.nyu.edu/ urban-science-sensing-complexity-informatics-doctoral-track/) is specifically designed for students who want to focus on urban science through a cohesive array of in-class and experiential learning activities, while pursuing their PhD at NYU Tandon. Doctoral track students will engage with CUSP's urban science faculty, experts in methodological aspects pertaining to complexity (dynamical systems, multi-agent systems, network science, and risk engineering), informatics (AI, machine learning, and robotics), and sensing (Internet of Things, smart infrastructure, wireless).

Admissions

To apply for admission to any Tandon graduate program, please contact the Office of Graduate Admissions (https://engineering.nyu.edu/ admissions/graduate/).

Program Summary

To receive a PhD in Computer Science at the NYU Tandon School of Engineering, a student must:

- satisfy a breadth course requirement, intended to ensure broad knowledge of computer science,
- satisfy a depth requirement, consisting of an oral qualifying exam presentation with a written report, to ensure the student's ability to do research,
- submit a written dissertation proposal and make an oral presentation about the proposal,
- write a PhD dissertation that must be approved by a dissertation guidance committee and present an oral dissertation defense, and
- satisfy all requirements for the PhD degree, as described below including credit points, GPA, and time-to-degree requirements.

Upon entering the program, each student will be assigned a faculty adviser who will guide them in formulating an individual study plan directing their course choice for the first two years. The department will hold an annual PhD Student Assessment Meeting, in which all PhD students will be formally reviewed.

Program Requirements

The program requires the completion of 75 credits, comprised of the following:

Course	Title Cro	edits
Choose 36 cr adviser. ¹	edits of graduate courses in consultation with your	36
Breadth Requ	uirement	
Theory Course	2	
Choose one o	course from the Theory Courses list below.	3
Systems & Ap	plications Courses	
Choose two o below.	courses from the Systems & Applications Courses list	6
Theory Course	e or Systems & Applications Course	
Choose one c course lists b	course from either the Theory or Systems & Applications below.	3
Free Choice C	ourses	
Choose two g	graduate courses of your choice. ²	6
Depth Requir	ement	
Qualifying Exa	am	
Students must dissertation r beginning the	st pass the qualifying exam (QE) before beginning research. Students must pass the QE within two years of e PhD program.	0 F
RE-GY 999	0 PHD QUALIFYING EXAM	
Dissertation		
After passing dissertation e dissertation o) the QE, students will enroll in at least 3 credits of each fall and spring term until graduation. A total of 21 credits are required for graduation. ³	21
CS-GY 999	X PhD Dissertation in Computer Science ⁴	
Total Credits		75
 Often stude credits tow Students at the CSE de other schoo Once cours them with t more course course list 	ents with a prior relevant MS degree transfer 30 blanket ard the electives requirement. re free to and encouraged to explore courses from within partment as well as other departments within Tandon ar ols at NYU, except for the School of Professional Studies es of interest have been identified, students should disc their adviser for approval. Alternatively, students may ch ses from the Theory course list or Systems & Application courses from these lists require no further approval	n nd uss oose s

from the adviser. The following courses cannot be used to meet this requirement:

- GA-GY 9993 Writing and Communication for Engineers and Scientists
- CS-GY 9963 Advanced Project in Computer Science
- · CS-GY 9413 Readings in Computer Science I
- · CS-GY 999X PhD Dissertation in Computer Science
- ³ Extra dissertation credits may count towards the electives, with the approval of the PhD adviser.

GA-GY 9993 Writing and Communication for Engineers and Scientists may also count toward dissertation credits.

Course Lists

Theory Courses

Course	Title	Credits
Theory Courses		
CS-GY 6043	Design and Analysis of Algorithms II	3
CS-GY 6703	Computational Geometry	3
CS-GY 6753	Theory of Computation	3
CS-GY 6763	Algorithmic Machine Learning and Data Science	e 3
Theory Course from	m the Courant Institute of Mathematical Sciences	
CSCI-GA 3520	Honors Analysis of Algorithms	4

Systems & Applications Courses Title

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Course
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Systems & Applications Courses			
CS-GY 6083	Principles of Database Systems		
CS-GY 6313	Information Visualization		
CS-GY 6513	Big Data		
CS-GY 6533	Interactive Computer Graphics		
CS-GY 6543	Human Computer Interaction		
CS-GY 6553	Game Design		
CS-GY 6613	Artificial Intelligence I		

CS-GY 6553	Game Design	3
CS-GY 6613	Artificial Intelligence I	3
CS-GY 6643	Computer Vision	3
CS-GY 6823	Network Security	3
CS-GY 6843	Computer Networking	3
CS-GY 6913	Web Search Engines	3
CS-GY 6923	Machine Learning	3
CS-GY 6943	Artificial Intelligence for Games	3
CS-GY 9163	Application Security	3
Systems & Applicat Mathematical Scien	tions Courses from the Courant Institute of nces	
CSCI-GA 2270	Computer Graphics	3
CSCI-GA 2271	Computer Vision	3

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er Graphics	3	
er Vision	3	For the QI
d Topics Database Systems	3	accompils
Intelligence	3	to the OF

Advance

CSCI-GA 2560 Artificial CSCI-GA 2565 Machine Learning CSCI-GA 2566 Foundations of Machine Learning CSCI-GA 2590 Natural Lang Processing

CSCI-GA 2620 Networks and Mobile Systems CSCI-GA 3110 Honors Programming Lang

GPA and Grade Requirements

The Computer Science PhD has several specific GPA and grade requirements. Breadth Grade Requirement: A grade of B or higher is required in all courses used to fill the breadth requirement. Theory and Systems & Applications GPA: Students must earn a GPA of 3.5 or higher in the four courses used to fill the Theory and Systems & Applications course requirements above. Free Choice GPA: A GPA of 3.5 or higher must be earned in the two Free Choice courses. Cumulative GPA: An overall GPA of 3.0 or higher is required in all graduate courses taken.

Algorithms

Any student who has not taken a course in Algorithms prior to entering the PhD program, at either the undergraduate or the graduate level, must take a graduate course in algorithms while in the PhD program. Students may take Design and Analysis of Algorithms I (CS-GY 6033), Design and Analysis of Algorithms II (CS-GY 6043), or Honors Analysis of Algorithms (CSCI-GA 3520) to fulfill this requirement. The department may revise these options in the future depending on course offerings. Alternatively, students may petition the PhD Committee (PHDC) Chair to use another course. The grade received in the course must be at least B.

Qualifying Exam

Credits

3

3

3

3

3

3

3

3

3

4

By the end of a student's third semester in the program, at the latest, the student must be involved in a research project under the guidance of a faculty research adviser. It is the responsibility of each student to find a faculty research adviser and a research project, and to inform the PHDC Chair about their choice of adviser. Students must inform the PHDC Chair if they change their research adviser.

To satisfy the depth requirement, students must take a qualifying exam (QE) based on their research. The QE must be passed before the start of the student's fifth semester in the program. Students are required to form a QE committee, select an exam topic, and a tentative date approved by the adviser and committee, by the end of their third semester.

Scheduling the QE less than two months before the start of the fifth semester is strongly discouraged. If a student does not pass the QE before the fifth semester, the student will not be allowed to continue the PhD in the fifth semester, unless an exception is granted by the PHDC and the Office of Graduate Academics.

The QE committee must consist of the adviser and at least two other members. The committee must be approved by the adviser and the PHDC. The adviser is the designated chair of the committee. All members of the QE committee must be CSE faculty, faculty from other departments at NYU, or individuals of like standing from outside the university. At least two of the QE committee members must be tenured or tenure-track members of the CSE department, unless permission is obtained from the nclude only one such member.

E, the student must give an oral presentation of their research shments to the QE committee and write a detailed document g those accomplishments. The document must be submitted to the QE committee and the PHDC no later than one week before the oral presentation. A student is expected to have conducted original research by the time of the exam. This research may have been carried out independently or in collaboration with faculty, research staff, or other students. Students are encouraged, but not required, to have publicationworthy results by the time of the exam. It is not sufficient for a student to present a survey of previous work in an area or a re-implementation of algorithms, techniques, or systems developed by others.

The committee, by majority vote, gives a grade for the QE as either "Pass" or "Fail". The chair of the QE committee will send this grade in writing to the student and to the PHDC Chair, together with a written evaluation of the student's performance, approved by the QE committee members. A student who does not receive a "Pass" may request permission from the PHDC to retake the exam. The PHDC will consult with the QE committee, review the case and make the final decision as to whether a retake is allowed or not. A student may petition the PHDC to change one or more

members of the QE committee, but approval of the request will be at the PHDC's discretion.

If the request for a retake is approved, the QE committee will determine the date for the second attempt. If the student is not allowed to retake the exam, the student will not be allowed to continue in the PhD program in the following semester. If the student does not pass the qualifying exam on the second attempt, or otherwise does not satisfy the conditions given to them upon failing the exam the first time, the student will not be allowed to continue in the PhD program in the following semester. If a student has passed the QE and then changes their area of research, the student need not retake the QE.

Dissertation Proposal and Presentation

Within 6 months of passing the QE, each student is required to form a dissertation guidance committee. This committee must be approved by the student's research adviser and by the PHDC. The committee must include at least four members, including the research adviser. The committee members can be CSE faculty, faculty from other departments at NYU, or individuals of like standing from outside the university. At least one member of the dissertation guidance committee must be a tenured or tenure-track CSE faculty member, and at least one member of the committee must be from outside the CSE department. The committee chairperson may or may not be the research adviser but must be a tenured or tenure-track faculty member in Tandon or have a cross-appointment of at least Associate level.

By the end of the student's fifth semester in the program, the student and committee must set a tentative date for the dissertation proposal presentation. The presentation must be done prior to the start of the student's seventh semester in the program.

Before finalizing the date of the presentation, the student must submit a written dissertation proposal to the dissertation guidance committee which should include:

- · a description of the research topic
- an explanation of how the research will advance the state of the art, and
- · a tentative research plan

After the dissertation guidance committee has approved the dissertation proposal, the student should schedule the dissertation proposal presentation and notify the PHDC Chair once this has been finalized. The presentation should be announced to the faculty by the PHDC Chair at least one week before it occurs. The presentation is open to all faculty. It may also be open to others at the discretion of the research adviser.

Substantial subsequent changes to the dissertation topic must be approved by the dissertation guidance committee.

Dissertation and Dissertation Defense

The last, and most substantial, aspect of the PhD program is the dissertation. The research for the dissertation should be conducted in close consultation with the research adviser. When the adviser determines that the student is ready to defend the dissertation, a dissertation defense will be scheduled. For the defense, the student will give an oral presentation describing the dissertation research, which is open to the public. Following the oral presentation and an initial question and answer session, the dissertation committee and CSE faculty may ask the student further questions in a closed session.

Annual PhD Student Assessment Meeting

All PhD students will be formally reviewed each year in a PhD Student Assessment Meeting. The review is conducted by the entire CSE faculty and includes at least the following items (in no particular order):

- · All courses taken, grades received, and GPAs.
- · Research productivity: publications, talks, software, systems, etc.
- · Faculty input, especially from advisers and committee members.
- · Student's own input.
- · Cumulative history of the student's progress.

As a result of the review, each student will be placed in one of the following two categories, by vote of the faculty:

- In Good Standing: The student has performed well in the previous semester and may continue in the PhD program for one more year, assuming satisfactory academic progress is maintained.
- Not in Good Standing: The student has not performed sufficiently well in the previous year. The consequences of not being in good standing will vary, and may include being placed on probation, losing funding, or not being allowed to continue in the PhD program.

Following the review, students will receive formal letters which will inform them of their standing. The letters may also make specific recommendations to the student as to what will be expected of them in the following year. A copy of each student's letter will be placed in the student's file.

Sample Plan of Study

Course	Title	Credits
1st Semester/Term		
CS-GY 9963	Advanced Project in Computer Science (elective)	3
Systems & Applications Co	purse	3
Theory Course		3
	Credits	9
2nd Semester/Term		
CS-GY 9963	Advanced Project in Computer Science (elective)	3
Systems & Applications Co	purse	3
Free Choice Course		3
	Credits	9
3rd Semester/Term		
CS-GY 9963	Advanced Project in Computer Science (elective)	3
Systems & Applications Co	purse	3
Free Choice Course		3
	Credits	9
4th Semester/Term		
CS-GY 9963	Advanced Project in Computer Science (elective)	3
CS-GY 9413	Readings in Computer Science I (elective)	3
RE-GY 9990	PHD QUALIFYING EXAM	0
Elective		3
	Credits	9
5th Semester/Term		
CS-GY 999X	PhD Dissertation in Computer Science	6
	Credits	6
6th Semester/Term		
CS-GY 999X	PhD Dissertation in Computer Science	6
	Credits	6
7th Semester/Term		
CS-GY 999X	PhD Dissertation in Computer Science	6
	Credits	6

8th Semester/Term

CS-GY 999X	PhD Dissertation in Computer Science	6
	Credits	6
9th Semester/Term		
CS-GY 999X	PhD Dissertation in Computer Science	6
	Credits	6
10th Semester/Term		
CS-GY 999X	PhD Dissertation in Computer Science	3
	Credits	3
11th Semester/Term		
CS-GY 999X	PhD Dissertation in Computer Science	3
	Credits	3
12th Semester/Term		
CS-GY 999X	PhD Dissertation in Computer Science	3
	Credits	3
	Total Credits	75

Learning Outcomes

Upon successful completion of the program, graduates will have:

- 1. A broad knowledge of computer science.
- 2. The ability to conduct original research in computer science.
- 3. The ability to present their research in written papers and oral presentations.

Policies NYU Policies

University-wide policies can be found on the New York University Policy pages (https://bulletins.nyu.edu/nyu/policies/).

Tandon Policies

Additional academic policies can be found on the Tandon academic policy page (https://bulletins.nyu.edu/graduate/engineering/academic-policies/).