

## ***THE PH. D. PROGRAM***

The Ph.D. Program is designed to prepare students for academic or research careers. To complete the program a student must make an original and significant contribution to the field of computer science and this contribution must be described in a Ph.D. dissertation. In addition to the thesis, there are course, programming and examination requirements for the completion of the program as described below. Students should keep in mind that these formal requirements are actually only a small part of a Ph.D. Degree. The main component of a Ph.D. program is the intangible process by which the student learns to do research and become a part of the academic community. Progress in the program will be judged by a student's progress in research as well as their progress in satisfying the formal requirements.

### **Master's Degree Within the Ph.D. Program**

TTI-C does not offer a dedicated master's program. A master's degree within the Ph.D. Program is granted to students who fulfilled the course and programming requirements (see *Course Requirements* and *Programming Requirement* sections below). Passing the qualifying exam is not required in order to receive a master's degree.

The deadline for completion of the master's degree is the last day of summer quarter. All requirements must be met and approved by this date. Specifically, the core courses and programming requirement should be completed and approved with the forms received by the registrar. Students completing all requirements as noted by this date will receive their degrees in early autumn. Students completing the degree after this date will receive their degrees the following autumn.

### **Advisors**

Upon entry to the program the Institute assigns each student, in consultation with the student, an interim advisor.

Before a student takes the qualifying exam, and in any case no later than the end of the second year, the student must choose a regular advisor. The research advisor must be tenured or tenure track TTI-C faculty. A student may also choose to designate a University of Chicago tenured or tenure track faculty member to be their primary research advisor and a (tenured or tenure track) TTI-C faculty member as a secondary advisor. In such cases, the TTI-C secondary advisor shall bear all the responsibilities outlined here for the research advisor, including bearing the primary responsibility for ensuring the student is engaged and progressing in the Ph.D. program.

The advisor relationship will be formalized by a form signed by both the student and the advisor. In the case of two research advisors (University and TTI-C), a form must be completed for both advisors. The form will be reviewed and signed off on by the Director of Graduate Studies. The student submits this completed form to the Registrar.

The relationship between a student and their advisor is a central aspect of the Ph.D. program. This relationship requires the ongoing consent of both parties -- either party

can withdraw from a Ph.D. research advising relationship by notifying the Chief Academic Officer. If a student has difficulty finding an advisor, they should seek the help of the Director of Graduate Studies or Chief Academic Officer. The Director of Graduate Studies is responsible for verifying that each graduating Ph.D. has fulfilled the Ph.D. requirements. The Director of Graduate Studies and the Chief Academic Officer shall be notified of all changes in advisors.

When the advisor of a student is also the Director of Graduate Studies, then any action or approval that is normally required by the Director of Graduate Studies will instead be required by the Chief Academic Officer.

### **Requirements**

There are four main required components of the Ph.D. program, as follows.

- Course requirements (required also for a master's)
- Programming requirements (required also for a master's)
- Qualifying exam
- Doctoral thesis and defense

Each of these requirements are discussed in turn below.

### ***Course Requirements***

All Ph.D. students must successfully complete (pass) at least eight courses.

### **The Core**

The course requirement is divided into a core requirement and electives. The core requirement is expected to be completed before the spring quarter of a student's second year. Each core course has a designated "faculty in charge" (appointed by the Chief Academic Officer, and typically the faculty teaching the course, if taught at TTI-C).

Students are required to have a grade of "B" or higher in every core course, with no more than two B's or B+'s overall. If a student does not receive an A in a course, he or she may retake the course once in order to improve the grade. Alternatively, the student may be granted an opportunity to satisfy the requirements for an A for that course in a manner to be determined by the faculty in charge of the core course.

The core consists of the following five courses:

TTIC 101	Algorithms
TTIC 102	Discrete Mathematics
TTIC 103	Artificial Intelligence
TTIC 104	Programming Languages
TTIC 105	Computer Architecture and Operating Systems

The above courses will have corresponding UOC course numbers and may be taught by either TTI-C or UOC faculty.

## **Electives**

Students must take at least three technical elective courses in addition to those required by the core. These elective courses are typically in computer science but may be courses offered by another department such as mathematics, statistics, or economics. They should be technical courses and need to be approved by a student's advisor.

## **Course Exemptions**

**All exemptions and substitutions must be approved by the faculty member in charge of the course.**

Core course exemptions for classes taken at another institution may be considered. Identical or very similar courses should have been taken within the last five years. Exemptions based on courses taken over five years ago require special approval from the Chief Academic Officer. Petitions must be submitted by the end of the student's first quarter at TTI-C. Petitions received at a later date will be reviewed only under special circumstances, as determined by the Director of Graduate Studies.

For all course exemption petitions, students are to petition the faculty member in charge of that course. The relevant faculty may meet with the student to discuss their level of knowledge of the subject. The faculty in charge of the course makes the final determination and reports it to the Director of Graduate Studies.

Exemptions will be awarded only when the student clearly performed at or above a grade level of "A" in the course at the other institution. Such courses that are exempted will not be recorded in the student's official TTI-C transcript. However, a course exemption form will be placed in the student's file and record will be kept of those courses the student enrolled in and completed, and those courses they were exempted from.

## **Course Substitutions**

Course substitutions are handled similarly, but less formally, than course exemptions. Substitutions for particular core courses must be approved in writing by the faculty member in charge of that course, preferably before the student enrolls in the substituted course.

## ***Programming Requirement***

Ph.D. students must have or acquire experience in computer programming with a general purpose programming language. Students must demonstrate that they have designed and implemented some substantial software system, either from scratch or as a significant extension to existing software.

The student must be responsible for the design of the software or the extension. The software does not have to be "industrial strength", i.e., it does not have to be polished to the point where it is ready to be released to a user community. A simple demonstration of

some algorithm or idea is sufficient. However, the problem should be large enough that significant systems engineering issues are addressed.

This requirement can be satisfied through a summer programming job, programming experience as an undergraduate, or by independently writing software, provided that the above criteria are satisfied.

TTI-C has appointed a member of the faculty as "Programming Experience Czar". Students should consult with this faculty member to make sure that whatever project they embark on or have embarked on is substantial enough to provide actual "programming experience". After completion of the project, students will submit a report to the Programming Experience Czar for approval.

### ***Qualifying Exam***

Each Ph.D. student must pass a qualifying exam administered by an Examination Committee. The core course and programming requirements must be completed before the exam is scheduled, generally by the end of the second week of the Spring Quarter of the student's second year. Extensions for special circumstances can only be approved by the Chief Academic Officer.

The main purpose of the exam is to analyze the student's mastery of concepts and approaches relevant for Ph.D. research, and the student's ability to apply these concepts and approaches in understanding research. The exam does not need to cover all topics or touch on all courses taken by the student. However, it is expected the exam will cover both the direct area in which the student intends to do research, as well as other relevant areas.

The Director of Graduate Studies will appoint an examination committee for each student taking the exam. The student should then schedule the exam at a time convenient for themselves as well as the examiners, prior to the end of June.

The examiners can request the student's transcript from the Registrar in order to decide on the topics and focus of the exam. The examiners will assign the student reading material at least three weeks prior to the exam. The exam will focus on the research presented in this reading, as well as related issues (e.g. methods used by the papers, or alternative approaches the paper mentions).

The examiners may also provide the student with specific questions or issues they would like the student to consider and discuss in the exam. The examiners should be explicit about whether the student is allowed to discuss these questions with others in preparing for the exam. At the examiners' discretion, specific questions can be provided to the students less than three weeks prior to the exam date, but the student should be told in advance to expect such questions.

The oral exam is expected to last approximately one hour. The student should be prepared to present the research described in the assigned reading, and address the issues

and questions assigned. This typically includes slides or other presentation aids. Examiners may ask additional follow-up questions during the exam.

The examiners must reach consensus on the outcome of the exam. Possible outcomes are:

- Full pass. This results in a recommendation to continue in the Ph.D. Program.
- Continuation. A continuation means that the student must still complete the exam to continue in the Ph.D. program. A continuation of the examination must be scheduled, possibly with additional reading material.
- Failure. The student may not continue in the PhD Program.

The examiners will provide formal feedback orally to the student regarding their performance in the exam, as well as via a qualifying exam evaluation form, which will become part of the student's record at TTI-C.

### ***Candidacy***

To become a Ph.D. candidate and therefore allowed to continue in the program, a student must have fulfilled the core course requirements, the programming requirement, passed the qualifying exam, and have a (non-interim) advisor willing to supervise the student's Ph.D. thesis. If all these requirements are met, the Director of Graduate Studies will notify the student that they have become a Ph.D. Candidate. If the requirements have not all been satisfied by the end of the Autumn quarter of the student's third year, the student will be asked to leave the program. Extension may be granted by the Chief Academic Officer.

### ***Doctoral Thesis and Defense***

The institute requires each student to write a Doctoral Thesis that includes significant original research in computer science.

The student's thesis committee must consist of at least three faculty members, with at least two TTI-C tenured and/or tenure-track faculty. The third and any further members may be any TTI-C faculty (tenured, tenure-track, research or visiting), or University of Chicago faculty. With the specific approval of the Chief Academic Officer, the third and further members may also be faculty or equivalent at another institution. The chair of the thesis committee is the student's advisor.

The student must choose their thesis committee members and complete the Agreement to Serve form available on the intranet. The student presents their thesis proposal defense orally to the committee and the committee either approves or makes recommendations. The student is advised of this both orally and on a thesis proposal defense evaluation form which is provided to the registrar to be placed in the student's file.

The student must successfully defend his or her thesis in a public forum before the thesis committee and any other interested faculty members. The thesis committee will decide the format for the defense. An evaluation will be provided to the student both orally and on a thesis defense evaluation form, by the thesis committee subsequent to the defense.

The thesis defense must occur at least two weeks after the student has given proper notice. Proper notice consists of the following actions:

- The student must give a draft of the thesis, approved by the advisor, to each member of the thesis committee and to the Chief Academic Officer. The draft must be nearly complete with only minor changes expected in the final version.
- The student must put an additional copy on display in a common area designated by the Registrar.
- The thesis abstract must be posted in a common area designated by the Registrar.
- The student must advertise the time and date of the defense in the appropriate mailing lists.

### ***Ph.D. Degree Completion***

The deadline for the PhD degree is the last day of the summer quarter. All requirements must be met and approved by this date. Specifically, in addition to the core courses and programming requirement met for the master's degree, the final thesis should be submitted and signed by the student's advisor and thesis committee, and the forms received by the registrar. Students completing all requirements as noted by this date will receive their degrees in early autumn. Students completing the degree after this date will receive their degrees the following autumn.

### **Faculty Reviews of Student Progress**

To ensure students are on track to meet the requirements discussed above, regular student progress reviews are conducted by faculty.

At the end of each quarter, students complete a review of their work in the previous quarter and a brief self-evaluation of their performance in academic activities and submit an academic/research plan for the upcoming quarter. This plan must be discussed with and approved by the student's advisor.

Twice a year, at the beginning of the Spring and Fall quarters, the faculty will hold a review and evaluation meeting to discuss each student's case.

The faculty will decide for each student whether that student is making sufficient progress to continue in the Ph.D. Program. If not, either a letter of warning may be served to the student or they may be notified that they are not permitted to continue with the program. In any case, a letter of evaluation is written to each student by their advisor, based on the discussion in the meeting, to be signed by the advisor and the Director of Graduate Studies.