Working Draft: PhD Checkpoint Proposal

Preamble

The main result of a successful PhD is not so much a thesis, but rather (and much more importantly) the goal is to train a researcher and prepare them for further professional development. One aspect of this training and preparation is to ensure that the individual has a broad and deep knowledge of Computer Science. The starting point for this aspect is the completion of our course and breadth requirements. However course work is, by design, limited to relatively closed and well-defined assignments, projects and exams. To be successful PhD student, the candidate needs a much broader set of skills, along including the ability and maturity as a researcher to cope with significantly more uncertainty than seen in course work. Critical skills include the abilities to evaluate the current literature, select promising directions for future work, and follow some of those directions through to the nuggets of new contributions. In our experience with training PhD students we see these skills slowly develop, perhaps starting in their undergraduate days and continuing to build through to their graduation from our PhD program. Our expectation is that the foundations for these skills should already be in place and evident by the first or second year of PhD studies.

Research Skills

Specific skills that we are looking for include the following:
a) The ability to **apply the basic tools of the field** in potentially new ways, along with the self-understanding of what they themselves know and what they have yet to learn.
b) The ability to **select significant research contribution**s from a larger set of published papers, and justify that selection.
c) The ability to **articulate a rationale for selection of these papers,** on the basis of significance of the results, novelty of the approach, etc.
d) The ability to **relate the papers to one another**, and to other research in the literature.
e) The ability to **critique the research methods** used in these papers, the strengths and weaknesses of these methods, and likely threats to validity, whether acknowledged in the papers or not.
f) The ability to **suggest alternative approaches** to answering the research questions posed in these papers.
g) The ability to **identify limitations on the results** (and possibly errors) reported in the papers , along with their implications.
h) The ability to **identify and prioritize lines of investigation for further research**, based on an understanding of significant limitations of the research described in the papers and/or important open problems that the papers fail to answer, and also on the likelihood of being able to make progress on such issues.

PhD Committee Meetings

In order to provide feedback to the student, both on the development of the above skills and on the student's thesis research work, the department requires that each PhD student meets regularly

with their PhD supervisory committee. The first such meeting must be held before the 16 month mark of the PhD program, with subsequent meetings held at least annually after that.

1. Qualifying Oral Examination

Deadline: Exam must be completed within the first 12 to 16 months of the PhD program.
Otherwise, the student will be placed on academic probation.

Purpose: To assess the student's current knowledge, and their ability to use this knowledge, in both in the general research area they are interested in pursuing and in one sub-area.

The overall scope of the general research area is expected to be roughly similar to any one of the first 14 "research areas" that DCS has divided their graduate courses into. During the qualifying oral the student is expected to be able to demonstrate knowledge of that general area, at least at the level of an introductory graduate course.

In addition, the student will also be expected to demonstrate an increased depth on knowledge in one sub-area of this research area. The sub-area is to be defined by 5 to 10 important and related research papers, which are to be selected by the student together with their supervisor(s).

Preparation:
a) Grad Skills Seminar: It is recommended that first year graduate students take a Research Skills seminar series. This series will serve a dual purpose.   First, it will guide students through the process of preparing the document for their qualifying oral exam. Second, it will cover topics that are of general importance for all CS MSc and PhD graduate students irrespective of research areas (e.g., communication skills, how to prepare a good survey, how to select a research topic, how to apply for a grant/scholarship, planning a successful career, the academic job search, how to put together a poster, how to give a good conference talk, how to write a good conference/journal paper).

b) Document for the Qualifying Oral: Before the examination, the student will write a survey of the 10 selected papers, addressing points (b) through (g) in the list of research skills above. This survey should be at most 6,000 words (not including references), and should be made available for the student's examination committee at least two weeks before the exam.

While the student may identify their PhD topic as a result of their preparation for the qualifying oral, this is not an expressed objective of this exam.

Qualifying Exam Format:
The student will give a 20 minute talk on their survey to their PhD supervisory committee (only), followed by several rounds of questions directed at assessing the student's current skills in areas (a) through (g) above.

Possible Results:
>   **-** Pass: This can include recommendations for further reading.

- Conditional Pass. The student is given one or more concrete tasks to complete before the next committee meeting, along with a deadline for completion.
- Fail (with the option to repeat). The student is placed in a probationary period, and must retake the exam within 6 months.   The student will not be given a third chance to pass the exam.
- Fail (no option to repeat). Student must withdraw from the program.

2. Yearly Progress Review (every 12 months thereafter)

These PhD supervisory committee meetings are for students who have passed their qualifying oral, and are not yet ready for their Departmental Thesis Defense.

Deadline: Such a meeting must be held at most 12 months after the student's previous PhD supervisory committee meeting (including the qualifying oral). (Exception: If the student expects to have a completed thesis ready shortly after this deadline, then a 6 month extension will be permitted.)

Purpose: To assess both the proposed research and the research progress that the student has made since the previous committee meeting. In addition, provide feedback to the student on the proposed research (or, even, on the completed thesis).

Student Preparation:
The student completes an annual progress report (much like our current progress monitoring reports). The student may include their own papers, or drafts they are working on.

Optional Materials: Senior students can also submit a thesis proposal for approval at this meeting. Such a proposal should be a brief document (e.g., table of contents, descriptions of current results, and descriptions of results expected from further research).

The student will be asked to speak for 20 minutes on their research efforts in the previous year, and to briefly sketch where they are planning to take this work in subsequent months. This talk could be open to all DCS members.

Questions and feedback: The general audience will be asked to leave after the talk.   This will be followed by one or more rounds of questions from the PhD supervisory committee. The committee chair will record brief minutes on the feedback provided.

Categorical Results: The options here are:
- Pass and, if appropriate, one or more of the following:
  o the thesis proposal has been approved.
  o the proposed research topics are sufficient for the student to achieve candidacy in research.
- Conditional pass. The student must provide additional material to the committee before a specific deadline (no more than 12 months in the future).

- Fail (first time). Student placed in a probationary period, and must reschedule the committee meeting within the next 6 months.
- Fail (while on probation). Student must either withdraw from the program or have their registration terminated.

Notes:
Students only need to achieve candidacy in research once. For example, if they achieve candidacy in one research topic, but then switch research areas entirely, they will still be considered to have achieved candidacy in research.

Students do not need to hold separate meetings for achieving candidacy and a thesis proposal. Rather, a student can go through more than one of these stages in one meeting.

Achieving Candidacy. In order to achieve candidacy the student must have completed the course and breadth requirements, and must lay out a suitable thesis topic. That is, the research scope needs to be sufficiently broad to form the basis for a thesis, and it should be plausible to have this work completed within several years. There is no implication here that the student must complete their thesis on this topic.

Approved Thesis Proposal. The purpose of this milestone is to allow the committee to sign off on the expected content of the final thesis. A short paper clearly describing the current state of the research, and the expected results, is required. For example, the written document could take the form of a table of contents for the proposed thesis along with one or more short conference style papers, which describe the results to appear in specific chapters, plus a brief sketch of remaining work.

3. Departmental Thesis Defense No changes proposed (but see below).**4. Final Oral Exam** No changes proposed (but see below).

[Still to be discussed by the GAC: Should the student be required to give a 50 minute public talk on the thesis work prior, possibly immediately prior, to either the FOE or the departmental defense?]