

COMPUTER SCIENCE PH.D. HANDBOOK

Computer Science Department, Naval Postgraduate School
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1. Program Objective

The Ph.D. (“doctorate”) is the highest degree awarded by universities in the United States and represents the pinnacle of academic achievement. The mission of the Ph.D. degree program in Computer Science is to provide an advanced education in Computer Science to both U.S. and international military personnel and government civilians, advance the basic understanding of the theory and practices of computing, and contribute to the creation and consolidation of knowledge in computer science for the U.S. Department of Defense. We equip our students with the expertise necessary to independently perform state-of-the art research, to formulate and develop creative solutions to novel and existing problems, and to intelligently manage the research of others. In addition to a resident curriculum, the program also supports distance learning options to accommodate special circumstances of military or government civilian students who cannot leave their duty stations on a long term basis.

2. Rules for the Ph.D. Program

Ph.D. requirements and rules are mostly specified by the Academic Council at NPS in section 5.4 of their Academic Policy Manual, available online at <https://www.nps.edu/web/registrar/academic-policy-manual>. What follows summarizes those rules and provides additional policy for the Computer Science Department. The Computer Science Ph.D. Program Committee supervises Ph.D. degrees in the Computer Science Department.

3. Application to the Ph.D. Program

U.S. military officers, foreign military officers, U.S. government civilians, and employees of foreign governments may apply. An applicant should have a Master’s Degree (or be in the process of earning a Master’s Degree) in Computer Science or a related field. Generally, an acceptable Ph.D. applicant should have above-average grades in a typical Master’s degree program. The Computer Science Ph.D. Committee will also take other evidence of research or academic ability into account in deciding whether to admit an applicant.

Applicants must follow the standard procedures of their sponsoring organization in applying to a graduate education program. See the Academic Council Policy Manual for further guidance. Applicants can apply online at <https://nps.edu/web/admissions/prospective-students>. The items every application must include are listed at this URL, including a cover letter (see template in Appendix A). Applications can also be sent to:

Director of Admissions (Code 01C3)
Naval Postgraduate School
1 University Circle, He-022
Monterey, CA 93943
Telephone (831) 656-3093, DSN 756-3093
Email: grad-ed@nps.edu

Transcripts of every university-level course taken are required except if the student is currently at NPS. Generally speaking, GRE scores are required. An applicant may make a written “Request for Waiver” to exclude GRE results as part of their application and must include a reason for the

request. The decision whether to grant the request is made by the Computer Science Ph.D. Committee.

An application can include sample material demonstrating ability to perform research, e.g., a Master's thesis or a published paper. An oral interview (typically a phone call) may be required to assess the applicant's readiness for the Ph.D. program. For a sample admission application letter, see Section 24.

The Computer Science Ph.D. Committee evaluates each applicant on their qualifications to complete high-quality Ph.D. level work in Computer Science. It also evaluates the minimum amount of time the applicant will need to complete the program. The normal minimum time is three years for a full-time student already proficient at the Master's level in Computer Science or a closely related field at the time of admission. The Committee and the Computer Science Department may require that the applicant obtain authorization for additional time to complete the degree. Admitted Ph.D. students may begin in any quarter, but it is recommended that the student start in the Fall Quarter (beginning in September) due to the requirements and timing of the Written Qualifying Examination.

The Computer Science Ph.D. Program Committee may choose to admit to our Ph.D. program a student already at NPS for a Master's degree. The following requirements apply:

- The student's sponsor must endorse this course of action in writing.
- The student must separately apply and be accepted by the Computer Science Ph.D. program.
- Following NPS Academic Council rules, students must spend one year in residence at NPS while pursuing the Ph.D.
- The student may take the Written and Oral Qualifying Examinations while still enrolled for the Master's degree, and the results will be credited to them when they officially start the Ph.D. program.
- The amount of additional time allocated to a Ph.D. degree must be at least two years.
- For students wishing to complete the Ph.D. in less than three years after attaining the Master's degree, the Ph.D. Program Committee may require identification of a dissertation supervisor and a topic, and/or may require passage of the two exams, before admitting them, since some topics require considerable research preparation time. While pursuing their Master's degree, the student must maintain the same QPR (grade average) as required for a dual degree at NPS.
- Students are cautioned that a Ph.D. dissertation requires deeper (not just more) research than a Master's thesis, so continuing a Master's thesis topic may not suffice for a Ph.D. dissertation.

Applicants are cautioned that admission to the Ph.D. program does not guarantee successful completion of the program. It is significantly more difficult to assess the qualifications of a student for a Ph.D. admission than for other degrees. This is because the research activities for the Ph.D. requires significant creativity and independence. Experience suggests that not all of the students admitted will successfully complete the program. The purpose of the Qualifying Examinations is to give students early warning if they are likely to have trouble in the Ph.D. program.

4. Ph.D. Degree Requirements

The student must complete the following steps in order, as detailed in the following sections and Appendix B.

1. Pass the Written Qualifying Examination (two tries allowed).
2. Form a Dissertation Committee and write a dissertation proposal.
3. Pass the Oral Qualifying Examination (two tries allowed).
4. Have the dissertation proposal approved by the Dissertation Committee.
5. Advance to candidacy by submitting a form to the Academic Council.
6. Do the dissertation research.
7. Pass the Dissertation Defense (also called the Final Oral Exam) (two tries allowed).
8. Submit the dissertation and all required forms for the Ph.D. degree.

Successful management of a Ph.D. student's academic career is primarily the responsibility of the student. They must ensure that the requirements for each stage of the process are met on schedule. This includes filling out the necessary paperwork, scheduling meetings, forming a committee, finding a dissertation topic, and doing dissertation research.

The only courses required for the Ph.D. degree are CS5805 (taken every quarter before Advancement to Candidacy) and CS5810 (taken every quarter after Advancement to Candidacy). However, students who have been out of school for a while may find it helpful to attend some classes to get thinking about computer science again and preparing for the exams. Auditing these courses may suffice rather than taking them for credit. It may also be helpful to attend classes related to the dissertation topic.

Students have two years from the date of admission to complete the Written and Oral Qualifying Examinations. They have five additional years to complete their degree after advancement to candidacy. Students can ask for an extension on the latter time limit by submitting a request with reasons to the Academic Council, but extensions are unusual.

5. The Written Qualifying Examination

The Written Qualifying Examination assesses a prospective candidate's proficiency in three major subject areas of computer science. A student may be able to validate parts of the exam and be exempted from taking those parts as explained below.

The Written Qualifying Examination is open-book, open-notes, and digital devices are allowed only to read preselected materials. It is prepared and graded by the Computer Science Ph.D. committee. It is usually offered once per year in the Fall quarter. All Ph.D. students must take the exam at NPS, including all distance-learning students.

Some courses at NPS are related to the exam material, so it is useful to audit these courses or at least study their syllabi. However, the exam goes into more depth on some topics than the courses do, and the student should read additional material beyond the NPS textbooks. Descriptions of the topics are in study guides along with suggested readings.

- Algorithms (most material is covered in CS3150)
- Automata and formal languages (most material is covered in CS3101)
- Programming language design and implementation

A candidate has three hours for each part of the exam. The grading is either or pass or fail. The student must pass or validate each of the three parts of the exam to pass the entire Written Qualifying Exam. There will be at least two graders for each question (usually including the author of the question). Graders will supply brief comments supporting the grades they assign. The Program Committee supervises the grading process and reconciles differences among graders.

The three parts of the exam may be validated by written approval from the course coordinator of the courses listed above, or by the Ph.D. Program Committee in the case of the third topic. The validator may require that the student answer some questions on the subject. Validation based on a course generally requires the equivalent of an A in a corresponding NPS course.

If a candidate fails the exam, the Program Committee may grant the candidate once the privilege of taking another written exam within one year. The student only retakes the parts of the exam that they failed. Granting this privilege is at the discretion of the CS Ph.D. Committee and is not guaranteed. See the Academic Policy Manual for more information.

The Program Committee keeps some previous written exams available to candidates. It also maintains a study guide which specifies for each of the major subject areas, the committee's expectations of a candidate in that area, and the suggested reading list for each subject. The guide describes techniques, methods and concepts in which a candidate is expected to demonstrate proficiency. A candidate's primary contact in preparing for the Written Qualifying Exam should be his or her appointed Faculty Mentor.

6. Forming a Dissertation Committee

The student's Dissertation Committee, once established, is responsible for supervising their completion of their degree, including taking recommended courses if any, dissertation research, and production of the dissertation document. It is specific to each student and should not be confused with the Ph.D. Program Committee.

The student proposes a Dissertation (doctoral) Committee and the Dissertation Supervisor after the Written Qualifying Examination but before the Oral Qualifying Examination. They must get approval from all the proposed members, and submit a request to the Program Committee. The request should include the proposed dissertation topic, and for each member of the Dissertation Committee, whether they have a Ph.D., whether they are full-time NPS faculty, what department or organization they are associated with, and a short explanation of how their expertise will contribute to the dissertation. Once the request is approved by the Program Committee, it should be entered into the Python system. Approval of the Dissertation Committee and Dissertation Supervisor is necessary to conduct the Oral Qualifying Examination, as it is administered by them.

The rules about members of the Dissertation Committee are:

- The Dissertation Committee must have at least five members including the dissertation supervisor.

- Four of the members must be full-time NPS faculty.
- Three of the members must be full-time Computer Science faculty.
- One of the members must be NPS faculty not in Computer Science.
- No more than one committee member may not have a doctoral degree. (The Academic Council rules say two, but Computer Science has a stricter policy.)
- At most one committee member may be from another university or appropriate institution.

The student's dissertation supervisor (or "dissertation advisor") is responsible for supervising the student's program of study in accordance with the requirements of the Academic Council. The dissertation supervisor must have the following qualifications:

- A doctorate degree and demonstrated expertise in his/her field of specialty.
- At least one year of experience serving on a Dissertation Committee.
- Activity and productivity in research, as evidenced by recent referred publications of his or her research in recognized journals or conferences, or a broad reputation as a productive researcher in his or her field of specialty.

The Dissertation Committee also has a Chair who is usually the same as the Dissertation Supervisor, though they should be different if the Chair does not satisfy the criteria for a Dissertation Supervisor. The Dissertation Committee Chair administers the oral examination and fills out forms about it. The members of the Dissertation Committee and/or Dissertation Supervisor may be changed later by submitting a request to the Academic Council with justifications (see Appendix G).

Beyond the rules for membership of dissertation committees, it is important to avoid picking a committee of just the professors whose areas are closest to the area of the proposed research. Since time to do a dissertation is usually short, it helps to have some members of the committee who are experienced in conducting research, not necessarily in the area of the dissertation.

7. Course Enrollment and Residency Requirements

Although no classroom courses are required for the Ph.D. degree, every Computer Science Ph.D. student is required to enroll each quarter in CS5805 (Dissertation Proposal Preparation) before advancing to candidacy, and enroll each quarter in CS5810 (Dissertation Research) after advancing to candidacy. CS5805 and CS5810 are ungraded courses.

Academic Council rules require that a Ph.D. student must be in residence for a total of at least one year at NPS during their course of study. This year need not be accomplished all at once.

8. Progress Report Requirements

It is expected that students without dissertation supervisors contact their Faculty Mentor or the head of the Ph.D. Program Committee at least monthly. It is expected that, after advancing to candidacy, students meet or talk with their dissertation supervisor at least every week, and meet or talk with the other members of their committee at least quarterly, but more frequent meetings may be necessary. It is important that the student stay in contact with their Dissertation Committee to be sure what they are working in approved areas and covering all the key issues they must

investigate. All members of the Dissertation Committee must approve the final version of the dissertation.

9. Dissertation Proposal

A dissertation proposal must be submitted and approved by the Dissertation Committee before the Oral Qualifying Examination. Its purpose is to enable the Dissertation Committee to determine whether the proposed research topic is suitable for a Ph.D. dissertation and within the student's capabilities to address. It also specifies the Dissertation Committee itself, and they will administer the subsequent Oral Qualifying Examination. The proposal should include a tentative research plan, although it can be changed later as the research subject is understood in more detail. Appendix D gives a sample dissertation-proposal outline.

10. The Oral Qualification Examination

Usually within a few months and no more than two years after the successful completion of the Written Qualifying Examination, the student must successfully complete the Oral Qualifying Examination. Any coursework required by the Dissertation Committee must be completed before the student takes the Oral Qualifying Examination.

The Program Committee creates an Oral Examination Committee and a Chair to administer the Oral Qualifying Examination. Usually this is the Dissertation Committee for the student and the Chair is the student's Dissertation Supervisor. The Chair schedules the exam and must arrange an Academic Council Representative to attend it. The Chair should inform the Ph.D. Program Committee of the time and place of the exam at least a week before the exam, and members of the Ph.D. Program Committee may also attend and ask questions.

The Oral Examination Committee can ask any questions that it feels may help decide whether the student has sufficiently broad knowledge of Computer Science and sufficient analytic capability to begin full-time Ph.D. research. The student should meet before the exam with the members of the Oral Examination Committee for guidance. There is no time limit for the exam, but 2-3 hours is typical, with a student presentation in the first hour and questions from the audience for the rest of the time.

When the Oral Examination Committee is satisfied that the student has been questioned thoroughly, the student leaves the room, the Committee discusses any concerns, and votes on whether to pass the student. The Academic Council representative and the attending members of the Program Committee do not vote. The only possible decisions are pass or fail, and a unanimous vote of the Committee is required. If the student fails, they are given one more chance to pass the exam, usually at least six months later.

The Oral Examination Committee Chair (who usually is the Dissertation Supervisor) must report the final result of the Oral Qualifying Examination to the CS Program Committee Chair promptly after the examination, who then signs it and forwards it to Academic Council no later than two weeks after the Examination. Appendix C gives the form that must be submitted.

11. Advancement to Candidacy

Usually shortly after passing the Oral Qualifying Examination, a Ph.D. student is officially advanced to candidacy for the Ph.D. degree. Advancement requires attestation as to:

1. Approval of the dissertation proposal and title by the Dissertation Committee, accomplished online in the Python thesis-management system
2. Passage of the Written Qualifying Examination
3. Passage of the Oral Qualifying Examination
4. Completion of any required studies

The student submits a request for Advancement to Candidacy in the Python student-management system. The Computer Science Ph.D. Committee then requests the Academic Council to advance the student to candidacy via an Advancement to Candidacy memo, a different form than the one reporting success on the Oral Qualifying Examination. The Dissertation Committee must approve the student's topic of investigation, and proposed title must be mentioned in the Advancement to Candidacy memo.

12. Dissertation Preparation

The most important requirement of the doctorate is the successful completion of a scholarly investigation leading to the original and significant contribution to knowledge in the candidate's major area of study. This usually involves at least one year of full-time research, but can take longer depending on the topic. The student writes a dissertation based on the research. A typical Ph.D. dissertation is at least 100 pages long in the NPS thesis format; Appendix E gives a typical dissertation outline. Usually the candidate submits drafts of each chapter to their Dissertation Committee after they finish and proofread each.

13. The Dissertation Defense (Final Oral Examination)

The final oral examination (final dissertation defense) is done when the Ph.D. research is substantially complete. The candidate is asked to demonstrate a significant and original contribution to computer science. They are expected to demonstrate a mastery of the topic, its history, its context within computer science, and the current state of the art. Appendix F describes the nature and contents of the defense in more detail.

The dissertation defense must be scheduled by the student in cooperation with the Dissertation Committee Chair with the following constraints:

- A nearly final draft of the dissertation must be provided to all members of the Computer Science Ph.D. Program Committee at least one month before the scheduled defense. The candidate's Dissertation Committee must approve this draft. The dissertation draft should be made available to all interested faculty one week prior to the defense.
- The date, time, and location must be announced to the Computer Science Department at least three weeks in advance.
- The defense must be at least six months after passing the Oral Qualifying Examination.
- The candidate's entire Dissertation Committee must be present either physically, by video conferencing, or (as last resort) by speakerphone.

The dissertation defense is primarily a public event to which the entire school is invited. It starts with an open presentation of the findings of the research by the candidate, including responses to questions from the audience within an allotted time period. Then non-faculty are asked to leave and all faculty can ask additional questions. Then everyone leaves including the student, except for the Dissertation Committee and the Academic Council Representative. The Dissertation Committee discusses the presentation and dissertation and votes to determine whether the student passes the examination. A unanimous vote is required to pass the examination. See the Academic Council Policy Manual for voting rights.

Since a defense is public event, rehearsal of the presentation portion of the defense in the presence of the Dissertation Committee is strongly encouraged. Generally speaking, the presentation portion should be understandable to anyone with a computer-science background, not necessarily a specialist in the area of the dissertation.

The Dissertation Committee Chair must arrange attendance by an Academic Council representative on the defense. The representative writes a separate report on the defense that states that it was conducted according to Academic Council rules.

In passing the Defense, the candidate's dissertation may be accepted as is or under the constraint of making specified minor revisions. Minor revisions are defined as those reasonably possible to make in 30 days. If more extensive revisions are required or the committee cannot achieve unanimity, then the candidate did not pass the Dissertation Defense. A candidate has two chances to pass the Defense.

14. Approval of the Dissertation by the Dissertation Committee

When the entire dissertation has been revised and clarified to the satisfaction of each member of the Dissertation Committee, it is ready for signatures. First, each member of the Dissertation Committee must sign the Dissertation Approval and Release Form. Then the Thesis Processing Office ensures that the dissertation format conforms to NPS guidelines. Then the dissertation is submitted to the Python system and electronic signatures are obtained from the Dissertation Committee, the Computer Science Chair, and appropriate Deans.

15. Checklist for Graduating Students

Deadlines are earlier for Ph.D. student dissertations than M.S. student theses due to the number of approvals required. Appendix A gives a summary..

During the dissertation work:

- The student submits drafts of chapters to their Dissertation Committee. Once they have three completed chapters, they should submit them to the Thesis Processing Office for format checking. If the student finds it helpful, they can also submit chapters to the Graduate Writing Center for suggested revisions; it is part of the Thesis Processing Office, but looks in more detail at the grammar, rhetoric, and clarity of dissertation drafts.

By Week 1 of the graduating quarter:

- The student submits the draft to thesis processor for a format check according to Step 1 of the On-line Dissertation Submission procedure.
- The student sends to the Computer Science Educational Technician or other designated staff:
 - Full name (which will appear on diploma)
 - Mailing address for the diploma
 - Will student be attending graduation at NPS?

By Week 3:

- The student revises the draft based on feedback from the Dissertation Committee and Thesis Processing Office.

By Week 4:

- The student provides a revised dissertation draft to the Dissertation Committee.

By Week 6:

- Dissertation committee members provide feedback to the student whether the dissertation is ready for a Final Defense.
- If ready, the student schedules the Dissertation Defense by week 8 and requests an Academic Council representative to attend. The student also sends the draft presentation slides to the Dissertation Committee.
- If not ready, student requests withdrawal from the graduation list.

By Week 8 (or earlier, to ensure that all documents arrive at the Academic Council in time for their monthly meeting):

- The Dissertation Committee conducts the Final Dissertation Defense. At the end of the defense, the student should get the Passage of Dissertation Defense Memo signed by all Dissertation Committee members before they disperse, as well as the Dissertation Approval and Release Form signed by Committee members who do not have a CAC for electronic signature.
- Week 8 is the withdrawal deadline for graduation.

By Week 10:

- The student prepares final version of dissertation responding to issues raised by the Dissertation Committee in the defense.
- The “**Final Five**” documents required by the Academic Council must be received by the Academic Council. These are:
 - Passage of Dissertation Defense Memo
 - Academic Council Representative’s report of defense
 - Degree Nomination Memo
 - Electronically-signed (via CAC) Dissertation Approval and Release Form, which can be found at http://www.nps.edu/research/Documents/Dissertation_Release_Form.pdf.
 - Dissertation Acceptance email sent to the Dissertation Supervisor by Python upon Thesis Office approval if the Thesis Processing Office does not notify the Academic Council Recording Secretary directly of approval.

- The Dissertation Acceptance Letter must be received by the student by the Friday of the week two weeks before graduation for the student to participate in the graduation ceremony.

By Week 12 of the quarter before graduation:

- The student submits a complete draft of the dissertation to their Dissertation Committee. It should be run through a spelling corrector and carefully proofread. A tool for checking unnecessary wording is at http://faculty.nps.edu/ncrowe/coursmaterials/deadwood_program.zip; check the README.txt file to run it.

Week 12:

- Graduating students must be present during the graduation week to attend the commencement rehearsal.

16. Dissertation Submission

The Thesis Processing Office gives guidelines for submission at <https://nps.edu/web/thesis-processing/submission-guidelines>. Resident students must use the SharePoint system; remote students are strongly encouraged, but not required, to use SharePoint. To get account for the SharePoint site, contact the Thesis Processing Office. Remote use of SharePoint requires a VPN client connection to connect to the site, and requires installation of client on the student’s computer.

17. Computer-Science Minor Requirements of Other Departments

For a C.S. Ph.D. minor by a student in another Ph.D. program, the student must earn a “B” or better grade in four courses that form a coherent sequence. The student should submit the proposed sequence in advance to the C.S. Ph.D. Program Committee for approval, and the Committee can then prepare a letter on request attesting to their completion.

18. The Computer Science Ph.D. Program Committee

The Computer Science Ph.D. Program Committee is responsible, in cooperation with the faculty and the students, for managing all aspects of the Ph.D. process for the department as described in this document. Generally however, they defer to the student’s Ph.D. Dissertation Committee, a committee formed for each Ph.D. candidate and separate from the Program Committee, once it has been formed.

The Computer Science Ph.D. Program Committee is responsible for defining and enforcing the standards of performance required of PhD students enrolled in the Computer Science Ph.D. program. Its duties are:

1. Decide whether to admit students to the CS Ph.D. Program.
2. Ensure that each student’s Ph.D. education plan conforms to the minimum requirements specified by the NPS Academic Council in the Academic Policy Manual.
3. Determine any standing requirements, beyond those of the Academic Council, that must be fulfilled by all Ph.D. students in the Department.
4. Nominate, for approval by the Academic Council, the members of each Ph.D. student's Dissertation Committee, and certify to the Academic Council that the Ph.D. Dissertation

Committee Chair is qualified.

5. Design and execute the Written Qualifying Examinations and oversee the Oral Qualifying Examinations for each Ph.D. student, and ensure that those examinations conform to the requirements of the Academic Council Policy Manual. Actual execution of the oral qualifying exam is normally delegated to the student's Ph.D. Dissertation Committee.
6. Request that the Academic Council advance a student to candidacy for the Ph.D. degree upon approval of a Dissertation Committee, a dissertation topic, and successful completion the Oral Qualifying Examination and all other mandated requirements and exams.
7. Appoint each entering Ph.D. student a Faculty Mentor to guide the student until such time as the student has formed a Dissertation Committee.
8. Review all students' performance statements and evaluate student eligibility to remain in the program. Notify students of any discrepancies and required actions in writing.

Prior to the naming of a Dissertation Committee and a dissertation supervisor, the departmental Ph.D. committee, with the help of the student's Faculty Mentor, has the responsibility of supervising the student's program of study, After the naming of the Dissertation Committee and dissertation supervisor, the departmental Ph.D. committee retains the responsibility of overseeing the activities of dissertation supervisor and the Dissertation Committee, maintaining quality control of the departmental Ph.D. program.

19. Where to Find NPS Ph.D. Memoranda and Templates

The most recent versions of all NPS Ph.D. memoranda can be found at the Academic Council forms site, currently https://nps01.sharepoint.com/sites/academics/acad_admin/acad_council/default.aspx. The Appendices that follow also give some useful guidelines and forms.

20. Contact

Questions about the CS Ph.D. Program should be directed to the chair of the Computer Science Ph.D. Program Committee. Currently Prof. Rowe (ncrowe@nps.edu, (831) 656-2462) is chair.

Appendix A: Cover Letter Template for an Application for Admission

<Your Return Address>

<Date>

Director of Admissions (Code 01B3) Naval Postgraduate School
589 Dyer Rd., Rm. 103C
Monterey, CA 93943-5100

To Director of Admissions:

Please accept my application to the Ph.D. program in Computer Science at the Naval Postgraduate School. I have enclosed the following application materials:

- Certified transcripts from <Academic Institution(s)>
- Results from a recent GRE general test
- Results from a recent TOFEL if not a native speaker of English
- Master's Thesis entitled <thesis title> or research paper entitled <paper title>
- Reference letters from <names of references>

Thank you for your consideration. Sincerely,

<Your Name>

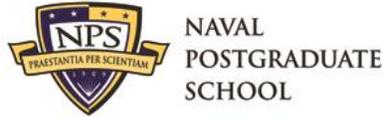
<Your Job Title>

Appendix B: Computer Science Ph.D. Milestones

Abbreviations: PO = Computer Science Program Officer, PCC = Computer Science Ph.D. Program Committee Chair, PC = Computer Science Ph.D. Program Committee, DCC = student's Dissertation Committee Chair, DC = student's Dissertation Committee, DPC = Computer Science Department Chair, AC = Academic Council, and ACR = Academic Council Representative.

Milestone	Documentation	Signatures	Time Limits
Application to Ph.D. program reviewed	Prospective students and PCC enter information into Python system	PCC; plus PO and DC for foreign students	None
Written Qualifying Exam passed	Internal	None	Students has 12 months to retake after a failure
Student is ready to take Oral Qualifying Exam	Approval of the DC by the PC; draft of dissertation proposal submitted to DC; request of DC for ACR to attend the Exam	PC or DCC	Usually within a few months of the Written Exam but no more than two years
Oral Qualifying Exam passed	Report of the Dissertation Committee Chair to the AC; report of the ACR about the Exam	DCC,DC, ACR	Submitted within two weeks to AC, Vice Provost for Academic Affairs, and PO
Advancement to Candidacy of the student	Memo to the AC in standard format listing the DC and passage of exams, first sent to the PC; dissertation proposal	DC, PC	Usually within a few weeks of the Oral Qualifying Exam
Student is ready to take the Dissertation Defense	Complete draft of dissertation; public announcement of the defense title, date, and time to the PC and school; request of DCC for ACR to attend the Defense	DCC	Defense must be announced and draft dissertation available schoolwide at least two weeks before
Dissertation Defense passed	Memo stating the student passed by Defense and signed by the DC; report of the ACR about the Defense	DC, ACR	None
Dissertation approved	Approval of dissertation and degree in the Python system	DCC, DC, DPC, AC, deans	Must be within 5 years of Advancement to Candidacy

Appendix C: Memo for Result of the Oral Qualifying Exam



Oral Qualifying Examination Memorandum

From: [*Name of Department*] Departmental Ph.D. Program Committee Chair
To: Academic Council
Subj: RESULT OF Ph.D. ORAL QUALIFYING EXAMINATION FOR [*student name*]
Date:

1. Student completed all required coursework on [*date of coursework completion*].
2. Student satisfactorily completed the Written Qualifying Examination on [*date of exam*].

On [*date of exam*], [*student name*] satisfactorily completed the Ph.D. Oral Qualifying Examination administered by the [*Name of Department*] Departmental Ph.D. Program Committee.

[*Name of AC rep*] was the Academic Council Representative for the Oral Examination.

[*Type name here, sign above line*]
Chair, Departmental Ph.D. Program Committee

The Departmental Ph.D. Program Committee delegated the following examiners:
[*Name and title of Program Committee member or Designatee here*]
[*Name and title of Program Committee member or Designatee here*]
[*Name and title of Program Committee member or Designatee here*]
[*Name and title of Program Committee member Designatee here*]

Appendix D: Recommended Ph.D. Dissertation Proposal Outline

<AUTHOR>

<DATE>

- I Proposed title of dissertation
- II Goals and proposed new contribution
 - A. Introduction to the problem.
 - B. Significance of the problem and its potential impacts
 - C. Specific goals of proposed research – which subproblems will be solved by the work you propose to do, how do they relate to the overall problem
 - D. Proposed advances to the state-of-the art – in what sense will your proposed work improve over the best previous results, for each issue you plan to address
- III Research strategy and proposed approach
 - A. Tactics for producing the proposed new contribution
 - B. Methods to substantiate new contributions including proposed experiments, measurements or theoretical analysis.
 - C. Expected delivery of products, if any
- IV Assessment of previous work. For each issue you plan to address in your contributions, find the best relevant previous publications.
 - A. Summarize the results and assess their significance in the context of your problem.
 - B. Explain the relation to your work – which parts will you use, or is this one of the best previous competing solutions you will improve over.
 - C. Point out weaknesses
 - D. Explain how you will overcome the weakness or improve on previous results, if you plan to do so
- V Tentative chapter outline for dissertation. The Master's thesis outline of http://faculty.nps.edu/ncrowe/thesis_guidelines_rowe.htm is a good start, but you may want to add chapters if you have different kinds of methods or different categories of results.
- VI Research plan and proposed schedule
- VII List of references

Appendix E: Recommended Ph.D. Dissertation Outline

(Modified from M.S. thesis guidelines at http://faculty.nps.edu/ncrowe/thesis_guidelines_rowe.htm. Page limits given there do not apply to dissertations.)

Abstract (10-22 lines)

- Summarize the methods and results of the thesis. Also give some motivation for the work, but don't try to write a second introduction. Usually you don't need to describe prior work unless it was really important for you.
- The abstract is not included in the templates for theses, but you should include it anyway at the front of your thesis file to make it easier to compare to the thesis. Once it is agreed upon, you can copy it into the introductory material form and delete it from the thesis.

Chapter 1: Introduction

- Describe the need (problem) your thesis tries to address. Convince the reader that it is a serious need (that is, motivate the reading of the thesis).
- Explain why a computer program or methodology can help this need.
- Explain why previous computer programs or methodologies (if any) haven't solved this need, or else haven't solved it completely.
- Explain what new ideas you had for solving this need. You only need describe these ideas in general terms here.
- Briefly describe the remaining chapters of the thesis. This should usually be the only place you describe chapters.

Chapter 2: Previous attempts to solve this problem, and other problems like it, with computer programs or methodologies

- Describe other attempts to solve the problem or problems that you are trying to solve ("previous work") using different methods than yours. Give citations, but not names of papers or other reference details that will be in the reference list.
- Prefer to cite refereed publications (which are, generally speaking, conference proceedings, journals, and book chapters). Web sites are usually unrefereed, so try to avoid referencing them unless they have information (such as software details) not available elsewhere. Every publication listed should have a specified author or authors; organizations can be authors too.
- Point out the key features of each example of previous work. Usually one paragraph per reference is enough, but important references may require more.
- Describe any general mathematical background necessary for your program or methodology. However, the specific mathematical methods you used should go in chapter 3 or 4.

Chapter 3: More precise description of the problem you tried to solve and the general approach that you used

- Describe the problems in the real world that your program or methodology will try to address. Describe the setting of those problems, and note things that aren't done as well as they could be, either because they aren't using digital technology or they aren't using it the right way. Focus on the problems, not the solution (that's for chapter 4).
- Describe the specific assumptions you made in writing your program or formulating your methodology, as for instance the situations they try to model, the sort of people that will use the program or method, applicable orders and regulations that define the task environment, and so on.
- Although references to previous work on problems similar to yours that used methods different from yours should go in chapter 2, describe here the software and/or data not written by you but which you used. But details of how you used it should go in chapter 4.

Chapter 4: Description of your program or methodology

- If you have created or modified a program, say what computer your program runs on, what programming language it is written in, and what special facilities it requires.
- Describe the input and output of your program or methodology in general terms.
- Give a block diagram of the main parts for your program or methodology, and describe the main interactions between the parts. Try to avoid procedure names, variable names, etc.; explain in a high-level way.
- Do not give instructions here for installing and running any software you wrote, as such information should go in an appendix.
- Mention any programs or subroutines or sub-methodologies that you use that were written by other people, and explain where they go in the block diagram.
- Describe the data structures used in your program if you created them.
- Give details of the components of your program or methodology that you created, each in a separate section (this may take many pages if it is complicated).
- Describe the error checking and other user-friendliness features of your program or methodology.
- If you experimented with more than one algorithm, program, or methodology, do the same thing above for the others. This may be best done in separate chapters if you have much to say about each.
- Usually write in the past tense in this chapter as if your work is finished.

Chapter 5: Discussion of results

- If your results can be quantified, summarize the performance of your program or methodology in whatever way is appropriate. That usually includes how long it took to run or do, how much space or resources it required, and how accurate its results were.
- Use tables and figures wherever you can to simplify the discussion. (Put actual computer runs in appendices.). Bear in mind there is a limit to how many tables and figures a reader can be expected to look at, particularly if they look similar.

- If your results are not quantifiable, discuss them and try to draw conclusions from them. However, major conclusions should go in the last chapter.
- Discuss any insights you obtained from your data. If your focus is on data analysis, categorize the data in a variety of ways and assess differences between the categories.
- If you experimented with more than one algorithm, program, or methodology, discuss each of their results. This may be best done in separate chapters.

Chapter 6: Conclusions

- State the major achievements of your program or methodology. Try to compare your program to similar previous work. Avoid repeating statements made earlier, and try to give a new perspective based on the results you have obtained.
- Honestly admit the major weaknesses of your program or methodology, and how they might be fixed by future researchers.

Possible appendices to the dissertation

- Instructions on downloading and installing software you wrote. If third-party software was important for this thesis and was not straightforward to download and install, give instructions for it too.
- Results of test runs or examples if interesting to the reader and too big to include earlier. If there are several types of these, make them different appendices.
- Text of your programs or data if interesting to the reader (but this should not exceed 50 pages). Do not include programs or data not written by you, even if they were important to the thesis.

Appendix F: Guide to a Ph.D. Dissertation Defense (Final Oral Exam)

General advice:

- Defenses usually consist of a presentation no longer than 45 minutes, followed by questioning from one to two hours. Expect to be interrupted for short clarification questions during the presentation. Questions after the presentation typically explore the assumptions, limitations, extensions, and applications of the dissertation work.
- The defense is intended to be a "public" event, open to attendance and questions by anyone at the school. That means you should design the presentation not for your doctoral committee but for anyone with a computer-science background, though you may want to include some more technical details for the committee. Avoid acronyms and other specialized terminology as much as possible. Your committee's vote on your performance will put some weight on how you handled questions from nonmembers of the committee.
- As with presentations at science and engineering conferences, you should rehearse your talk in advance. It is best to give a practice run for your entire Dissertation Committee, but at least you should present it orally to your dissertation supervisor. The practice run should help both with judging the length of the talk and finding things that can be improved.
- The core of your presentation should be a set of novel claims from your work and the validation of your claims. This is supplemented with how these claims relate to prior work and what is different about them, plus speculations about future implications of what you have done.
- Slide counts in the outline below are for 28 point font. Do not use font smaller than this for exams with videoconferencing, and less than 20 point otherwise, with the possible exception of important figures and tables that cannot be compressed.

Outline of the slides (for a total of 15-42 slides):

- What problem are you addressing (1-2 slides). Focus on the primary problem if there is more than one.
- Why this problem is important (1 slide).
- What contributions you have made that no one previously has done.
- (1-2 slides). The contributions must be to the field of the degree. State them as claims. Most of the remainder of your presentation will be the validation of your claims.
- Previous work addressing the same problem with different methods than yours (1-3 slides, depending on the topic). Give names of researchers and summarize succinctly what they did. Explain why previous work didn't solve your problem completely.
- Previous work addressing different problems with similar techniques to those you used in the dissertation work (2-5 slides, depending on the topic). This can be short if you used well-known techniques.
- Design of the validation for each of your claims (5-15 slides). The validation can include experiments, tests, and proofs. If you built something, this is where you describe it. Note that validation can be of design as well as of implementation, although validation of an implementation is more convincing. Thorough validation is the key feature distinguishing Ph.D. dissertations from Master's theses.

- Results of the validation of each of your claims (2-10 slides). Usually this is presented in the form of statistics and some analysis of data that has been collected.
- Conclusions: How your validated claims have contributed to the solution of the original problem (1-2 slides).
- Broader implications: Why your work is useful to society (1-2 slides).

Appendix G: Memorandum for a Dissertation Committee Change

<DATE>

MEMORANDUM

From: Chair, Computer Science Ph.D. Committee
Via: Chair, Computer Science Department
To: Chair, Academic Council Doctoral Committee, Code O1B

Subj: Dissertation Committee Appointment Change

<State the requested changes and provide justifications here for each addition to and removal from the Dissertation Committee, and/or changes to the Dissertation Supervisor and Dissertation Committee Chair.>

<Name>
Chair, Computer Science Ph.D. Committee

<Name>
Chair, Computer Science Department

Copy to:

<Name of Chair of Dissertation Committee>

< Dissertation Committee members>