PhD Student Orientation
Fall 2020

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Goals

- Extend a warm welcome
- Introduce the CS department
- Describe the PhD degree requirements
- Provide suggestions and general tips
PhD in Computer Science @ GMU

- 112 PhD students
  - Many supported by assistantship positions and fellowships

- 10-15 graduates per year
  - Join academia or top companies (Google, Microsoft, Facebook,..)

- 48 tenured and tenure-track faculty (who can act as the dissertation director)
  - +15 instructional

- Research Expenditure: ~$16,000,000
Fast facts about the department

- Students in other programs offered by CS dept
  - Undergraduates: Computer Science and Applied Computer Science (1800+ students)
  - Masters: in Computer Science, Software Engineering, Information Systems, Information Security and Assurance (400+ students)

- PhD and MS programs are integrated
  - Students entering with BS degree can receive a MS degree in addition to the PhD degree “along the way”
  - Students with a previous MS degree can receive a reduction of credit and waiver of course requirements
Areas of Research Expertise

- Algorithms and Theory of Computation
- Artificial Intelligence and Machine Learning
- Robotics
- Bioinformatics
- Computer Game Design
- Computer Vision
- Databases
- Graphics and Image Processing
- Programming Languages
- Software Engineering
- Security
- Systems and Networks
- Parallel and Distributed Computing
- Data Mining
- Information Systems
Faculty Awards

- 15 NSF CAREER Awards
- 4 IEEE Fellows
- 2 ACM Fellows
- 4 Lifetime Achievement Awards
- 1 AFOSR Young Investigator Award
- 1 IAPR Fellow
- 11 Mason Teaching Excellence Awards
Key People

- Chair of the Computer Science Department: David Rosenblum
- Director of the PhD program: Hakan Aydin
- Your Academic Advisor
  - Assigned based on your areas of interest at the time of admission
  - Advises you on academic/procedural matters
- Your Research Advisor
  - Advises you on your doctoral research
  - When you have one, he/she will also serve as your academic advisor.
  - When your dissertation is committee is formed, he/she becomes your dissertation director
- Office staff
  - Ryan Lucas (Office Manager, graduate program specialist e-mail: wlucas@gmu.edu)
  - Michèle Pieper (Department Operations Manager)
What is PhD (in CS)?

- Highest academic degree awarded in Computer Science

- On top of multi-year graduate study, PhD degree requires producing original research in a sub-field of Computer Science, culminating in the creation and defense of a research dissertation

- The research must be worthy of publication in peer-reviewed academic journals and/or conference proceedings.
Success Criteria in PhD

- Success in the graduate courses and exams is a necessary condition
  - But not sufficient!

- The culmination of the PhD study is the dissertation which requires
  - Becoming an active researcher in a specific area
  - Producing original research
PhD Degree Requirements

- GMU Catalog is the official resource
  http://catalog.gmu.edu

- Lots of information on the CS web site
  http://cs.gmu.edu

- PhD Program underwent a significant revision effective Fall’18

- Main objective: Facilitate and speed up the involvement of PhD students in research
Degree Requirements

- PhD degree requires the completion of formal course work and a number of well-defined milestones
  1. Course Work
  2. Breadth Requirement
  3. Comprehensive Exam
  4. Proposal Defense
  5. Dissertation
Overall Picture

Course Work

Breadth Requirement

Find a Research Advisor

Comprehensive Exam

Proposal Presentation

Advance to PhD Candidacy

PhD Dissertation

PhD Defense
1. Course Work

72 credits post Bachelor’s degree (GMU requirement)

• CS 600 (3 credits)  
  Theoretical Computer Science [requires B+ or better]
• CS 700 (3 credits) - Research Methodology in CS
• CS 701 (3 credits) - Research Experience in CS
• 3 advanced graduate courses (9 credits)
  – Complete list of approved courses (~100) on the CS web site
• CS 800 (2 x 0 credits) - CS Colloquium
• CS 998 (proposal) and CS 999 (dissertation) [24 credits]
  – At least 12 in CS 999
  – Not more than 24 will be counted towards the degree
• 30 credits of “elective” graduate courses  
  (MS- or PhD- level)
Credit for Previous Graduate Work

- If you did graduate work in computer science you may get credit (maximum 30).
  - Courses must be graduate level computer science (IT or business courses do not count).
  - Grade B or better
- An MS degree in computer science may get you a total of 30 credits.
- Must apply during your first academic year
- Case-by-case evaluation
- Transcripts are required.
CS 700 & CS 701

- Two mandatory courses
  - CS 700 (Research Methodology in CS) is offered in Fall semester
  - CS 701 (Research Experience in CS) is offered in Spring semester

- You must take CS 700 in Fall’20 and CS 701 in Spring’21

- Register in CS 700 for Fall’20 if you haven’t done so already!
CS 700 (Research Methodology in CS)

- Three main components
  1. Basic research literacy
     - Tips for reading, writing, evaluating, and presenting research papers
     - Hints for becoming a successful PhD student
     - Research integrity and ethics issues
     - Research Computing Infrastructure at GMU
  2. Quantitative models and methods in experimental computer science
     - Use of analytic and simulation models
     - Design of experiments
     - Statistical analysis of data
  3. Guest talks by the CS faculty
CS 701 (Research Experience in CS)

- Prerequisite: Grade of B or better in CS 700.
- Main objective is to give the student a first “research experience”
- The student works closely with a CS faculty on a preliminary research task.
  - The student reports his/her findings in a professionally prepared document
  - All CS 701 students give brief (10-minute) presentations about their projects at the end of the semester during a public meeting.
  - A departmental form is signed by the student and the faculty sponsor before the student can enroll in CS 701.
Advice: Courses

- Consult your academic advisor on your course plan.
- Students who do not receive the full 30 credit reduction based on previous graduate work should choose additional graduate level computer science courses.
- Those additional courses must be selected from the list of graduate level courses in Computer Science or a field related to the intended doctoral research area of the student, in consultation with the academic advisor.
- Courses that will potentially help the student to satisfy the breadth requirement should be considered.

- With careful selection of courses, students may earn an MS in Computer Science degree as part of their PhD studies.
  - Consult the catalog for the requirements of the MS CS.
**Advice: Courses**

- Students who do not receive the full 30 credit reduction may also choose to take additional credits of **CS 896 – Directed Reading and Research** with the research advisor’s approval
  - Must satisfy the breadth requirement before enrolling in CS 896
  - May be repeated up to 18 credits
CS 800 Computer Science Colloquium

- Take during two semesters (0 credit)
  - Each semester, attend and prepare summaries of at least 8 seminars
  - Purpose:
    - Help to choose a research area.
    - Broaden knowledge of cutting-edge research.
    - See examples of “new research results”.
    - Learn presentation techniques.
  - Must be completed within the first 36 credits
2. Breadth Requirement

- The students should demonstrate the breadth of knowledge at the graduate level in multiple Computer Science areas

- Two ways to satisfy the breadth requirement
  - Show superior performance in graduate courses (The course-oriented criterion – default)
  - Take and pass written qualifying exams in different areas
Course-Oriented Criterion for Breadth Requirement

- The student should demonstrate superior performance in four selected courses that span at least three different areas
  - In at least three out of four courses, the student should receive at least a grade of A- or better.
  - In the fourth course, the student should receive a grade of B or better.
  - *CS 583 Analysis of Algorithms* (from the *Theoretical Computer Science* area) must be selected.
  - A course may be repeated at most once (otherwise the course cannot be used to satisfy the breadth requirement)
  - If a course is repeated, the grade in the second attempt is considered for the breadth requirement
# Breadth Requirement:
## Courses and Areas

<table>
<thead>
<tr>
<th>Course</th>
<th>Area</th>
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<tbody>
<tr>
<td>Analysis of Algorithms (CS 583)</td>
<td>Theoretical Computer Science</td>
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<td>Computer Networks (CS 555)</td>
<td>Systems and Networks</td>
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<td>Operating Systems (CS 571)</td>
<td>Systems and Networks</td>
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<tr>
<td>Network Security (ISA 656)</td>
<td>Security</td>
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<td>Database Systems (CS 550)</td>
<td>Databases</td>
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<td>Artificial Intelligence (CS 580)</td>
<td>Artificial Intelligence</td>
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<td>Data Mining (CS 584)</td>
<td>Artificial Intelligence</td>
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<td>Compilers and Languages (CS 540)</td>
<td>Programming Languages</td>
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<td>Software Construction (SWE 619)</td>
<td>Software Engineering</td>
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<td>Software Testing (SWE 637)</td>
<td>Software Engineering</td>
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<tr>
<td>Computer Graphics (CS 551)</td>
<td>Visual Computing</td>
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Course-Based Criterion for Breadth Requirement

- The student can use the grade (s)he received in the past if the course was taken at GMU.
  - No more than five years must have elapsed since the student took the course.

- Exceptions to this rule are rare and require filing a petition with supplementary documents to the Computer Science department.
Written Qualifying Exams

- Qualifying exams are an alternative way to satisfy the breadth requirement.

- Must pass exams in **four** different areas:
  - *Foundations of CS + any three from eight areas* (software construction, software testing, operating systems, networks, languages & compilers, databases, AI, information security)

- Each area has a recommended graduate course
  - If you have MS degree, you may have taken suitable courses.

- Exams offered in August and January
  - **Two** chances to pass four exams in **two consecutive semesters**.
Satisfying the Breadth Requirement

- The breadth requirement must be satisfied within the first 24 credits in the program either through the course-oriented criterion or written qualifying exams.
- The course-oriented criterion will apply by default.
- Mixing and matching the written qualification exams and the course grades is not allowed.

- If the student takes a written qualifying exam, the course-oriented criterion can no longer apply.
Advice: Research Advisor

- Remember: The most important component of the PhD study is the PhD research

- Common mistake: Postponing research activity to the completion of the formal course work or breadth requirement
  - Finding a PhD research topic and research advisor does not happen in one day!

- Start exploring potential research topics and interacting with the faculty while taking courses!
How to get involved in research?

- Identify the areas of Computer Science you are interested in
  - But be open-minded as well!
- Attend departmental research talks / symposia
- Take the courses in those areas to build a good background
  - Seminars, independent-study based courses.
- Check the web pages of the CS faculty, learn more about their research activities
How to get involved in research?

- Make the best use of CS 700 and CS 701
  - In CS 700 (Fall), CS faculty will give research talks in a couple of class meetings
  - In CS 701 (Spring), you will have a chance to pair up with a CS faculty to work on a preliminary research topic.

- Interact with the faculty outside class hours
  - The faculty will be happy to provide more pointers/papers to get you trained in their areas

- Get involved in their research!
Determining Research Advisor

- All full-time PhD CS students must determine their research advisor within the first 24 credits.

- This is also important because the comprehensive exam (with the deadline of 36 credits) assumes that:
  - you have determined your research area,
  - you have linked up with your research advisor, and,
  - you have gained the depth of knowledge in that specific area to start your original research.
3. Comprehensive Exam (Depth Exam)

- Checks the depth of the student’s knowledge in the target PhD research area
  - Has both written and oral components.
  - Administered by a departmental comprehensive exam committee

- The student can form the dissertation committee only after passing the comprehensive exam

- Comprehensive exam must be taken within the first 36 credits in the PhD program.
Comprehensive Exam

- Written Part: The student prepares a critical review of the research literature on a specific topic, and submits to the exam committee in advance.

- Oral Part: The student makes a short presentation about his/her report, which is followed by the question-answer phase.
Comprehensive Exam (Written Part)

- The written report will summarize the state of knowledge in the target area with particular emphasis on open problems, and possible approaches to tackle those problems.

- The report should be 8-10 pages long and should contain a minimum of 20 references.
Comprehensive Exam (Oral Part)

- About two hours, student presentation is limited to 20 minutes
- The committee asks questions about the presentation and material in the reading list
  - Key textbooks, important papers in the broader research area and determined by the examination committee
  - Papers selected by the student/advisor
- The oral exam is public (but only the examination committee can ask questions).
Decision in the Comprehensive Exam

- The exam committee consists of 4 members
  - Research advisor
  - Another CS or School of Engineering faculty member determined by the advisor and the student
  - Two tenured CS faculty members appointed by the PhD CS Program Director (one of them chairs the committee)
- Majority vote is needed to pass the exam
  - At least 3 out of 4 members should give PASS in both written and oral components
- A student who fails in the exam must succeed in the next attempt (which must occur during the next semester).
The role of the advisor in the comprehensive exam

- The written report must reflect the student’s own writing and paper reading skills.

- The advisor may not work closely with the student on the comprehensive exam preparation

- The student’s reliance on the advisor for the exam should be at a minimum
Each student forms a dissertation committee.
  • Must first pass the comprehensive exam
Four (or five) members:
  • Three members must be tenured or tenure-track faculty in CS Department.
  • One member must be from GMU but outside the CS Department.
  • The fifth member (if any) may be from outside the university.
  • Dissertation director chairs the committee.
  • Committee must be approved by the Chair of the Computer Science Department.
4. Dissertation Proposal

- Each student must prepare a written dissertation proposal.
- While preparing the proposal, student enrolls in CS 998.
- Proposal must be presented to and approved by the dissertation committee.
  - Two chances to pass
- Committee determines:
  - Whether the proposal has merit and can lead to significant research contributions, and
  - If the student has knowledge and skills to complete proposed work successfully, and in timely manner.
- Upon completing proposal successfully and finishing the course work, the student is advanced to candidacy for the PhD degree.
5. Dissertation

- While preparing the dissertation, the candidate enrolls in CS 999.
- When the work is complete, the dissertation is defended.
- Public defense is preceded by a pre-defense meeting:
  - Candidate meets with the dissertation committee and the Director of PhD program.
  - If the committee approves, the candidate may schedule the public defense.
- At least 1 month between pre-defense and public defense.
5. Dissertation (cont.)

- Dissertation
  - Must make significant contributions to its area
  - Must be publishable in quality journals or conferences.
- Dissertation Defense is oral and open to all
  - Two chances to pass
Summary of Milestone Deadlines

- Complete CS 700 in Fall 2020
- Complete CS 701 in Spring 2021
- Complete the breadth requirement and determine the research advisor: Within the first 24 credits
- Take the comprehensive exam and complete both instances of CS 800: Within the first 36 credits
Milestone Deadlines are Firm

- **Students who fail to meet the deadlines will be dismissed from the program unless there are extenuating circumstances approved by the department.**

(From the PhD CS program GMU catalog entry)
Time Frame for Graduation

- GMU rules:
  - Maximum time from starting PhD program to advancement to candidacy – 6 years.
  - Maximum time for the entire PhD – 9 years.
- This does not distinguish between full-time and part-time students.
- Expectation from full-time students: Complete the program in 4-5 years.
How many credits per semester?

- Depends on your capabilities and available time.

- Remember that milestone deadlines for full-time students are expressed in terms of credits
  - Example: a GTA taking 9 credits per semester is required to satisfy the breadth requirement in 3 semesters and pass the comprehensive exam in 4 semesters.
  - But this translates to 4 and 6 semesters, respectively, for a GTA taking 6 credits per semester
Course Selection for the first year
(Suggestion)

- **Fall:**
  - CS 700 (required)
  - Consider one or two additional courses that can be used to satisfy the breadth requirement (or to prepare for the written qualifying exams)

- **Spring:**
  - CS 701 (required)
  - One additional course to satisfy the breadth requirement
  - An advanced PhD course (seminar) in your interest area [or another breadth course]
About CS 530 & CS 531

- CS 530 (Mathematical Foundations of CS) and CS 531 (Fundamentals of System Programming) are for MS students and they can’t be taken for credit by the PhD CS students
International Students

- Students with F-1 or J-1 visas must be full-time students
  - At least 9 credits per semester
  - 6 credits for GTAs and GRAs
  - May not switch to part-time status.
Fall’20 ICE Directive for Incoming International Students (F-1 or J-1)

- Incoming F-1 students currently in US (who were not in F-1 status in Spring’20) must enroll in at least one F2F or hybrid course.

- Incoming J-1 students currently in US (who were not in J-1 status in Spring’20) must take at least half of their courses in person, or in a hybrid format.

- Continuing F-1/J-1 students or those who transfer from another US institution are not subject to these limitations.
Graduate Assistantships

- **Graduate Teaching Assistants (GTAs):** Participate directly in instructional activities, such as giving recitations, grading, holding office hours. Funded by the school/department.

- **Graduate Research Assistants (GRAs):** Participate in a research project administered by the GMU faculty. Funded by the sponsored research project.
Graduate Assistantships

- We expect that the doctoral GTAs will
  - Become gradually research active
  - Transition to GRA positions funded by the specific CS faculty

- The department cannot guarantee funding as GTA after two years.
Annual Progress Report

- Submit report every year in Fall semester (you will be contacted).
- Helps us monitor the progress of each individual, advise students about the upcoming “milestones”, etc.
- Students who fail to submit are blocked from enrolling in classes.
Communication

- GMU email will be used to communicate with you.

- General queries about the PhD program: csphd@gmu.edu

- Announcement listserv for PhD CS students: phd-cs-l@listserv.gmu.edu (moderated list)
PhD CS Student Organization

- Mission
  1. Establish strong connection with other graduate students and faculty members
  2. Be the students’ voice towards the department
  3. Provide workshops to enhance graduate students’ skills in programming/writing
  4. Share experiences among students during regular coffee hours
  5. Pizza party/group outdoor activities inside/outside the campus

- Communication through Slack
  - Send e-mail to Abdulrahman Alshammari (aalsha2@gmu.edu) to join!
Virtual Computing Research Day

- September 11, 2020 10 AM – 4 PM
- Presentations by CS faculty (including new faculty)
- Panels on CS research directions

- Attendance mandatory for 1st and 2nd year PhD students (partial attendance is fine).

- Great opportunity to learn more about research
Thanks for your attention...

QUESTIONS?