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 limited 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 training PhD students we see these skills slowly develop, perhaps starting in their undergraduate days and 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 second year of PhD studies.

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 contributions** 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.

**Qualifying Oral** (before 16 months): Working with their supervisor, the student should have selected 5-10 research papers to be emphasized in this meeting. These should be important
papers in one research area. This research area need not correspond to the student's eventual choice of PhD topic, and hence the student does not have to have picked a thesis topic prior to this committee meeting. The student will be examined on points (a) through (e) above in relation to these papers. It is expected that students will have read and understood more than just these selected papers, but it is not expected that the student master the majority of literature on a broad subject. The student will prepare a short position paper (less than 10 page, double spaced, in a reasonable font) on points (e-e) above. This should be distributed to the committee at least a week before the meeting, and a 15 minute talk is to be given at the beginning of the committee meeting. If the student has begun to investigate this area themselves, then she is welcome to briefly describe her progress so far.

If this will be your first oral exam, try to stay calm. Note that it is common in oral exams for the candidate to be questioned along any single direction in increasing detail until the student cannot answer any further questions. This provides the committee with an accurate assessment of the student's knowledge. But the contrast from a written exam can be very striking for a student undergoing their first oral exam! That is, if you cannot answer a significant proportion of the questions in a written exam then you are in trouble, while that may or may not be the case in an oral exam.

A report will be provided from the committee for each committee meeting, assessing the student's progress to date, and making recommendations for the next year. The student may be asked to repeat the Qualifying Oral, and this must be passed within 6 months of the first attempt.

Research Proposal (before 28 months): The student is expected to have an increasingly mature perspective on a research area (points (a) through (e) above) and, critically, be able to defend their ideas on promising research directions (points (f) through (h)). The specific research area may be different from the one discussed in the Qualifying Oral. The student will prepare a short position paper (less than 10 page, double spaced, reasonable font) on points (f-h) above to be distributed at least a week before the committee meeting. It should emphasize specific potential research directions. The student will give a 15 minute talk to be given at the beginning of the committee meeting. Typically the student will have already made some progress on some of these research topics, and can summarize their work in both the paper and the talk. The rationale for selecting these research directions are to be defended during the oral exam, and all of the points (a) through (h) above may be evaluated.

Thesis Proposal (before 30 months): The student is expected to have continued to build on their knowledge of one or more research areas (points (a) through (h) above). Critically, at this stage of the PhD program, the student should be able to sketch the expected contents of their thesis. Some new work should have been completed by this point, and a plan should be in place for remaining topics to be investigated. Again a short paper describing the current state of the research, and the expected results, is required. This could simply 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. The student will give a 15 minute talk to be given at the beginning of the committee meeting.

Departmental Thesis Defense, and Final Oral Exam
Students who do not pass a committee will be asked to repeat it within six months. They will *not* be given a year from the repeat date to meet the next checkpoint.

The thesis proposal checkpoint will be repeated until the thesis has been completed and a Departmental Defense is scheduled. There must be an annual committee meeting in the form of a Thesis Proposal until the thesis is completed.

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For your reference, the old qualifying oral description:

The student presents an area of research to the supervisory committee, normally in a closed forum. The purpose of this examination is to assess the student's understanding of the literature in the area of research, as well as preparedness to do research in that area. This involves assimilating the significant research papers on the topic, understanding how they relate to one another, and identifying valid open research questions. The student typically prepares a short written survey of the work in the area, and distributes it to the supervisory committee at least two weeks prior to the examination. The length of the survey should not exceed that appropriate for inclusion in a doctoral thesis in the area. Material written by the candidate for another purpose (for example, the research paper) may be re-used in the survey. The area chosen by the student should be sufficiently broad to contain many potential thesis topics, yet sufficiently narrow that the highly relevant papers number in the tens rather than in the hundreds. The examination typically lasts approximately two hours and begins with a 20 to 30 minute presentation by the candidate. The committee will determine whether the student should proceed to thesis work. They may recommend that the student do more course work or reading."