School of Computing[1]
Binghamton University

2024-25

Graduate Student Handbook

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[1] Effective September 1, 2024, the Department of Computer Science at Binghamton University will be renamed as the "School of Computing".

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Contact Information

School website: https://www.cs.binghamton.edu

Mailing address:
School of Computing,
Thomas J. Watson College of Engineering and Applied Science,
State University of New York at Binghamton,
P.O. Box 6000,
Binghamton, NY 13902-6000

Graduate Program Inquiries can be sent to the following:

Prof. Leslie Lander	Graduate Director	lander@binghamton.edu	607-777-2309	EB P06
Ms. Katarzyna Mazur	Graduate Programs Assistant	kmazur2@binghamton.edu	607-777-4819	EB Q01
Prof. Patrick Madden	Program Director, MS Information Systems	pmadden@binghamton.edu	607-777-2943	EB Q04
Ms. Jessica Cook	Information Systems Program Assistant	jcook@binghamton.edu	607-777-4812	EB P12
Prof. Ping Yang	Coordinator, Cybersecurity Tracks and Certificate	pyang@binghamton.edu	607-777-5697	EB P11
Prof. Shiqi Zhang	Coordinator, AI Tracks	zhangs@binghamton.edu	607-777-4355	EB N12
Prof. Kartik Gopalan	Associate Chair for Research and Graduate Programs	kartik@binghamton.edu	607-777-4319	EB Q17
Prof. Weiyi Meng	Chair, School of Computing	meng@binghamton.edu	607-777-4311	EB P08

Introduction

The Graduate Student Handbook describes the requirements and procedures of the various graduate programs offered by the School of Computing (SoC) at Binghamton University.

The graduation requirements for a student are as stated in the handbook that was in effect at the time of entry to the program. If the requirements change subsequently, a student may use, if they so choose, the latest requirements in effect at the time they apply for graduation. Whichever set of requirements are chosen shall be applied in whole; for instance, it will not be possible to apply a part of requirements in effect at the time of entry and another part in effect at the time of graduation.

The precise regulations for all graduate programs are governed by relevant policies of the Graduate School and Binghamton University. In general, the student should keep abreast of the latest version of this Graduate Student Handbook and all academic regulations, procedures and degree requirements of the Graduate School, and other policies of Binghamton University.

Exceptions to these requirements to accommodate special circumstances must be approved by the Graduate Director and, when needed, by the student's academic advisor. Such exceptions must be documented and included in the student's academic file.

The requirements documented in this handbook are primarily intended for full-time graduate students, though most requirements may also apply to part-time graduate students. Part-time graduate students must contact the Graduate Director to determine precise requirements which apply to them, such as timeline, registration requirements, etc.

Every effort has been made to present this material in a straightforward and accurate manner; the document will be updated regularly. Any minor errors or ambiguities will not affect the actual rules and processes of the Graduate School, University Academic Guide, and the Program.

Overview of Degree Programs in the School of Computing

The School of Computing offers three graduate degrees with optional tracks:

- **Master of Science in Computer Science (MS CS)**
  - Artificial Intelligence Track
  - Cybersecurity Track
- **Master of Science in Information Science (MS IS)**
  - Applied Data Science Track
- **Doctor of Philosophy (Ph.D.) in Computer Science**

In addition, the School of Computing also offers

- Advanced Certificate in Cybersecurity in collaboration with the Department of Electrical and Computer Engineering.
- Artificial Intelligence Micro-Credential program.

General Requirements for All SoC Graduate Programs

This section provides a summary of general requirements across all SoC graduate programs. In the following text, "completed" means that a student has received a passing grade in the corresponding courses.

Residence Requirement

All graduate students, except 4+1/Accelerated MS students, are required to have completed a minimum of 24 graded credit hours from Binghamton University to meet the University's residence requirements.

For 4+1/Accelerated MS students, a minimum of 18 normally graded credits (residence hours) must be completed at the graduate level after the bachelor's degree is awarded.

Courses offered by EngiNet (a graduate distance learning program; for more information about this program, please visit https://www.binghamton.edu/watson/graduate/enginet/index.html) can also be counted toward the residence requirement.

Registration Requirements

Maintaining Full-time Status: To maintain full-time status, a graduate student must register for <u>at least</u> the number of graduate credits listed below per semester:

Student type		Full-time Credits
MS Student	who has completed fewer than 24 credits at Binghamton University	12
	who has completed at least 24 graduate credits at Binghamton	9
PhD Student	without a prior MS degree in any discipline from any institution — who has completed fewer than 24 credits at Binghamton University	12
	without a prior MS degree in any discipline from any institution — who has completed at least 24 graduate credits at Binghamton	9
	having a prior MS degree in any discipline from any institution — who has not yet provided the graduate school with an official copy of a transcript showing the award of an MS degree	12
	having a prior MS degree in any discipline from any institution — who has provided the graduate school with an official copy of a transcript showing the award of an MS degree	9

All international students are **required to maintain full-time registration** during Fall and Spring semesters.

Domestic students (US citizens/permanent residents) are not required to maintain full-time status, but they must register for at least one credit each semester (See "Continuous Registration" section).

Loss of full-time status: Classes from which students withdraw (with a W) do not count towards full-time status. Any student who needs to be full-time and is dropped from full-time status must apply for reinstatement as a full-time student using the appropriate Graduate School form.

Students receiving tuition scholarships, or any other financial aid, or international students on a visa are advised to be cautious when requesting Incomplete (I) grades. If an incomplete (I) grade later converts to a No Credit (NC), dropping the student below full-time enrollment, it might violate the terms of any tuition scholarships or financial aid and might result in situations that require repayment of tuition and/or loss of further funding.

Confirmation of Enrollment Each Semester: To prevent losing all your registered courses, at the beginning of the semester, you are required to complete confirmation of enrollment for each semester in which you are enrolled (fall, winter, spring and summer). Courses can always be changed after the confirmation of registration.

If confirmation of enrollment is not completed by the deadline posted, all courses will be dropped whether or not the semester bill is paid in full. If courses are dropped because you failed to confirm, you must re-enroll in courses online via BU BRAIN and confirm your enrollment.

To confirm your enrollment, follow the instructions posted on this website.

Registration Requirements for Graduation: Students need to be registered for the semester they plan to graduate. Incomplete and missing grades must be resolved before students can receive a graduate degree. Because students are using University resources and services, students must be registered in the term for which the Incomplete grade is converted to a grade.

Courses Outside Student's Major: Registration for courses outside a student's major requires the approval of the Graduate Director and student's academic advisor (if applicable). In order to be approved, the substitute courses must be demonstrably related to the major and of rigor similar to courses offered in the School of Computing.

"CC" (Course-Complete) Status

To qualify for "CC" status, a graduate student must have completed all coursework required for the degree by the first day of classes of the semester in which the student is to be designated as "CC."

Degree Program	Coursework requirement for CC Status
MS	30 credits of graduate classes - 10 courses, 2 can be independent study
4+1 MS	21 credits of graduate classes with the "Graduate"(GD) level, 3 are done with the "Undergraduate" (UG) level and double counted in

	the BS and MS.
PhD students with prior Masters	24 credits of graduate courses--8 courses, 2 can be independent studies.
PhD students with only Bachelors	54 credits of graduate courses--18 courses, 4 can be independent studies (at most 2 independent studies could count to an MS along the way).

Coursework can be considered complete only when a grade has been assigned for each course; coursework is not complete when the grade recorded is Incomplete (I). Students in CC status can register for only one credit of project, pre-dissertation, thesis, or dissertation (as applicable) and usually pay a lower registration fee.

Full-time Certification (Or Full-time Working Towards Degree Status)

Immigration rules require that international students maintain full-time status. Domestic students may also desire to maintain full-time status for loan deferral purposes. Full-time certification (FTC) can be used under certain conditions to allow a student to maintain full-time status at the end of the program. In order to qualify for FTC, students must meet all the criteria specified by the Graduate School Manual, which includes the requirement that students must have completed 24 or more graduate credits in residency; accelerated (4+1) students must have completed 18 or more graduate credits after the undergraduate degree.

Once a PhD student becomes ABD, only 1 credit of registration is needed for full-time status as long as the FTC has been approved. Hence FTC can be helpful for PhD students in reducing the amount of financial support needed from their advisor.

Continuous Registration

All students who have been admitted into a degree-granting program must maintain continuous registration each semester (except summer and winter). This means that they must be either registered for courses or a minimum of 1 credit hour of CS700 in each semester. Students who do not maintain continuous registration are severed and they must reapply for admission to return and pay a new application fee and up to 4 credits of registration for the semesters missed. Students graduating in the summer must be registered for at least one credit in the summer.

GPA Requirements and Academic Standing

To be certified for graduation, a cumulative grade point average of 3.0 (out of maximum 4.0) or better overall in graduate courses is required by the Graduate School. In addition, a cumulative GPA of 3.0 is required for the courses taken to satisfy the M.S. or Ph.D. degree in Computer Science. In the case of a repeated course, the latest grade will be used. A course can be repeated at most once.

Students with a cumulative GPA below B average (3.0) are placed on "academic probation" by the Graduate School. While on probation, the student must meet before the start of the semester with the

Graduate Director and their academic advisor (if any) to review academic performance. They must progress toward a return to satisfactory standing within one semester after being placed on probation; otherwise they may be subject to dismissal by the Graduate School.

A graduate student whose cumulative grade-point average falls below 2.6 will be considered in "academic jeopardy" as well as on academic probation. They are expected to check in with their Graduate Director and academic advisor (if any) regularly during their jeopardy semester. Students may be in academic jeopardy for only one semester.

Transfer of Graduate Credits from Other Institutions

Per Graduate School policies, MS students matriculated in advanced degree programs may petition to have graduate credits from other institutions transferred toward their Binghamton masters' degrees. Transfer credits are not normally considered for doctoral degrees.

Controlling Course Load

Graduate courses and projects tend to require a substantial amount of work, so students are advised to plan carefully. Students are advised to take a judicious combination of lecture courses, CS 595/599 (MS Project/Thesis), CS 597/CS697 (Independent Study), and CS 698/699 (Predissertation/Dissertation).

A schedule that includes more than 3 regular lecture courses in one semester is strongly discouraged. The sample schedule in the appendix shows our default advice for students in the first semester, given the effort needed to adjust to a new environment and the potential impact that such high workloads may have on a student's overall academic performance and GPA.

Financial Support

Although the School of Computing does not guarantee any funding, currently, the vast majority of full-time Ph.D. students, and some exceptional MS students are fully/partially funded.

Teaching Assistantships (TA) and Research Assistantships (RA) are awarded competitively to students based on a number of criteria including research potential, teaching potential, and strong academic performance. These positions normally provide a stipend sufficient for all basic living expenses and a tuition waiver (see below). Ph.D. students may qualify for a higher stipend than MS students.

Normally, TA and RA positions are awarded for an academic semester or an academic year. RA positions may also provide summer funding. Renewals depend upon funding availability, satisfactorily meeting teaching and/or research obligation, academic standing, and satisfactory progress towards degree.

TAs are responsible for assisting with course teaching (including but not limited to grading, overseeing discussion sections, labs, holding office hours, proctoring, and class logistics). Generally, TA support is limited to 6 semesters per student due to limited availability of TA positions.

RA positions are awarded by individual faculty members who have positions open to work on their projects. Students should contact individual faculty members to enquire about RA opportunities. In

many cases, RA positions are awarded to students after their first year, when they have completed their course requirements and faculty have had an opportunity to evaluate them.

Graduate Assistantships (GA) are sometimes available from the university. Terms and conditions may vary, including stipend amounts.

Tuition Waivers: TA and RA funding normally covers tuition, although in some cases they may not include a tuition waiver. GA positions normally do not come with a tuition waiver. To enable expeditious progress towards candidacy, normally, funded pre-candidacy PhD students receive a tuition waiver of 12 credits or 9 credits per semester, depending on the number of courses they register for. After being admitted to candidacy, funded PhD students normally receive 1 credit of tuition waiver.

In-person Presentation of RPE, Prospectus, Dissertation Defense, and MS Thesis

In-person public presentations are essential for graduate students to develop public speaking skills and self-confidence. All presentations for RPE/Prospectus/PhD Defense/MS Thesis must be held in person (not via video conference) where the student defends their work in front of all committee members and public audience. Some committee members can attend remotely if there is unanimous consent of the student and all committee members.

Presentation announcements must be made on public forums at least one week in advance. Reservations for rooms must be made at least two weeks in advance due to limited availability of conference rooms.

Requests for "undue hardships" for in-person presentation should be emailed to the Graduate Director and/or Associate Chair for Research and Graduate Programs for approval at least 2 weeks before presentation. The most typical valid reasons for undue hardship include the student being out of the country and unable to return in time due to visa issues, or if the student is sick and must defend to meet an immediate graduation deadline. Having started a full-time job in another location is generally not a valid reason for remote defense.

Internships and Curricular Practical Training (CPT)

Internships may be undertaken after finishing at least one full academic year (two semesters) at Binghamton University. It is necessary to obtain approval from your advisor and the Graduate Director for an internship, especially if one is being undertaken during the academic year.

International students should be aware of the restrictions on employment off-campus for students on F-1 visas. An exception to these restrictions may be granted via the Curricular Practical Training (CPT) process, which allows up to 12 months of training that contributes to the student's course of study. Only students who have been enrolled full-time for at least one year are eligible for CPT. To learn more about this process, please refer to the Office of International Students and Scholar's Services (ISSS, http://www.binghamton.edu/isss).

Optional Practical Training (OPT)

F-1 students may be eligible for 12 months of Optional Practical Training (OPT). Employment under OPT can be paid or unpaid. F-1 students within the fields of science, technology, engineering or math (STEM) may be eligible for a 24-month extension of their Post-Completion OPT work permission, contingent upon being gainfully employed by an E-Verified approved employer. For more information on the OPT process and guidelines, please visit the ISSS website.

Ethics and Regulatory Requirements

All students must follow the Watson College's Academic Honesty Code and Binghamton University's Student Academic Honesty Code in their coursework, research work and professional conduct. Violation of these policies will entail appropriate penalties specified in these policies.

Please read this letter from SoC faculty to students, which details the School of Computing's expectations of ethical behavior by graduate students in particular.

All students are required to complete the School of Computing's online Professional Ethics Assessment module during the course of their graduate study.

Apart from the academic requirements listed above, students may be asked to meet certain eligibility requirements or acquire and periodically renew certain credentials during their study. For instance, every student appointed as a TA is expected to undergo mandatory TA training. Every student appointed as a federally-funded RPA is required to undergo "Responsible Conduct in Research" (RCR) training. In addition, students working on projects involving sensitive data or human subjects may be required to undergo specific training (e.g., human-subject training). Credentials for RCR and human subjects training will need to be renewed at specified intervals to maintain eligibility for RPA appointments.

Master of Science in Computer Science (MS CS)

The Master of Science in Computer Science degree focuses on the design and application of computing systems, including the design of hardware and software components, hardware-software trade-offs and the diverse applications of computing.

Requirements - MS CS

Holders of a baccalaureate degree in computer science or a related field are invited to apply for admission to the MS CS program. Students whose undergraduate degrees are not in computer science may be required to complete some preparatory work in addition to fulfilling the requirements listed below. All MS CS students must complete 31 credits of computer science graduate courses.

1. Complete the following three core courses (total of 9 credits):

- CS 551 Systems Programming
- CS 571 Programming Languages
- CS 575 Design and Analysis of Computer Algorithms

2. Complete the courses in one of the following two options (total of 22 credits):

- Project Option: Seven electives approved by the student's faculty advisor (making a total of ten courses) and a one-credit project the student develops and presents
- Thesis Option: Six electives approved by the student's faculty advisor (making a total of nine courses) and a four-credit thesis the student writes and defends.

Students may choose electives from the list below. One chosen elective must be a large software development course. Large software development courses are marked below.

- CS 515 Social Media Data Science Pipeline*
- CS 517 Human Computer Interaction
- CS 520 Computer Architecture and Organization*
- CS 524 Intelligent Mobile Robotics
- CS 526 Internet of Things
- CS 527 Mobile Systems Security
- CS 528 Computer Networks and Data Communications**

- CS 532 Database Systems
- CS 533 Information Retrieval*
- CS 535 Introduction to Data Mining
- CS 536 Introduction to Machine Learning**
- CS 540 Advanced Topics in Object-Oriented Programming*
- CS 541 Game Development for Mobile Platforms*
- CS 542 Design Patterns*
- CS 544 Programming for the Web*
- CS 545 Software Engineering
- CS 547 High Performance Computing*
- CS 550 Operating systems*
- CS 552 Introduction to Cloud Computing
- CS 553X Software Security
- CS 555 Introduction to Visual Information Processing*
- CS 556 Introduction to Computer Vision
- CS 557 Introduction to Distributed Systems*
- CS 558 Introduction to Computer Security***
- CS 559 Science of Cyber Security
- CS 560 Computer Graphics*
- CS 561 Topics in Data Privacy
- CS 565 Introduction to Artificial Intelligence
- CS 572 Compiler Design*
- CS 576 Programming Models for Emerging Platforms***
- CS 601 CS Research Methodology Seminar****
- All CS 580 and CS 680 Special Topics courses**

* Large software development course

** Will count as a large software development course dependent on course instructor; large software development courses will be announced well in advance of the start of the semester

*** Counts as a large software development course only with completion of course project

**** This course is intended for new PhD students. MS students may take this course with the permission of the instructor

3. Maintain a B average in all graduate coursework.

With approval of the faculty advisor and Graduate Director, at most two courses may be taken from other departments/schools in Watson College or from other schools within the University.

Requirements - MS CS with Artificial Intelligence (AI) Track

To complete the AI track in the MS CS, students must replace four electives in the MS CS with the following:

1. Two required AI courses:

- CS 536 Introduction to Machine Learning
- CS 565 Introduction to Artificial Intelligence

2. Two AI electives chosen from the following list:

- CS 515 Social Media Data Science Pipeline
- CS 517 Human Computer Interaction
- CS 524 Intelligent Mobile Robotics
- CS 535 Introduction to Data Mining
- CS 555 Introduction to Visual Information Processing
- CS 556 Introduction to Computer Vision
- CS 580 - Certain approved CS topics course in areas such as Computational Social Science, Deep Learning, and Natural Language Processing. The Computer Science web-page will maintain a current listing.

Note: Students who take the AI track in the MS CS must still complete the three core courses, a project or thesis and fulfill the requirement to take a minimum of one large software development course. The MS CS requires 31 total credit hours, with or without a track.

Requirements - MS CS with Cybersecurity Track

To complete the cybersecurity track in the MS CS, students must replace four electives with the following:

1. Two required cybersecurity courses:

- CS 558 Introduction to Computer Security
- CS 559 Science of Cybersecurity

2. Two cybersecurity electives chosen from the following list:

- CS 527 Mobile Systems Security
- CS 528 Computer Networks
- CS 536 Introduction to Machine Learning
- CS 553X Software Security
- CS 561 - Topics in Data Privacy
- CS 580 - Certain approved CS topics course in areas. The Computer Science web-page will maintain a current listing.

Note: Students who take the cybersecurity track in the MS CS must still complete the three core courses, a project or thesis, and fulfill the requirement to take a minimum of one large software development course. The MS CS requires 31 total credit hours, with or without a track.

Requirements - 4+1 BS-MS in Computer Science

Students are encouraged to apply at the end of their junior year (i.e. the semester in which they will complete all of the 300-level computer science and mathematics area requirements) but must apply no later than the end of the first semester of their senior year. A GPA of at least 3.3 is required for admission; students with a GPA above 3.0 (but below 3.3) may be admitted at the discretion of the Director of Graduate Studies with two signatures of support from SoC faculty. An application workflow can be found at the Binghamton portal (my.binghamton.edu). Applicants should meet with the Director of Graduate Studies as part of the application process. In addition, students must apply for formal admission to the Graduate School during their senior year. At the time of completion of the bachelor of science (BS) degree in CS, students will have completed at least 19 credits of CS courses numbered 400 or above. The 19 credits will include 400-level required and elective courses as well as graduate elective courses. At most, three graduate elective courses (9 credit hours) may double-count in the BS and MS programs but courses must be selected to meet the distribution requirement of the undergraduate degree. In addition to 9 double-counted credits, 22 credits must be taken at the graduate-only level and of these 22 graduate credits, 18 credits of coursework (not including project or thesis credit or any other course graded S/U) must be completed after the award of the BS in CS to meet graduate residence. Students must meet all other requirements for the master's of science (MS) degree in CS.

Undergraduate credits: 126. Double counted credits: 9. Graduate credits: 31.

Master of Science in Information Science (MS IS)

The Master of Science in Information Science prepares students for careers in information technology, spanning from the design configuration and deployment of information processing systems to the management of teams tasked with work of this nature.

Requirements - MS IS

Holders of a baccalaureate degree who have adequate programming skills in at least one programming language are invited to apply for admission to the MS IS program.

1. Complete the following three required courses (a total of nine credits):

   - INFO 501 Information Systems I: Python and Data Mining

   - INFO 502 Information Systems II: Management of Systems

   - INFO 532 Database Systems

2. Complete a total of 21 credits (seven elective courses) chosen from the following list:

   - INFO 505 Software Project Management

   - INFO 533 Web Based Information Retrieval and Search

   - INFO 535 Applied Data Mining

   - INFO 536 Applied Machine Learning

   - INFO 537 Tools for Data Science

   - INFO 541X Mobile Applications for Social Networks

   - INFO 542 OO Design in Java+Design Patterns

   - INFO 544X Web-based Programming

   - INFO 554X Data Analytics for Security

   - INFO 558X Web and Database Security

   - INFO 559X Information Systems Security
   - INFO 591X Python Programming Practicum
   - CS 515 Social Media Data Science Pipeline

   - CS 527 Mobile Systems Security

   - CS 558 Introduction to Computer Security

   - CS 580 - Certain approved CS topics course in areas such as Natural Language Processing. The Computer Science web-page will maintain a current listing.

3. Complete the INFO 595 Termination Project course

4. Maintain a B average for all graduate coursework

Requirements - MS IS with Applied Data Science Track

To meet the requirements to complete the applied data science track in the MS IS, students must complete the following courses within their 21 credits of electives.

1. Two required applied data science courses:

- INFO 535 Applied Data Mining
- INFO 536 Applied Machine Learning

2. Two applied data science electives chosen from the following list:

- INFO 505 Software Project Management
- INFO 533 Web Based Information Retrieval and Search
- INFO 537 Tools for Data Science
- INFO 554X Data Analytics for Security
- INFO 558X Web and Database Security
- INFO 559X Information Systems Security
- CS 515 Social Media Data Science Pipeline
- CS 580 - Certain approved CS topics course in areas such as Natural Language Processing. The Computer Science web-page will maintain a current listing.

PhD in Computer Science

The doctoral program leads to a PhD degree in computer science. Students admitted into the program normally have a master's degree in computer science or a closely related discipline. Students must complete the requirements listed to earn the PhD.

A more detailed description of the requirement follows. Beyond these program-specific requirements, the academic policies of the Graduate School Manual for doctoral degrees must be satisfied.

Admission to the Program

For admission to the doctoral program, current students in the computer science MS program should discuss their intentions to continue into the PhD program with their faculty advisor of choice and the Graduate Director. Students with their MS in computer science, or a closely related field, from other institutions should apply through the Graduate School application process. For students with exceptional academic backgrounds and research experiences, it is possible to pursue a direct BS-to-PhD path (without earning an MS along the way).

Because of the wide range of potential research topics and the limited enrollment in the PhD program, preliminary discussions between the applicant and the intended faculty advisor are expected to occur before admission.

Credit and Coursework Requirements

Requirements for Students without a Prior MS Degree

For full-time students without a prior MS degree, a minimum of 60 credits must be completed.

- At least 42 credits (14 courses) must come from letter-graded courses, including:
  - CS601 - CS Research Methodology
  - at least one more 600-level course (CS 697 cannot be used to fulfill this requirement).
- A maximum of 12 credits may be earned from letter-graded Independent Study courses.
- A total of 54 credits must be completed before admission to candidacy.
- The remaining 6 credits may be pre-dissertation research or dissertation research taken after admission to candidacy.
- Students must also satisfy the "PhD Core Courses Requirements" and "PhD Qualifying Exam Requirements" described below.

Requirements for Students with a Prior MS Degree

For full-time students with a prior MS degree, a minimum of 30 credits must be completed.

- At least 18 credits (6 courses) must come from letter-graded courses, including:
    - CS 601 - CS Research Methodology and
    - at least one more 600-level course (CS 697 cannot be used to fulfill this requirement).
- A maximum of 6 credits may be earned from letter-graded Independent Study courses.
- A total of 24 credits must be completed before admission to candidacy.
- The remaining 6 credits may be pre-dissertation research or dissertation research taken after admission to candidacy.
- Students must also satisfy the "PhD Core Course Requirements" and "Qualifying Exam Requirements" described below.

PhD Core Courses Requirements

At the start of the PhD program, the student and advisor must decide the four PhD core courses which the student is required to take towards their "Qualifying Exam Requirements."

At least two of the four core courses must be from the three MS CS core courses (CS 551 Systems Programming, CS 571 Programming Languages, CS 575 Design and Analysis of Computer Algorithms) and the rest from 500-level graded courses closely related to the student's research.

Students who have completed an MS CS at Binghamton University can count their CS courses already taken during MS CS towards this PhD core course requirement, subject to the above restrictions. However such students must still satisfy the 30 credits of "Credit and Coursework Requirements'' for PhD students mentioned above using other CS courses not yet taken.

For students who have not completed an MS CS at Binghamton University, the four PhD core courses can count towards their "Credit and Coursework Requirements."

These mutually agreed-upon PhD core courses must be recorded in the student's Learning Contract, subject to the approval of the Graduate Director.

Once agreed upon, no changes are permitted to the PhD core courses that the student has started/completed. Any changes to core courses not-yet taken must be accompanied by a written justification by the advisor in the Learning Contract, with the approval of the Graduate Director.

Guidance Committee

In the first year of study in the PhD program, students must form an approved guidance committee. The guidance committee consists of at least three members from the School of Computing; however, in addition, students may propose members from other schools at Binghamton University, and, with Graduate School approval, faculty from other universities or professionals from outside academia may also be included. The guidance committee advises

the student and evaluates and certifies the student's performance throughout the program of study and research. If a guidance committee requires any changes to the committee members, the student must notify the school's Graduate Programs Assistant.

PhD students are required to identify an outside examiner from an approved list from the Graduate School at least one month prior to the defense of the dissertation presentation.

Learning Contract

In consultation with the guidance committee, the student prepares a learning contract in which a program of study is specified, including the major area of research, additional course requirements, teaching requirement, evaluation procedures and the form of the qualifying examination and research proficiency examination. Each modification must be approved by the guidance committee and the Graduate Director and must be properly documented. The learning contract is completed in parts during the progression of PhD and the details are provided to each admitted student. A copy of the learning contract is placed on file with the School of Computing.

Qualifying Exam Requirements

Every PhD student must complete the qualifying exam. The qualifying exam ensures that every PhD candidate has the breadth of general computer science knowledge covered in a four-course core of Computer Science courses determined by the student's guidance committee including at least two of the MS core courses (Design and Analysis of Computer Algorithms, Systems Programming, and Programming Languages), subject to approval by the Graduate Director. The qualifying exam requirement is waived if the student has a B+ grade or better in each of the four core courses and a 3.5 grade point average or better for the four core courses.

In the event that a student does not receive a qualifying exam waiver, the student must pass a PhD qualifying exam in any course in the four course core where the student receives a grade of B+ or lower.

Research Proficiency Examination (RPE)

Students must pass the RPE related to the topic of research, administered by the student's guidance committee. The RPE consists of an oral presentation and the submission of a technical document with thorough related work study. The oral presentation should be announced at least one week in advance of the presentation. A copy of the RPE report must be submitted to the School of Computing.

Admission to Candidacy

Once the course requirements, qualifying exam, and the RPE are successfully completed, the student is recommended for admission to candidacy.

Prospectus

The primary purpose of the prospectus is to assess the PhD student's progress toward completing the dissertation and specific plans for achieving the research objectives. The PhD guidance committee will assess the student's research competence at the PhD level.

The prospectus should describe the motivation and justification for the selected research topic. It should include background material and current status of the intended research area with references, specific research objectives to be achieved for the completion of the dissertation, concrete plans toward completion and evidence of progress toward the objectives.

The announcement about the prospectus presentation must be made in the school at least one week before the presentation. A copy of the final prospectus must be submitted to the Graduate Programs Assistant.

Proficiency in Teaching

Doctoral candidates must demonstrate proficiency in teaching. Students must complete at least six public presentations with at least one of them being a colloquium in the School of Computing colloquium series. The remaining teaching requirements may be satisfied with any of the following options:

- Teach a CS course at Binghamton University as an instructor of record or under the supervision of a faculty member

- RPE presentation

- Prospectus presentation

- Dissertation defense presentation

- Any public presentation that is announced at least one week in advance

- Lecture given to students in a normal class (including guest lecturing)

- Paper presentation at a technical conference/symposium/workshop

Dissertation

With the guidance of the dissertation advisor, the student completes research and preparation of the dissertation, which is an original written contribution demonstrating originality and competence in the chosen field of research. The guidance committee has direct charge of all matters pertaining to the dissertation, which must have the committee's unanimous approval before arrangements are made for the final examination for the degree.

In defense of the dissertation, the student is required to pass an oral examination in the form of a presentation open to the University community. The announcement must be made at least 10

days in advance of the presentation. The oral presentation is evaluated by the student's guidance committee and an outside examiner. The decision to recommend the candidate for the doctoral degree is made by unanimous vote of the guidance committee and the outside examiner.

Advanced Certificate in Cybersecurity

The Advanced Certificate in Cybersecurity will document a student's completion of a formally organized suite of courses in information systems security. The program will introduce a breadth of cybersecurity concepts in a foundational course that is common to all students in the program, but will allow depth in chosen areas of emphasis. In addition to the foundational course, each student will take one course each related to analysis, design and applications as they pertain to information systems security. The intent of the program is not to provide a comprehensive self-contained competency, but rather to provide the student with special attention, in the context of an MS program or in professional practice, to information security issues inherent in computer science and electrical and computer engineering subject matter. It therefore highlights security dimensions of existing coursework and professional experience.

General Academic Program Requirements

The Advanced Certificate in Cybersecurity is designed to:

- Address depth and breadth of information science and security topics
- Attract both CS and ECE undergraduates or students in closely related disciplines
- Offer flexibility in choosing courses for certificate

Students will take a common foundational course and at least one course in three focus areas:

- Design: creation and specification of secure systems (software or hardware) from elementary design principles
- Analysis: assess and quantify security aspects and dimensions of software and hardware systems
- Application: use existing tools and templates to defend systems or exploit vulnerabilities to become penetration testers or "red-team" assessors

The student must maintain at least a B average in four courses spanning all four general areas:

- Cybersecurity Foundations: Fundamentals of Computer Security (WTSN 551) or Introduction to Computer Security (CS 558)
- Design Course: Cyber-Physical Systems Security (EECE 567) or Operating Systems (CS 550)
- Analysis Course: Science of Cybersecurity (CS 559), Fundamentals of Steganography (EECE 562), Contemporary Stats Cybersecurity (EECE 580I), Network Security (EECE 657), Hardware-Based Security (EECE 658), or Cryptography and Information Security (EECE 560)

- Applications: Cyber-Physical Systems Security (EECE 567), Network Computer Security (EECE 565), Software Security (CS 553X), Mobile Systems Security (CS 527), Operating Systems (CS 550), or Hardware and Systems Security (CS 580A)

Admission

The Advanced Certificate in Cybersecurity program is open to graduate students in computer science, electrical and computer engineering or a closely related area as an add-on certificate program or as a standalone certificate program to non-matriculated students. Non-matriculated students who intend to apply to Binghamton University to earn the certificate, but not a graduate degree, are required to hold a bachelor's degree in CS, ECE or a closely related area.

Artificial Intelligence Micro-Credential Program

The Artificial Intelligence (AI) Micro-Credential program will document a Binghamton University student's completion of a formally organized suite of courses tailored to AI. The program will formally introduce students to the fundamental theories and methods of AI to a reasonable level, both in breadth and depth. The program offers two required courses as the foundation to AI: CS 565 Introductions to Artificial Intelligence and CS 536 Introduction to Machine Learning. Students who have taken these two required courses shall be equipped with the essential foundation of AI. In addition to these two required courses, students in this program are also required to take two electives out of a wide suite of the courses offered in the MS CS program related to AI, ranging from specific applications such as using machine learning techniques to address issues in social media to specific areas within AI such as computer vision, natural language processing and robotics. The intent of the program is not to provide a comprehensive self-contained competency, but rather to provide students with the special attention, in the context of the existing MS CS program or existing professional practice, to AI as a focus area to help the students become well-prepared for the emerging era of AI.

General Academic Program Requirements

The AI Micro-Credential program within the existing MS CS program is designed to:

- Embrace the phenomenal needs in our society for AI
- Offer fundamental knowledge of AI to a reasonable level both in breadth and depth
- Help train the AI workforce for our society

Students in this program are asked to complete the two required courses:

- CS 565 Introduction to Artificial Intelligence
- CS 536 Introduction to Machine Learning

In addition, students must also complete two electives from a wide suite of MS CS courses related to AI, such as:

- CS 524 Intelligent Mobile Robotics
- CS 533 Introduction to Information Retrieval
- CS 535 Introduction to Data Mining
- CS 555 Introduction to Visual Processing
- CS 556 Introduction to Computer Vision

- CS 580 - Certain approved CS topics course in areas such as Natural Language Processing. The Computer Science web-page will maintain a current listing.

An average of B or above for all courses must be achieved in order to complete this program.

Admission

The Artificial Intelligence Micro-Credential program is open for Binghamton University graduate students already admitted into the MS CS program, or Binghamton University graduate students already admitted into a related program (e.g., electrical and computer engineering) with the required background. The program is also open to Binghamton University CS seniors. People outside Binghamton University may also apply for admission into this program, subject to the review and approval of the Computer Science Graduate Director.

Appendix A: PhD Progress Tracking and Learning Contract

School of Computing, Binghamton University
(Effective Fall 2024)

Overview

The Learning Contract (available at [Google Classroom for PhD Status Tracking](#)) records various requirements and milestones of a PhD student towards a PhD degree, in consultation and agreement with the student's Advisor and/or Guidance Committee.

This Learning Contract must follow all the requirements of the CS PhD Program, which supersedes any conflicting requirement that may be entered into these documents.

This Learning Contract consists of several parts.
- Parts A-D are To be filled by the student/advisor and approved by the Guidance Committee
- Part E: List of publications to be filled in by the student/advisor
- Part F: Instructions to submit university-level forms for PhD defense

Instructions

1. Please join the [Google Classroom for PhD Status Tracking](#)
2. Submit Part A immediately in consultation with your PhD advisor.
3. Submit Part B as soon as your PhD Qualifying requirements are met.
4. Submit Part C along with your report as soon as you pass RPE.
5. Submit Part D along with your report as soon as you pass Prospectus.
6. Update Part E whenever you publish a new paper in a journal, workshop, or conference.
7. Follow Part F instructions before and after you defend your dissertation.

Make sure that you click "Turn In" for each part, once complete.

The Graduate Director or Graduate Programs Assistant will request approval of each part from the PhD advisor and Guidance Committee. Students do not need to request signatures.

PhD Milestones and Evaluation Procedures

The following milestones must be met by a full-time PhD student and accepted by the Guidance Committee and the Graduate Director. Part-time students may require additional time, their expected timeline will be noted on a case-by-case basis in the Learning Contract.

Milestone	Description	Recommended Timeline (latest by)
Part A: Learning Contract	Complete Part A in consultation with the PhD advisor and Guidance Committee.	End of Month 1. Update as needed during PhD if there are changes.
Part B: PhD Qualifying Requirement	Complete PhD Qualifying Requirement.	End of Year 2
Part C: Baseline literature list for RPE	Decide with the PhD advisor on a baseline literature list for the RPE exam.	End of Year 2
Part C: RPE Approval	Submission and acceptance of the Research Proficiency Examination (RPE) report and public oral presentation.	End of Year 3
Part D: Prospectus	Submission and acceptance of the Prospectus report and a public oral presentation.	End of Year 3.5
Part E: Publications and presentations	Publication of student's research results in conferences and/or journals and public presentations to meet "Teaching Requirements"	Update whenever you have new peer-reviewed publications and/or public presentations.
Part F: Dissertation	Submission and acceptance of the Dissertation and a public oral defense.	End of Year 6

Appendix B: Sample Course Schedules

These are just samples recommended for the vast majority of SoC graduate students. Students can tailor these schedules per their unique situations, preferably with the advice of the Graduate Director.

MS in Computer Science (Project Option)

Semester	Course 1	Course 2	Course 3	Course 4	Full-time credits
Fall 1	Core 1 - CS575	Core 2 - CS551/CS571	Elective 1	CS707	12
Spring 1	Core 3 - CS551/CS571	Elective 2	Elective 3	Elective 4	12
Fall 2	Elective 5	Elective 6	Elective 7	N/A	9
Spring 2	CS595 (1 credit)				FTC

MS in Computer Science Cybersecurity/AI Tracks (Project Option)

Semester	Course 1	Course 2	Course 3	Course 4	Full-time credits
Fall 1	CS Core 1 - CS575	CS Core 2 - CS551/CS571	Track Core 1	CS707	12
Spring 1	CS Core 3 - CS551/CS571	Track Core 2	Track Elective 1	CS Elective 1	12
Fall 2	Track Elective 2	CS Elective 2	CS Elective 3	N/A	9
Spring 2	CS595 (1 credit)				FTC

MS in Computer Science (Thesis Option)

Semester	Course 1	Course 2	Course 3	Course 4	Full-time credits
Fall 1	Core 1 - CS575	Core 2 - CS551/CS571	Elective 1	CS707	12
Spring 1	Core 3 - CS551/CS571	Elective 2	Elective 3	Elective 4	12
Fall 2	Elective 5	Elective 6	CS599 (3 credits)		9
Spring 2	CS599 (1 credit)				FTC

MS in Computer Science Cybersecurity/AI Tracks (Thesis Option)

Semester	Course 1	Course 2	Course 3	Course 4	Full-time credits
Fall 1	CS Core 1 - CS575	CS Core 2 - CS551/CS571	Track Core 1	CS707	12
Spring 1	CS Core 3 - CS551/CS571	Track Core 2	Track Elective 1	CS Elective 1	12
Fall 2	Track Elective 2	CS Elective 2	CS599 (3 credits)		9
Spring 2	CS599 (1 credit)				FTC

MS in Information Systems - 3 semesters

Semester	Course 1	Course 2	Course 3	Course 4	Full-time credits
Fall 1	Core 1 - INFO501	Core 2 - INFO502	Elective 1	Elective 2	12
Spring 1	Core 3 - INFO532	Elective 3	Elective 4	Elective 5	12
Fall 2	Elective 6	Elective 7	INFO 595 (1 credit)		7 (Reduced Load)

MS in Information Systems - 4 semesters (Option 1)

Semester	Course 1	Course 2	Course 3	Course 4	Full-time credits
Fall 1	Core 1 - INFO501	Core 2 - INFO502	Elective 1	Elective 2	12
Spring 1	Core 3 - INFO532	Elective 3	Elective 4	Elective 5	12
Fall 2	Elective 6	Elective 7	INFO 591		9
Spring 2	INFO 595 (1 credit)				FTC

MS in Information Systems - 4 semesters (Option 2)

Semester	Course 1	Course 2	Course 3	Course 4	Full-time credits
Fall 1	Core 1 - INFO501	Core 2 - INFO502	Elective 1	INFO 591	12
Spring 1	Core 3 - INFO532	Elective 2	Elective 3	Elective 4	12
Fall 2	Elective 6	Elective 7	Elective 5		9
Spring 2	INFO 595 (1 credit)				FTC

MS in Information Systems Applied Data Science Track - 3 semesters

Semester	Course 1	Course 2	Course 3	Course 4	Full-time credits
Fall 1	Core 1 - INFO501	Core 2 - INFO502	DS Elective 1	Elective 1	12
Spring 1	Core 3 - INFO532	DS - INFO535	DS Elective 2	Elective 2	12
Fall 2	DS - INFO536	Elective 3	INFO 595 (1 credit)		7 (Reduced Load)

MS in Information Systems Applied Data Science Track - 4 semesters

Semester	Course 1	Course 2	Course 3	Course 4	Full-time credits
Fall 1	Core 1 - INFO501	Core 2 - INFO502	DS Elective 1	INFO 591	12
Spring 1	Core 3 - INFO532	DS - INFO535	DS Elective 2	Elective 1	12
Fall 2	DS - INFO536	Elective 2	Elective 3	N/A	9
Spring 2	INFO 595 (1 credit)				FTC

PhD in Computer Science (with prior MS from another school)

Semester	Course 1	Course 2	Course 3	Full-time credits
Fall 1	PhD Core 1 - CS575/CS551/CS571	PhD Core 2 - CS575/CS551/CS571	CS601	9
Spring 1	PhD Core 3 - CS5XX	PhD Core 4 - CS5XX	CS697	9
Fall 2	CS6XX	CS697	CS698	9
Spring 2	CS698/CS699 (1 credits) + RPE			FTC

PhD in Computer Science (with prior MS from Binghamton)

(Assuming that PhD Core courses have been already completed during MS)

Semester	Course 1	Course 2	Course 3	Full-time credits
Fall 1	CS601	CS5XX/CS6XX	CS697	9
Spring 1	CS6XX	CS5XX/CS6XX	CS697	9
Fall 2	CS5XX/CS6XX	CS5XX/CS6XX	CS698	9
Spring 2	CS698/CS699 (1 credit) + RPE			FTC

PhD in Computer Science (with no prior MS)

Semester	Course 1	Course 2	Course 3	Course 4	Full-time credits
Fall 1	PhD Core 1 - CS575/CS551/CS571	PhD Core 2 - CS575/CS551/CS571	CS601	CS6XX	12
Spring 1	PhD Core 3 - CS5XX	PhD Core 4 - CS5XX	CS5XX/CS6XX	CS597	12
Fall 2	CS5XX/CS6XX	CS5XX/CS6XX	CS5XX/CS6XX	CS597	12
Spring 2	CS5XX/CS6XX	CS5XX/CS6XX	CS5XX/CS6XX	CS697	12
Fall 3	CS5XX/CS6XX	CS697	CS698 (6 credits)		12
Spring 3	CS698/CS699 (1 credit) + RPE				FTC