PhD Student Orientation
Fall 2024

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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

- 208 PhD students (Spring'24)
  - 92% are full-time; 8% part-time
  - Nearly all full-time students are supported by assistantship positions and fellowships
- 10-15 graduates per year
  - Join academia or top companies (Google, Microsoft, Facebook,..)
- 55 tenured and tenure-track faculty (who can act as the dissertation director)
  - +30 instructional

Fast facts about the department

- Students in other programs offered by CS dept
  - Undergraduates: Computer Science and Applied Computer Science (2,400+ students)
  - Masters: in Computer Science, Software Engineering, Information Systems, Information Security and Assurance (1,100+ students)

MS vs. PhD

- PhD and MS programs are integrated
  - Students entering with BS degree can receive an secondary MS degree in addition to the PhD degree “along the way”
  - More on this later

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
- Natural Language Processing
- Programming Languages
- Software Engineering
- Security
- Systems and Networks
- Parallel and Distributed Computing
- Data Mining
- Information Systems
- Quantum Computing

Faculty Awards

- 26 NSF CAREER Awards
- 2 Lifetime Achievement Awards
- 1 AFOSR Young Investigator Award
- 6 Mason Emerging Researcher & Scholar Awards
- 11 Mason Teaching Excellence Awards

Key People

- Chair of the Computer Science Department: David Rosenblum

- Director of the PhD program: Hakan Aydin

Communication

- Use your @gmu.edu e-mail address for all communication with the department, faculty, and staff

- csphd@gmu.edu: The PhD program account for general questions about the PhD program, form submissions, etc.
  - Monitored by PhD Program Specialists

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

PhD Program Specialists

- Alyssa Tsukamoto
- Beth Posocco

- Send e-mail to csphd@gmu.edu to reach the PhD program specialists

- In-person advising for PhD students will resume soon – look for e-mail on the PhD CS listserv.

PhD Advisor

- All admitted PhD students are assigned an Initial Academic Advisor based on their stated research interests
  - Advises the student on course selection, procedural matters, and offers guidance for first steps in research
- Research (Dissertation) Advisor
  - Will be declared within the first 24 credits
  - Will direct the student's PhD Dissertation Research (will become the dissertation director)

What is PhD (in CS)?

- Highest academic degree awarded in Computer Science
- Quite different in nature from BS or MS degrees

- 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

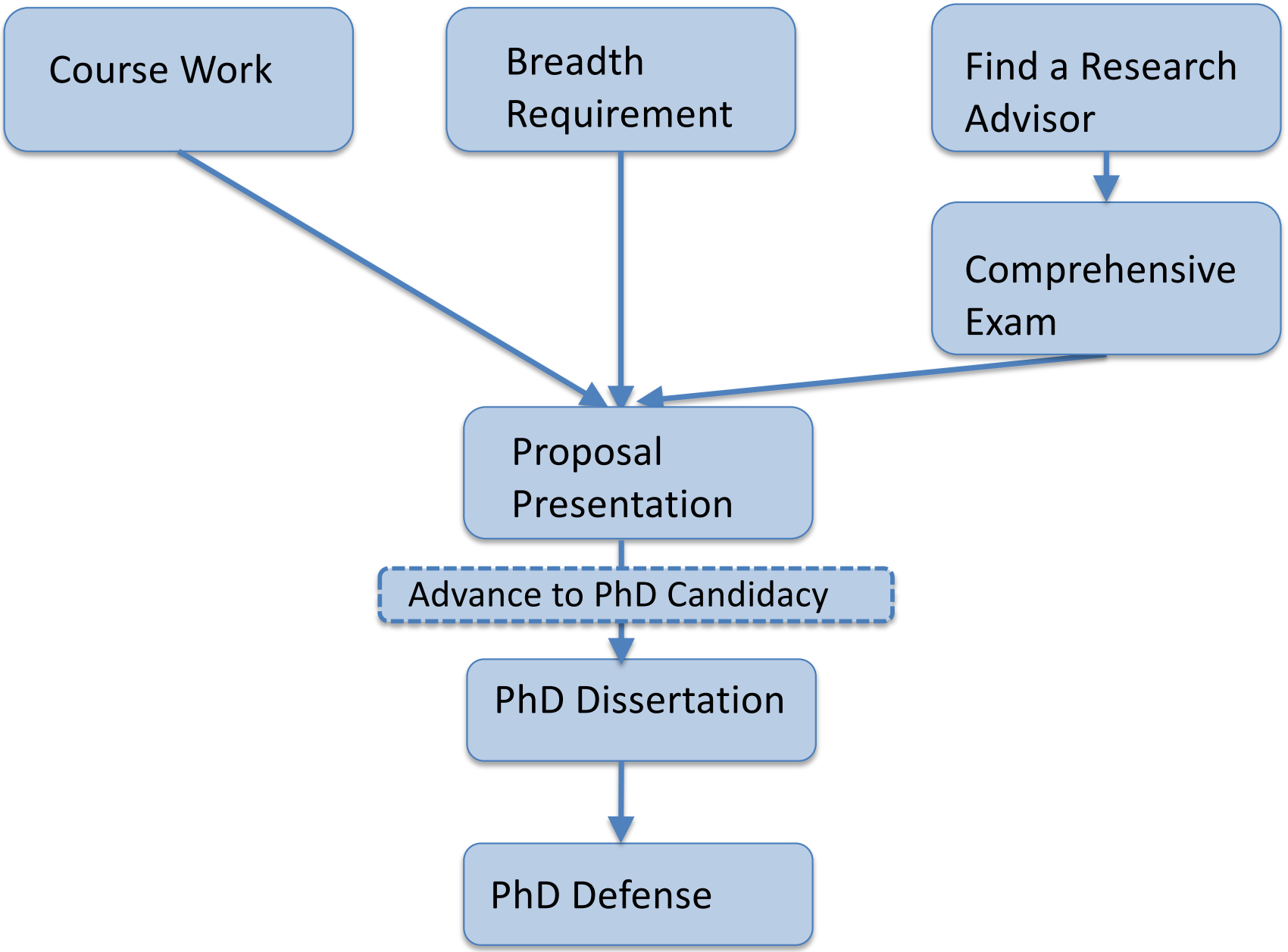
- GMU Catalog is the official resource
  http://catalog.gmu.edu

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

Degree Requirements

- PhD degree requires the completion of formal coursework and a number of well-defined milestones
  - Breadth Requirement
  - Comprehensive Exam
  - Proposal Defense
  - Dissertation

Overall Picture



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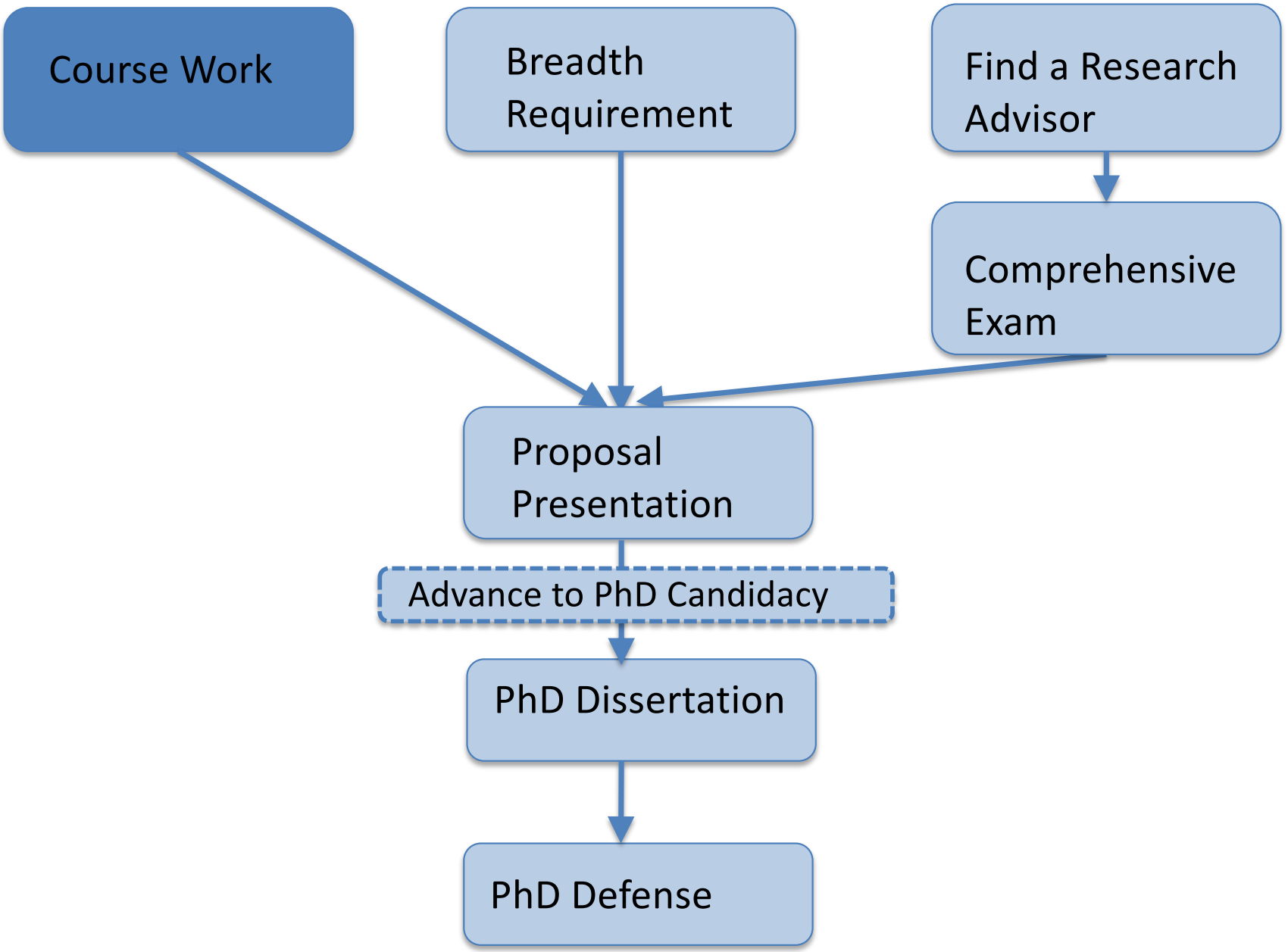


1. Coursework – Big Picture

- 72 credits (University Requirement)
  - 48 credits in formal coursework +
    24 dissertation research credits
- 48 credits = 16 graduate courses
  - 10 graduate courses (electives)
    - may be equivalent to an MS degree
  - CS 700
  - CS 701
  - CS 600 (Theoretical Computer Science)
  - 3 “Advanced” Graduate Courses
    - Can choose from 100+ graduate courses

1. Course Work – Catalog Language

- 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
    - https://cs.gmu.edu/current-students/doctoral-students/degree-requirements/course-requirements/advanced-courses/
  - 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)

"MS along the way"

- If you don't have an MS degree, you can get one "along the way"
  - Strongly recommended
- 30 credits of "elective" graduate courses in the PhD course work list will count towards the MS degree!
- You need to declare "MS" as a secondary degree by filling out a form
- Contact csphd@gmu.edu for details and the form
- However, you need to select 30 credits carefully to satisfy the requirements of the MS degree.
- Consult the catalog and the CS web pages for the requirements of the MS degree.

Credit for Previous Graduate Work

- If you did graduate work in computer science you may request transfer of credit (ToC)
  - Courses must be graduate level computer science (e.g., IT or business courses do not count).
  - Must have earned grade B- or better
- Can transfer up to 35 credits (GMU-level limit).
  - Can't effectively use more than 30 transferred credits for PhD CS in most cases.
- Must apply during your first academic year
- Case-by-case evaluation
- Official transcripts must be on file.

Submitting Transfer of Credit Forms

- GMU implemented significant changes in the rules and paperwork for ToC over the summer
  - Still a few unresolved issues in the workflow

- During the Fall'24 semester, the ToC forms will be accepted from October 1 - October 31.

- You will receive detailed information about how to fill out the online ToC form on the PhD listserv in late September.

- Do not attempt to submit the online forms before Oct. 1st !

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'24 and CS 701 in Spring'25

- Remember to take CS 700 in Fall'24 (catalog rule)!

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
  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 supervisor before the student can enroll in CS 701.

Advice: Elective Courses

- Consult your academic advisor on your course plan.
- Students who join PhD after BS, or those who do not have 30 credits transferred based on previous graduate work, should choose additional graduate level courses.
- Those additional graduate courses (electives) must be selected from CS 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.
- Also consider getting "MS along the way" (if applicable) – the credits from MS can be used for electives in PhD!

Advice: Courses

- Students 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

- Example: Student who is only pursuing the PhD degree (not a secondary MS), and who has not received any ToC, can use 18 credits of CS 896 within the 30-credit electives.

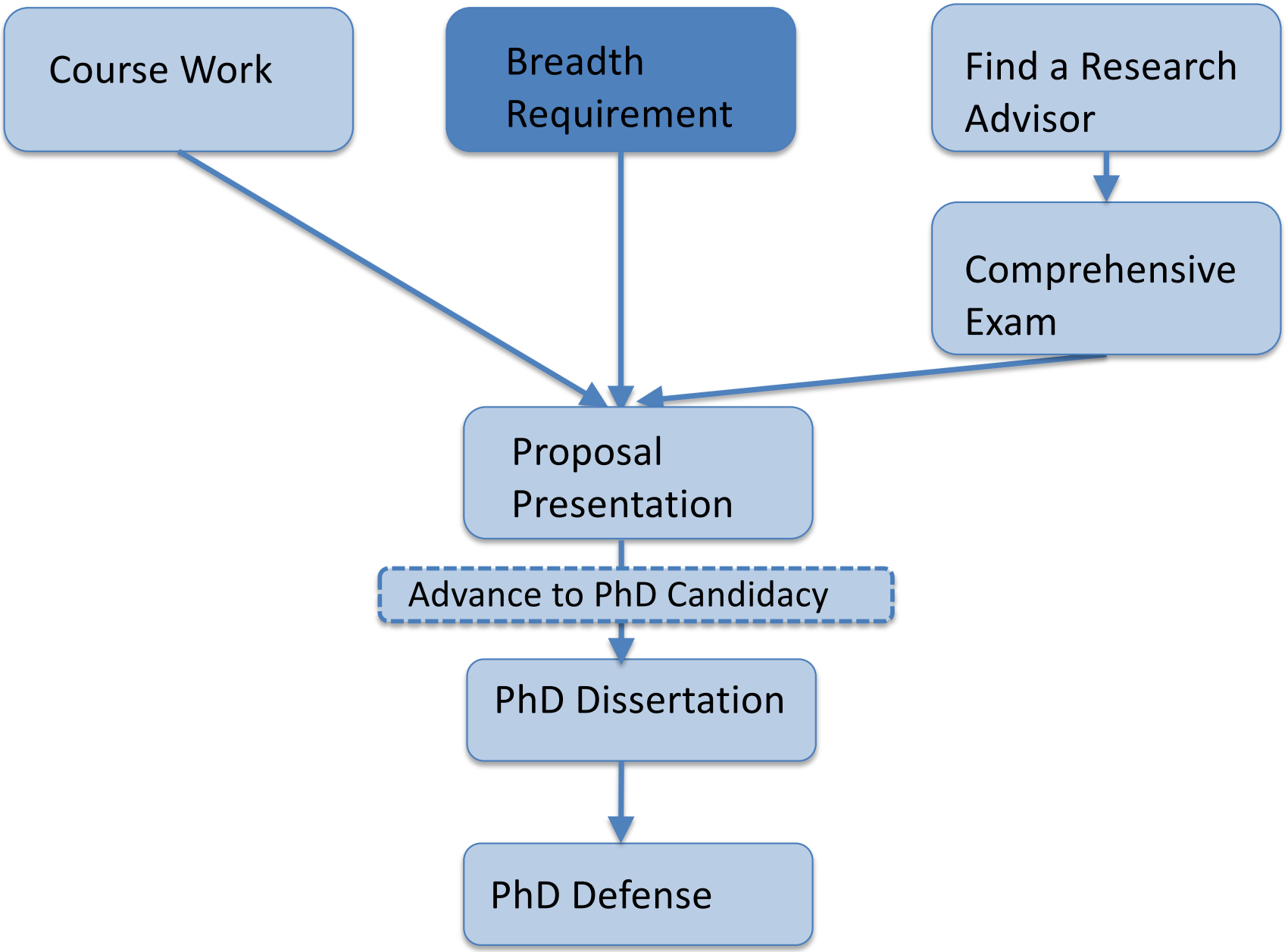
Another flexibility for "MS along the way"

- CS 600, CS 700, and three advanced graduate courses (up to 15 credits) may be counted towards the secondary MS degree; and the PhD student can then take multiple instances of CS 896 towards the 72 credits required for PhD.
  - Assuming that the selected courses satisfy the requirements of the MS degree.

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

Overall Picture



2. Breadth Requirement

- PhD 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

Course	Area
Analysis of Algorithms (CS 583)	Theoretical Computer Science
Computer Networks (CS 555)	Systems and Networks
Operating Systems (CS 571)	Systems and Networks
Network Security (ISA 656)	Security
Database Systems (CS 550)	Databases
Artificial Intelligence (CS 580)	Artificial Intelligence
Data Mining (CS 584)	Artificial Intelligence
Compilers and Languages (CS 540)	Programming Languages
Software Construction (SWE 619)	Software Engineering
Software Testing (SWE 637)	Software Engineering
Computer Graphics (CS 551)	Visual Computing

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.

Breadth Course Waiver Petitions

- If the student took a graduate course *nearly identical* to the GMU CS PhD breadth course elsewhere, they can request a waiver by submitting a detailed petition to the CS department
- Strict Conditions
  - The course must have been taken for credit at the graduate-level in a US or Canada institution, in the last five years
  - The student is able to supply detailed course material
    - Syllabus, assignments, slides, etc.
- The department will evaluate and get back to you with the decision
- During the Fall'24 semester, the breadth course waiver petitions will be accepted from October 1 - October 31

Written Qualifying Exams

- Qualifying exams is 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 no longer applies*.

Procedural Note: ToC vs. Course Waivers

- ToC and course waivers are separate concepts
- Transfer of credits does not have an impact on GPA and it does not bring a waiver for a specific course.
- Receiving a course waiver from the department (in consideration of a graduate course taken at another US institution) does not bring a ToC for that course from the university.
- Each has separate paperwork and approval processes.

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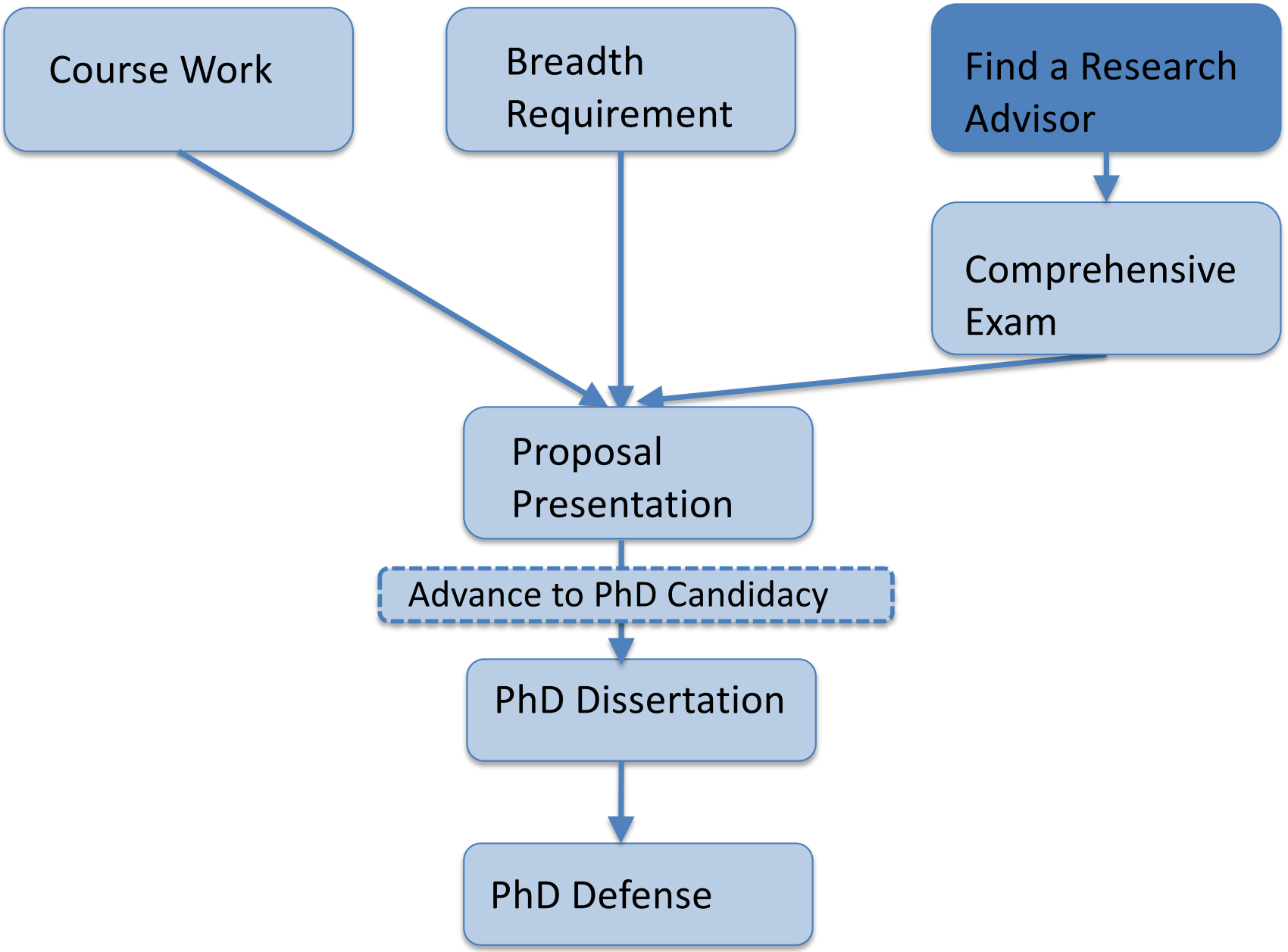

Advice: Research Advisor

- 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.

Who can be a PhD Research Advisor?

- Any full-time tenured or tenure-track faculty of the Computer Science Department
  - Faculty from other departments cannot advise PhD CS students
  - One exception is officially "CS-affiliated" faculty from other departments, who can co-advise PhD CS students, along with a full-time CS faculty.

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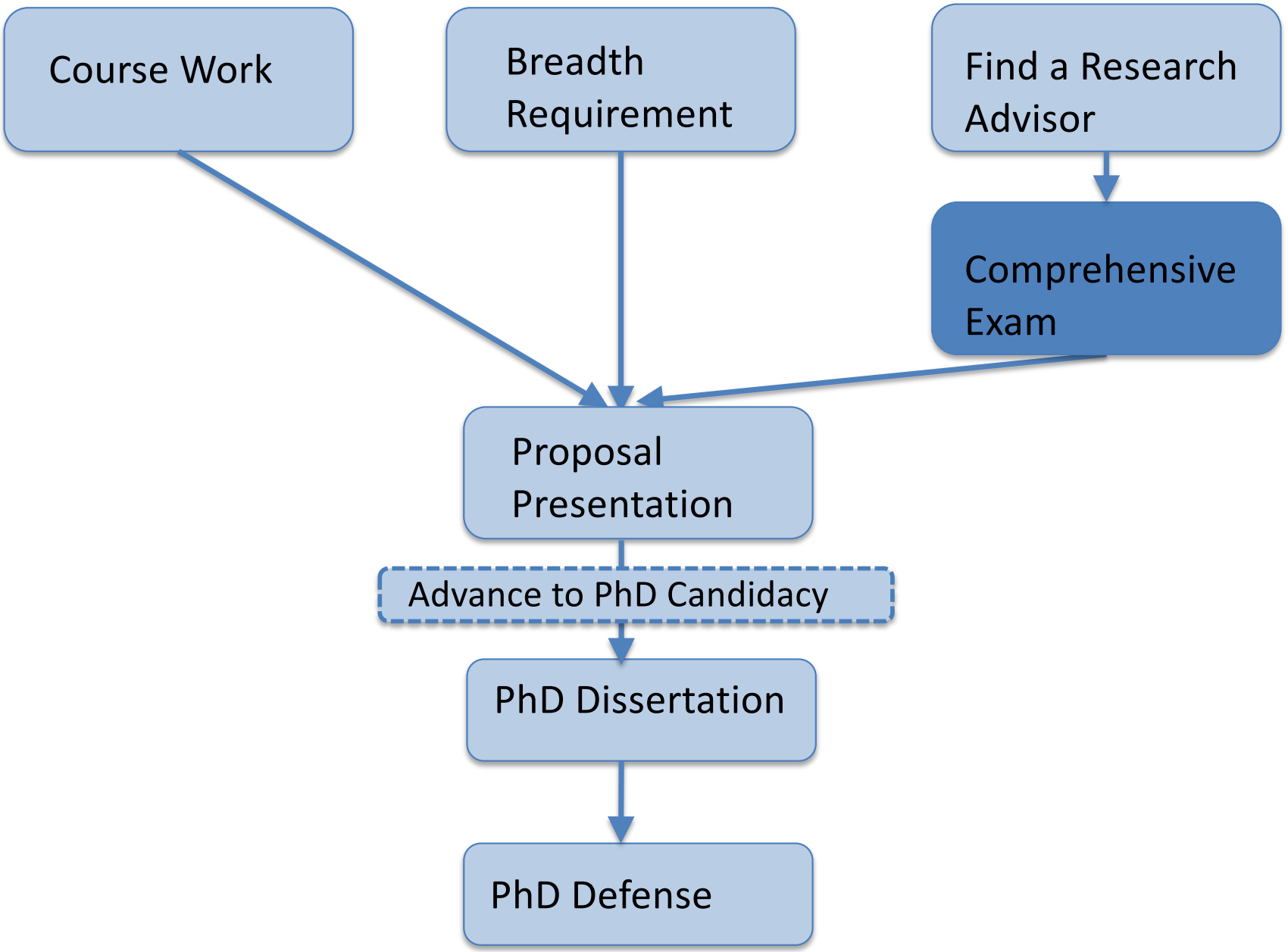


3. Comprehensive Exam (Depth Exam)

- 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 (survey) 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 tenured or tenure-track 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).

Comprehensive Exam Preparation

- The comprehensive exam is the culmination of your research activities within the first 36 credits
- Starting to prepare in the beginning of the semester during which you will take the exam is not likely to succeed
- Plan for the comprehensive exam early (preferably at the end of the first year)

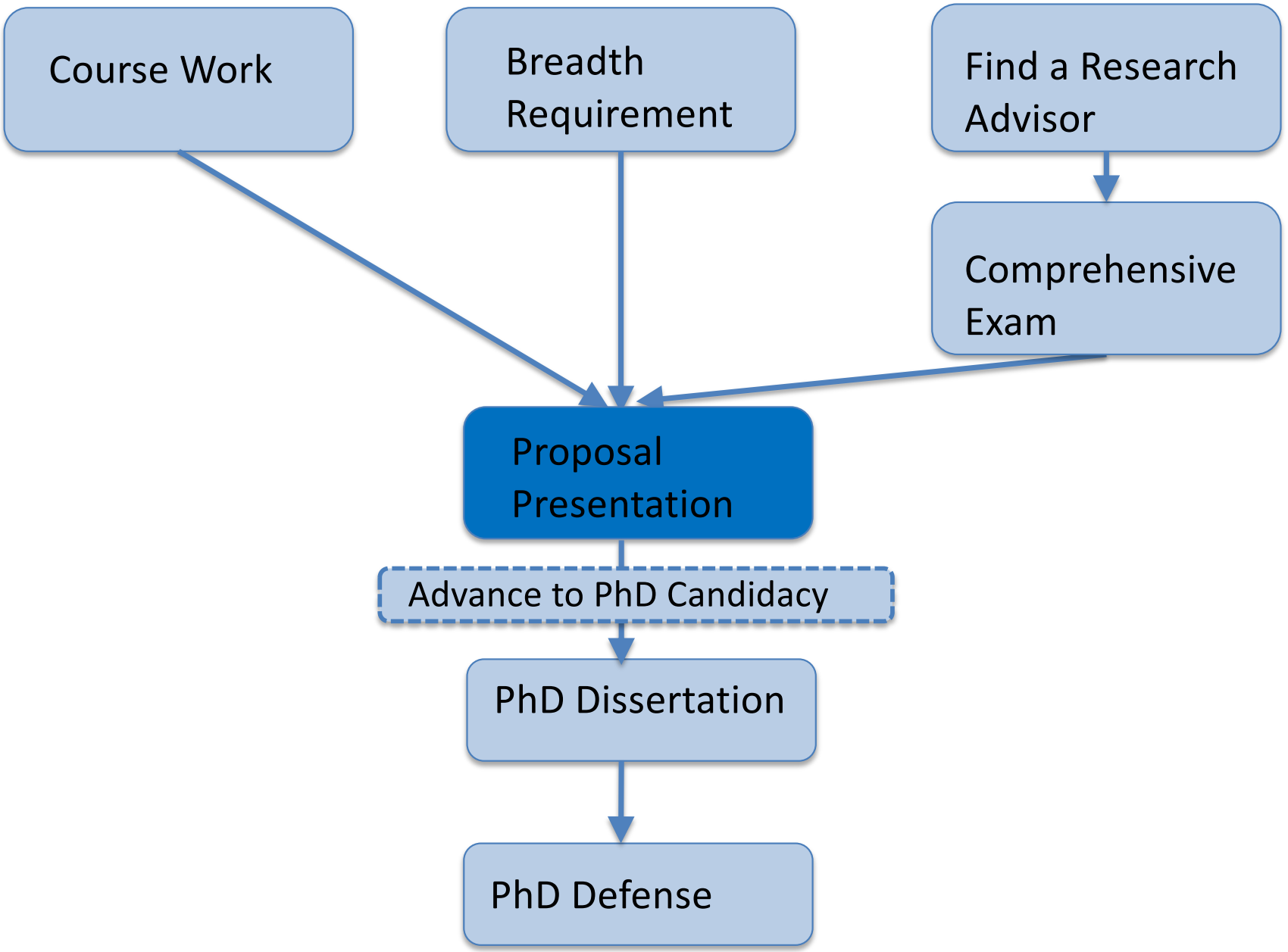
The role of the advisor in the comprehensive exam

- 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*

Dissertation Committee

- Each student forms a dissertation committee.
  - Must first pass the comprehensive exam
- Four (or five) members:
  - Three/four members must be tenured or tenure-track faculty in CS Department.
  - One member must be from GMU but outside the CS Department.
  - Dissertation director chairs the committee.
  - Committee must be approved by the Chair of the Computer Science Department.

Overall Picture



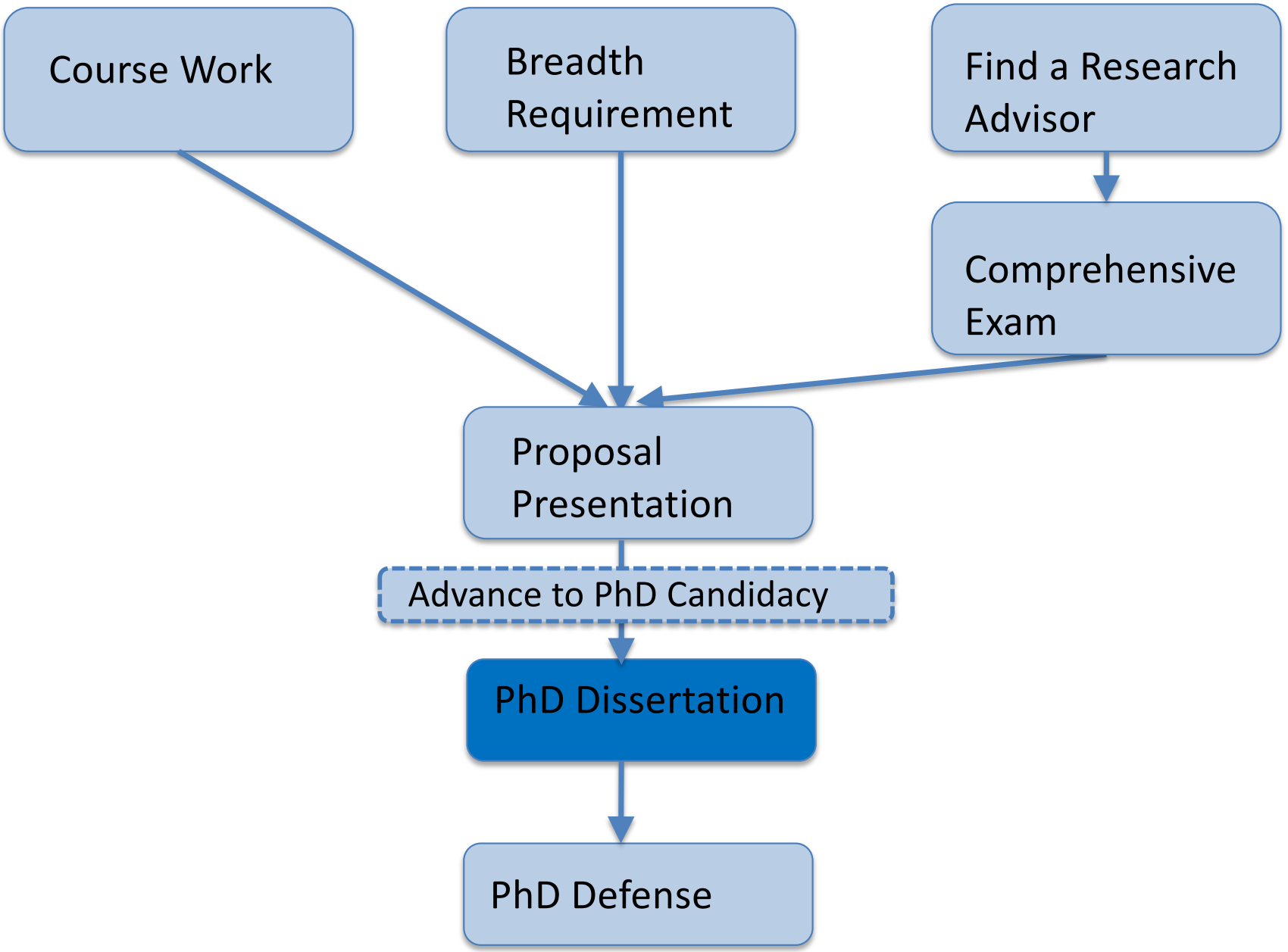
4. Dissertation Proposal

- 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
- The dissertation 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.

Advancement to Candidacy

- When the student passes the proposal defense, completes all the 48-credit course work (excluding the CS 998 credits), and all prior milestones, they advance to candidacy
  - They become PhD candidate and start working on their dissertation research

Overall Picture



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 one 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 2024
- Complete CS 701 in Spring 2025
- Complete the breadth requirement and declare the PhD 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.

Suggested Timeline for Full-time Students

- Semester 1-3: Complete CS 700, 701, and the breadth requirement. Determine the research advisor.
- Semester 4-5: Take the comprehensive exam.
- Semester 6-7: Complete the coursework (except the dissertation research) and advance to the candidacy
- Semester 8-10 (Year 4-5): Dissertation Research and Public Defense

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'24
  - CS 700 (required)
  - One additional course for the breadth requirement and/or an advanced PhD course in your interest area
- Spring'25
  - CS 701 (required)
  - One or two additional courses

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

Academic Warning and Termination (GMU rules)

- A notation of academic warning is entered on the transcript of a graduate student who receives a grade of C or F in a graduate course.

- A graduate student may be terminated from the program for any of the following reasons:
  - Fail to make satisfactory progress toward degree as determined by the academic unit and/or Associate Provost for Graduate Education.
  - Accumulate grades of F in two graduate courses or 9 credits of unsatisfactory grades (3 Cs, or 2 Cs and 1 F) in graduate courses.

Honor Code

- All PhD CS students are expected to know and abide by:
  - GMU Academic Standards (Honor Code) https://academicstandards.gmu.edu/
  - CS Department's Honor Code and Academic Integrity Policies https://cs.gmu.edu/resources/honor-code/

- Failures to follow the Honor Code may result in warnings, terminations, or loss of funding (GTA/GRA positions)

International Students

- Students with F-1 visas must be in "full-time" status
  - At least 9 credits per semester
  - 6 credits for GTAs and GRAs
  - May not switch to part-time status.

Online classes for F-1 International Students

- F-1 students in US can enroll in at most one online course during a semester, unless there are special circumstances approved by OIPS
  - Other courses must be F2F or hybrid

- Contact GMU OIPS if you have further questions about this

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
- This will also help with the research progress!

GPA Requirement

- All graduate assistants must maintain a GPA of 3.0 or better, at all times.

- Otherwise, the re-appointment as a GTA/GRA will not be possible until the student's GPA improves (to 3.0 or better).

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.

CS Graduate Student Organization (CSGSA)

- Mission: Establish strong connection with other graduate students and faculty members; be the students' voice towards the department

- Communication through Slack
- Search for @CSGSA on Mason360 or send e-mail to Liuchuan Yu (lyu20@gmu.edu) to join

Graduate Student Orientation from CEC

- Pre-recorded videos for general incoming CEC graduate students available at: https://cec.gmu.edu/admissions/graduate-admissions/new-graduate-students
  - Graduate Academic Affairs: Student Policies and Procedures
  - Computer Resources
  - Library Services
  - University Career Services
  - Office of Diversity, Outreach, and Inclusive Learning

Thanks for your attention…

QUESTIONS?

Overall Picture