Information on the Ph.D. Degree Requirements

Department of Computer Science
Brown University

This document describes the requirements for the Ph.D. degree in computer science at Brown University. It begins with a one-page summary of the requirements and continues with a detailed explanation of these requirements. Should these requirements change in the future, the requirements that apply to a given student will be either those in existence at the student's entry into the program of study or those as revised since that time, at the student's option.

1. Summary of Requirements

Ph.D. students must satisfy a set of requirements for admission to candidacy, fulfill major and minor course requirements, do a thesis proposal, complete a thesis that embodies the results of original research and gives evidence of high scholarship, and obtain 24 credits.

The requirements for admission to candidacy include a course requirement that encourages study in diverse areas of computer science, a programming assignment that tests programming ability, and a research project that tests ability to do independent research. These requirements must be completed by the end of the student's second year. Upon satisfying these requirements the student will be formally admitted to candidacy for the Ph.D. degree in computer science.

The student must complete one major and two minor course requirements. Each requirement is normally met by the satisfactory completion of two approved one-semester courses. The minor requirements are normally one inside and one outside the field of computer science. The major and minor course requirements are normally completed by the end of the student's third year in residence.

The student's thesis research will normally be done under the supervision of a member of the faculty of the Department of Computer Science. A thesis proposal demonstrating the student's knowledge of the area, outlining the proposed research problem and its solution, and demonstrating that the student has done substantial work in the area and is capable of successfully completing a Ph.D. is required. The thesis itself will be read by the thesis supervisor and two readers appointed by the graduate committee upon the recommendation of the thesis supervisor. It will be presented at a meeting open to students, faculty, and the public. Its

adequacy will be judged by the thesis supervisor, the readers, and the computer science faculty attending the oral presentation.

2. Ph.D. Requirements

The requirements for a Ph.D. degree can be summarized as follows:

- Admission to candidacy
  - Course requirement
  - Programming assignment
  - Research project
- Minor and major course sequences
- Thesis proposal
- Thesis
- Tuition credits

Students must normally be in residence at Brown while fulfilling these requirements. Each of the requirements listed above is discussed in one of the following sections.

2.1 Admission to Candidacy

The requirements for admission to candidacy have three parts: a course requirement, a programming assignment, and a research project. The course requirement encourages students to study in a variety of areas of computer science. The programming assignment tests the student's ability to solve a moderately difficult problem using good programming techniques. The research project tests the student's aptitude for doing significant research. Satisfactory completion of requirements for admission to candidacy, therefore, ensures that the student is well acquainted with the important topics of the field and is ready to begin research that will lead to a Ph.D. thesis. All the requirements for admission to candidacy are to be completed within the student's first two years. Students who are not admitted to candidacy after two years will normally be asked to leave.

All three parts of the requirements for admission to candidacy are taken and judged separately. Once a student has passed all three parts, he or she is formally admitted to Ph.D. candidacy. In addition, when a Ph.D. student has passed the research project and has satisfactorily completed eight approved courses in the department, he or she is eligible to receive the Sc.M. degree. The three parts are summarized below.

- **Course requirements:** Each student must take eight computer science courses in the first two years and obtain a grade of B or better in each. Six of these eight courses must be at the 2000 level; none may be reading and research courses, and four must be completed in the first year. In addition, the courses chosen must satisfy the area requirements described below. Courses taken

to satisfy this part of the requirements for admission to candidacy can also be used to satisfy the two-course major and two-course inside minor requirements for the Ph.D.

- **Research project:** Each student must undertake a one-year research project under the supervision of a principal advisor and two readers. A proposal for this project must be completed and approved before the end of the student's first year. The project should culminate in a substantial research paper to be completed and approved by the end of the student's second year. This project can be used to fulfill one of the requirements for the Master's project, but meeting the requirements for the Master's degree and meeting those for admission to candidacy are independent; in particular, meeting the former does not imply meeting the latter.

- **Programming exam:** Each student must pass a one-week programming exam with a grade of B or better.

2.1.1 Admission to Candidacy – Course Requirements

The purpose of this requirement is to encourage Ph.D. students to have a broad background in Computer Science. While the requirements set a minimum level of competency, students are encouraged to take additional courses and to expand their knowledge of the field while they are at Brown.

There are eight areas in which students can show proficiency. See the table at http://www.cs.brown.edu/grad/phd/reqs/course-areas-phd.html for a complete list of courses and areas they cover.

A student must take at least a total of eight non-reading and research courses in the first two years of study subject to the following requirements:

- At least six of the eight must be 2000-level courses.
- At least four of the eight must be taken in the first year.
- At least six total courses (including Reading and Research) must be complete by June 1 of the first year and count for a total of eight (8) credits.
- Courses must cover five of the above areas including three of areas A, B, C and D.
- All courses must be completed with a grade of B or better. Students are expected to maintain an A average (better than 3.5/4.0).

2.1.2 Admission to Candidacy – Programming Assignment

The programming assignment is given once a year, from Tuesday through Friday a week before classes begin in January. A student can undertake the programming assignment no more than twice, and must pass it by the end of the second year.

For the programming assignment, the student has four days to analyze a moderately difficult problem and construct a program that solves it. The program should be written using what are accepted as modern programming techniques: e.g., it should be designed in a top-down fashion with its basic components broken into modules. The program should also contain adequate documentation and should be accompanied by an explanation of its use (a 'user's guide'). After the program is handed in, students will meet individually with the exam's committee. During that

meeting students will have a chance to present the program and demonstrate its functionality. These will not be formal presentations and no slides or elaborate preparations are required.

2.1.3 Admission to Candidacy – Research Project

The goal of the research project is to give the faculty a chance to assess the student's ability to carry out Ph.D. research, which is not necessarily well-measured by courses or examinations. There are many characteristics that affect a student's potential. Intelligence is one of these, but some others are drive, inventive spark, diligence, enthusiasm, and open-mindedness. The entire constellation of characteristics is best judged in direct work with the student. The several steps along the way (advisor-selection deadline, committee formation, initial proposal, mid-process review) are meant to give feedback to the student as well as to make certain that the process advances. Students should actively engage their committees, not just their advisors. They should make certain that the committee is aware of the progress of the work throughout the year.

A student will select an advisor and 2 additional committee members by March 15 of his/her first year. The advisor must approve the choice of the other committee members.

The student will present a research proposal (a short document of about 1 – 3 pages describing the intended research and a 10 minute talk) by April 21 of the first year. This proposal talk will be given to the committee, the graduate representative (i.e., a member of the Committee on Graduate Examinations), and any other faculty who wish to attend. Since this is an examination, other students will not be allowed to attend. The date and time of the talk should be announced to the faculty at least one week in advance. The student should treat it as an opportunity to get feedback. The faculty will briefly discuss the proposal, and the student will be informed of the results within a few days. If the proposal is not considered to be of sufficient quality, the student will be asked to present again by the end of the semester; this presentation will be given to the committee, the graduate representative, and any other faculty who wish to attend. If the second presentation is also inadequate, the student will be asked to leave the program.

A student will meet with his/her committee (and any other faculty who wish to attend) during the fall semester of his/her second year. The student will present progress to date in a form that is agreeable to the committee as a whole (e.g., a talk, a short written report, or both). The committee will give the student feedback on directions, approach, and content. The committee will file a short written report with the Graduate Chair by Dec. 31, and the student will get a copy.

A student will present his or her work to the committee, the graduate representative, and any faculty who wish to attend, by March 15 of the second year, in a 20-minute talk, to be followed by questions. The date and time of the talk should be announced to the faculty at least one week in advance. The student must also submit a written research report that has been approved by the committee to the Graduate Chair one week before the presentation. The report should be roughly comparable to a conference submission in the given research area.

If the committee and the faculty present decide that the student shows adequate research potential, the student passes the research comps exam and will be asked to present a public talk on the work. "Adequate" is a strong standard: the committee must express confidence that the student can carry out Ph.D.-level research. If the first presentation does not demonstrate adequate research potential, the committee may recommend that the student try a second time. The second presentation must be completed by May 15.

In the event that the student has not shown adequate research potential, s/he will be so informed by the research supervisor, and will be asked to leave the program.

In some cases, the student may feel it necessary to change advisors and form a new committee. This should be decided and communicated to the Graduate Chair in writing by July 1 of the first year. It is felt that, at this point in the process, there remains adequate time to catch up and meet the subsequent dates as outlined above.

If a first-year student enters with significant research experience (perhaps in the form of a Masters degree), the student will be allowed to demonstrate research proficiency based on this previous work. The student will select an advisor and form a committee including two additional faculty members. The student must present the results of this previous research to the committee by December 1 of the first year and must convince them that she/he has demonstrated adequate research potential. If the committee is unconvinced, then the student must follow the regular research project exam procedure.

Any problem or grievance that occurs during this process can be appealed. This should be done by submitting a complete description of the problem in writing to the Graduate Chair. The problem will first be considered by the Committee on Graduate Examinations and will then be brought before the full faculty.

2.2 Minor and Major Course Sequences

The Ph.D. student must complete two minor course sequences and one major course sequence. Each major and minor course must be completed with a grade of B or better. Each minor consists of two related graduate-level courses. One pair must be in computer science but outside of the student's primary area of interest; the other pair must be in some field related to but outside computer science (e.g., applied math, engineering, cognitive science). The minor requirements ensure that the student has some moderately deep knowledge of subjects other than the central topic of the Ph.D. thesis.

The major course sequence consists of two courses in the student's area of interest. These should be Computer Science courses at the 2000-level, but if such courses are not available others may be substituted with the graduate advisor's approval.

The graduate advisor must approve the student's choice of minors and major. The student, however, should first discuss with his or her faculty advisor which courses to use. The advisor can help the student make this choice based on knowledge of the department's guidelines and the courses it has approved in the past.

2.3 Thesis

Shortly after beginning the research intended to be the subject of his or her thesis – usually within a year and a half after attaining candidacy – a Ph.D. student must present a thesis proposal. The purpose of the proposal is to give the faculty a chance to judge and comment on the general course of the research. In particular, they are interested in assuring that the student has sufficient knowledge and ability to carry out the research. This proposal also allows the faculty to advise the student of any major problems they foresee while the research is still in its early stages.

The thesis proposal should be a moderately long paper, usually between ten and thirty pages. The format of this paper is left to the student. The student might, however, consider discussing the following topics: a review of the literature and past work relevant to the research; the objectives of the research; how the research will be carried out; any results already achieved; and the expected contributions of the research.

No less than four weeks after making copies of the proposal available to members of the department, the student will present and defend the proposal at a one-hour talk.

The student is expected to complete the proposed work, produce a thesis document that satisfies the requirements of the registrar and meets the highest standards in terms of both content and presentation, and defend the work at an open thesis defense. This defense must take place at least six months after the proposal has been approved. Between a student completing their proposal and scheduling their defense, once every academic year, the student must give their committee a written update on their status. This update must be sent to the DGS. The advisor must then obtain confirmation from ALL members on the student's committee that the student is making reasonable progress. This confirmation must be provided by October 15 or March 15, in time for inclusion in the next Grey Monday discussion. Failure to obtain this confirmation will result in the student being penalized one level of standing.

The thesis defense is a meeting open to students, faculty, and the public. A complete draft of the thesis must be presented to the graduate advisor four weeks prior to the thesis defense. The thesis advisor and readers must approve of the defense being scheduled at this time. The thesis will be read by the thesis supervisor and two readers appointed by the graduate committee on the recommendation of the thesis supervisor. Its adequacy will be judged by the thesis supervisor, the readers, and the Computer Science faculty attending the oral presentation.

2.4 Advising

As mentioned, it is the student's responsibility to find an advisor for the research and thesis requirements. In many cases, the same faculty member will serve as the advisor for both requirements. However, once the requirement has been satisfied, either the student or the faculty member or both may elect not to continue working together. In such cases, the student is responsible for finding another advisor. These are the guidelines from the Graduate School on this topic:

Semester I: Each entering student needs to be placed into the available courses that are most appropriate to the requirements of the program and to the student's personal goals. Those goals may have changed since the student applied, almost a year previously, and care should be taken to see that each student enrolls in the most appropriate courses. Any gaps in preparation should be filled as soon as possible. Courses essential for passing departmental exams should be taken, and plans for meeting language requirements must be begun. Sometimes it is clear to a student after only a few meetings of a course that the course is at the wrong level or its content is not what was expected. Students should be encouraged to seek advice after the first week of classes and revise their registrations appropriately, if necessary. If a student shows any deficiencies at the end of the semester, he or she needs to be told what to do in order to be allowed to continue or to receive financial support for the second year.

Semester II: The Graduate Representative should report to each student, preferably in writing before the second semester begins, on his or her first semester's progress and the faculty's expectations for progress in the second semester. Plans for second semester courses may need revision. Later in the semester, students need to be told how they stand with respect to funding for the second year. Not knowing whether they can expect financial aid can be a distracting emotional burden for many students.

Semester III: The Graduate Council has ruled that each student should be advised, no later than the end of the third semester, whether he or she should proceed towards the PhD, plan to stop with the master's degree, or plan to leave without a degree.

2.5 Tuition Credits

The university requires that a student in the Ph.D. program obtain 24 tuition credits. Unlike a course credit, which is awarded upon satisfactory completion of a course, a tuition credit is awarded when a course is paid for. Students are expected to earn a full course load of course credits in each semester until he/she reaches the residency requirement of having earned 24 tuition credits. Students who are being supported by a fellowship must earn four course credits in each semester he/she is a Fellow. Students who are being supported as Research Assistants or Teaching Assistants are expected to earn three course credits in each semester he/she is an RA or TA. Other than to complete the requirements explained in other sections, no minimum number of course credits is required

As many as eight of these tuition credits may be awarded for courses taken at other institutions. That is, with the approval of the graduate advisor and the graduate school, a student may transfer in outside graduate courses, typically ones taken as part of a program leading to a master's degree. A graduate computer science course is usually eligible for transfer credit if it is judged to be of comparable difficulty to corresponding courses in the department. In addition, two courses outside of the computer science field may be transferred in if they can justifiably be used as one of the student's minors. Students are encouraged to obtain as many tuition credits as possible for previous work done at other institutions. Courses transferred for tuition credit will also count as course credits on the student's transcript but do not automatically count toward area requirements.

2.5.1 Transferring Courses

Students must fill out two forms to transfer credits earned at other institutions. The first is the "Application for Graduate Transfer Credit", which is to be submitted to the Registrar's Office after it has been approved by the department's Director of Graduate Studies. A copy of the form can be found on the department's website (http://www.cs.brown.edu/degrees/phd/reqs/).

The second form is for departmental use only and is intended to make it clearer which transferred courses will be used as substitutions for Brown Computer Science courses and will also satisfy area requirements. In order for a course to satisfy the course area requirements, both the faculty member who teaches the complementary course at Brown and the student's faculty advisor need to approve the request. The "Department of Computer Science PhD Transfer Credit Form" is available on the department's website at: (http://www.cs.brown.edu/degrees/phd/reqs/). The student should obtain the required faculty signatures on the department's form.

Both forms should be submitted to the Faculty and Student Affairs Manager (FASAM). The FASAM will obtain the DGS's signature on the Registrar's form if the transfer credit is approved and will forward the "Application for Graduate Transfer Credit" to the Registrar's Office. Detailed instructions are available on the requisite forms.

2.6 Satisfactory Progress

The Graduate Council has declared that students in their first two years who are allowed to register for courses are in good academic standing. There is no category of "academic warning" or "serious warning" for graduate students, but the Council has set standards for satisfactory progress. Requirements for the Master's degree should be met within two years (University regulations state that requirements should normally be met within five years, but that rate of progress is not satisfactory for a student whose goal is the PhD.) Comprehensive exams should be passed by the end of the fifth semester (although the Council recognizes that, particularly when several foreign languages must be mastered, the sixth semester may be a realistic goal.) The dissertation should be completed by the end of the sixth year; if it is not completed by five years after achieving candidacy, the student must petition the department and Graduate School for an extension of candidacy. If the dissertation is not completed by the end of seven years after advancing to candidacy, the student must petition the department and the Graduate Council. Appropriate justification for extensions of candidacy must be provided by the student and supported in writing by the department or program.

Each student should be notified in writing at least once a year of his or her academic standing. If progress has not been satisfactory, the student should be told what must be done and given deadlines to regain good standing. Written warning should be given a semester in advance of any termination of financial support or dismissal from the program.

6. Requirements Form

Each student will be given a copy the attached requirements form to keep up to date. It should contain the appropriate signatures and indicate how the student is completing the various requirements. At the end of each semester, this form should be given to the Faculty and Student Affairs Manager so that the departmental files can be updated appropriately.

Advancement to Candidacy Contract

Name: _____ Starting year: _____

General instructions: use this form to plan and report your progress toward advancement. Put in *only* those courses used to fulfill the requirements of your degree. Put check marks in the boxes in the leftmost column for those courses and milestones that have been completed.
Contract must be submitted at the end of each academic year: this contract must be reviewed and approved by your research advisor at the end of *each academic year*. If there are no changes, review is still required, but approval is automatic. Please submit the original for your student file to the Faculty and Student Affairs Manager (Lauren Clarke, lkc) before the last day of class in the spring semester.

I. Coursework Requirements

Each student must take eight computer science courses in the first two years.

- Six of these eight courses must be at the 2000-level, none of these six may be reading and research courses, and four of these six must be completed in the first year.
- A total of at least six courses (including Reading and Research) must be complete by June 1 of the first year.
- Courses chosen must include five of the PhD course areas including three of areas A, B, C, and D. For more information about areas see: http://cs.brown.edu/grad/phd/reqs/course-areas-phd.html
- All courses must be completed with a grade of B or better. Students are expected to maintain an A average (better than 3.5/4.0)

Complete?	Course Number/Title	Year/ Semester	Area (A-H)	Grade	Level (1000 / 2000)
❑					
❑					
❑					
❑					
❑					
❑					
❑					
❑					

II. Programming Comp Requirement

Year 1 Test Date: _____ Grade: _____ (Pass/Fail)
Year 2 Test Date: _____ Grade: _____ (Pass/Fail)

III. Research Requirement

There are several milestones, which are meant to give the student feedback as well as to make certain that the process advances, to completing the research requirement. Students should actively engage their research committees and make certain that the entire committee is aware of the student's progress. Note that meeting space may be reserved by sending date, time and room preferences to reception@cs.brown.edu.

Use this checklist to track your progress:

- ❑ **By March 15, First Year:** the student will select a research project advisor and two additional committee members.
  Name of research project advisor: _____
  Name of two additional committee members: _____
  Date committee was finalized: _____

- ❑ **By April 21, First Year:** the student will present a research proposal (1-3 page document describing the intended research & a 10-minute talk) to his or her committee, a member of the Committee of Graduate Examinations (http://cs.brown.edu/people/faculty/committees.html) and to any faculty who wish to attend; proposal should be formally announced at least one week in advance by sending date, time, location, title and abstract to fasam@cs.brown.edu. Proposal must be approved by the committee.
  Date announcement was sent to FASAM: _____
  Date research proposal presentation delivered: _____
  Date research proposal was approved: _____

- ❑ **During the fall semester, Second Year:** the student should meet with his or her committee to present progress to date in a form that is agreeable to the committee as a whole (e.g. a talk, a short report, or both). The committee will file a short report with the Graduate Chair by **December 31**, and the student will receive a copy.
  Date research progress was delivered: _____

- ❑ **By March 15, Second Year:** the student will present his or her work to the committee, to a member of the Committee of Graduate Examinations and to any faculty who wish to attend in a 20-minute talk to be followed by questions. This talk should be formally announced at least two weeks in advance by sending date, time, location, title and abstract to fasam@cs.brown.edu. If the date and time are approved, it will be announced to the faculty and a room will be reserved. These presentations are not open to the CS department-at-large as they are an examination. A committee approved, conference submission quality research report should be submitted to the Graduate Chair one week before the presentation; the final pdf needs to be sent to fasam@cs.brown.edu.
  Date announcement was sent to FASAM: _____
  Date research report was sent to Graduate Chair: _____
  Date research presentation was delivered: _____
  Date research project was approved: _____
  Date final pdf of research project was sent to FASAM: _____
  Note: if a student needs make a second attempt at the research presentation, this second presentation must be completed by May 15.

Advisor Notes:

	Date	Student Signature	Advisor Name	Advisor Signature
1st Review				
2nd Review				
3rd Review				

Post Candidacy Contract

Name: _____ Starting year: _____

General instructions: use this form to plan and report your progress after advancement to candidacy. Put in *only* those courses used to fulfill the requirements of your degree. Put check marks in the boxes in the leftmost column for those courses and milestones that have been completed. **Contract must be submitted before thesis defense:** this contract must be reviewed and approved by your research advisor before you defend your thesis. Please submit the original for your student file to Lauren Clarke (lkc).

I. Major and Minor Sequences

Each student must complete two minor course sequences and one major course sequence.

- Each major and minor course must be completed with a grade of B or better.
- Each minor course sequence consists of two related graduate-level courses. One pair must be in computer science but outside the student's primary area of interest; the other pair must be in some field related to but outside computer science (e.g., applied math, engineering, cognitive science).
- The major course sequence consists of two courses in the student's area of interest. These should be Computer Science courses at the 2000-level, but if such courses are not available others may be substituted with the graduate advisor's approval.

Inside Minor Course Sequence Area: _____

Complete?	Course Number/Title	Year/ Semester	Grade
❑			
❑			

Outside Minor Course Sequence Area: _____

Complete?	Course Number/Title	Year/ Semester	Grade
❑			
❑			

Major Course Sequence Area: _____

Complete?	Course Number/Title	Year/ Semester	Grade
❑			
❑			

II. Thesis

There are several milestones, which are meant to give the student feedback as well as to make certain that the process advances, to completing the thesis. Students should actively engage their research committees and make certain that the entire committee is aware of the student's progress.

Use this checklist to track your progress:

- ❑ **Thesis Proposal, usually within a year and a half of attaining candidacy:** shortly after beginning the research intended to be the subject of his or her thesis the student must present a thesis proposal, a moderately long paper between ten and thirty pages. Four weeks after this proposal has been made available to members of the department, the student will present and defend the proposal at a one-hour talk.

  A Thesis Proposal Checklist is available online to help you plan your thesis defense. http://cs.brown.edu/grad/phd/proposal/Thesis_Proposal_Checklist.pdf

  Date of successful thesis proposal: _____

- ❑ **Thesis Defense, usually within eighteen months of a successful thesis proposal:** the student is expected to complete the proposed work, produce a thesis that satisfies the requirements of the registrar and meets the highest standards in terms of content and presentation, and defend the work at an open thesis defense.

  A Thesis Defense Checklist is available online to help you plan your thesis proposal: http://www.cs.brown.edu/grad/phd/proposal/Thesis_Defense_Checklist.pdf

  Date of scheduled thesis defense: _____

Advisor Notes:

	Date	**Student Signature**	**Advisor Name**	**Advisor Signature**
Review				