Guidelines for the
Computer Science PhD Qualifying Exam

1. Purpose
Each doctoral student must satisfy the PhD qualifying requirement, which consists of an in-depth written document surveying a particular research area that is accompanied by a public oral presentation. The purpose of the qualifying requirement is to assess the PhD student's understanding of literature in a potential area of research, demonstrate the student's ability to comprehend and explain the material through a question-and-answer process regarding this literature, and to determine the student's level of preparedness to conduct research in the selected area. The written document and oral presentation should identify important research issues and/or define research questions that are appropriate for the topic and research area that are the student's intended future research focus.

Qualifying exams will be scheduled at the beginning of each semester. At the end of the semester prior to the next exam period, the Graduate Advisor will send email invitations to students who would like to enroll in the next examination.

2. Written Document
The following is expected of the written document:

1. The student must demonstrate an ability to search the literature for additional relevant papers, summarize important findings, and understand a related set of research papers.
2. The document should provide a clear explanation of basic definitions and motivate the importance of the topic.
3. The document should also provide all of the necessary background so that a non-expert in the area (e.g., a faculty member who works in a different area of research) can understand the report and presentation.
4. The document should not be an annotated bibliography of the literature, but should draw some conclusions or make observations that could not be made from the individual papers.
5. The document should identify standard techniques, measures and metrics.
6. The document should identify the contributions of a paper and how these contributions helped to advance the field (e.g. countered or disproved previously held thoughts in the area).
7. In the document solved problems should be distinguished from unsolved problems, as well as limitations associated with any existing practices within the field.
8. The document should be written in a manner that makes an intellectual contribution by identifying gaps of knowledge and potential areas for new inquiry that is based on a critical analysis of the related literature.
9. The discussion and comparison of the collective body of literature in a specific area should lead to some insights into new topics for future investigation

2.1 Document Guidelines
Students should work with their faculty advisors to develop their proposal focus and outline. They should also consult their advisor to define research questions that are appropriate for the topic and research area prior to conducting the literature search. Before performing the literature review, students should ensure that there will be an adequate number of papers available to provide insight into the driving research questions.

The document is expected to be an original work written solely by the student and in the student's own words. Paragraphs should be made up of a topic sentence and supporting or clarifying statements. All references and any replicated text must be properly cited. All figures, tables and diagrams must be original. The student must demonstrate superior aptitude in organization skills and writing skills (including grammatical correctness).

The number of papers that should be included in the literature review is dependent upon the depth and maturity of the area chosen, as well as general questions that drive the survey purpose. Therefore, it is not possible to give guidance regarding the minimum or maximum number of references expected. However, all papers mentioned in the bibliography should be cited and discussed in the report; it is not appropriate to pad the bibliography with references that are not discussed in the text of the report. Citations within papers that occur frequently should be identified.
The student should work with his/her major professor to determine the desired style for the qualifying exam document. Two common styles within computer science are shown in the Appendices. It is the student's responsibility to select a format for this document that is appropriate to the research area.

Rubric for Qualifying Exam Document (Appendix A)

Alternative Rubric for Systematic Literature Review Qualifying Exam Document (Appendix B)

3. Oral Presentation

The oral component of the PhD Qualifying Exam is a total of 90 minutes in length. The student oral presentation should be 30-40 minutes, followed by questioning by the audience and committee.

The following is expected of a successful completion of the Oral Presentation for the PhD Qualifying Exam. The student must:

1. Present a talk that indicates the student has a solid understanding of the core concepts and principles within the area. Do not spend too much time on introductory material.
2. Present a talk that indicates the student has a solid understanding of the seminal results (to date) in the field and the people currently working in the field.
3. Present a talk that indicates the student understands how the foundational papers in the field relate to each other, and all build together to define the state-of-the-art in this area.
4. During Q&A, be able to answer general questions about the field of study.
5. During Q&A, be able to answer specific questions regarding the research associated with any of the foundational papers in the area.
6. During Q&A, be able to distinguish between solved and unsolved problems in the area.

4. Mistakes that Could Result in a Student Failing the PhD Qualifying Exam

1. Producing a document that contains direct quotes or pictures from other sources that is not properly cited and referenced.
2. Producing a document that has not been thoroughly discussed and vetted with the student's major professor.
3. Producing a document that is grammatically weak. Any student with weak writing skills is ***strongly*** urged to take advantage of UA's Writing Center in the preparation of this document.

4. Making a presentation that is longer than the limit. Part of this process is demonstration of the student's ability to concisely present the relevant issues in the area.
5. The inability to answer general questions from the audience regarding the student's presentation and its relationships to the overall computing field.
6. The inability to answer questions from the audience regarding specifics with any of the papers from the student's presentation.
7. The inability to answer questions from the audience regarding the contributions of any of the papers from the student's presentation.
8. The inability to answer questions from the audience regarding the relationships and interactions of the papers in the student's presentation.
9. The inability to answer questions regarding standard practices and the state-of-the-art in the student's specific research area.
10. The inability to discuss the current state of the student's specific research area, including leading researchers, seminal results and open problems.

Appendix A
Suggested Guidelines for the Written Document of the Computer Science PhD Qualifying Exam

1. The paper
The paper itself should be composed of the following five **suggested** sections:
- Introduction
- Analysis of each Core Paper
- Synthesis of the Core Papers
- Overview of the Current State of the Art (additional references)
- Future directions

1.1 Introduction

This section should give an overview of the problem area, explain why the problem is important, describe the problem area in the context of the fundamental areas of Computer Science, and discuss the potential impact of various solutions.

1.2 Analysis of Core Papers

In this section, each core paper should be discussed in turn with an emphasis on the findings of and the questions raised by the paper.

1.3 Synthesis of Core Papers

This section should present a summary of the overall findings of the papers, how these findings relate to each other, what about these findings make the core papers so important to the problem area, and which aspects of the problem area have been settled by the core papers.

1.4 The Current State of the Art

In this section, a discussion of the current state of the art in the problem area should be given and should include references to additional relevant papers. The section should also discuss the influence the core papers had on developments in the problem area.

1.5 Future Directions

This section details some of the future directions for research in the problem area, including open problems and possible approaches to solving these problems. The section should be at least one page long and focus on areas of interest to the candidate.

2. Format
IEEE conference format 10-14 pages or 20-25 pages (11pt font, single spaced, 1 inch margins), with additional pages available for the bibliography.

Appendix B
Guidelines for the Systematic Literature Review
Written Document of the
Computer Science PhD Qualifying Exam

1. Definition

The systematic literature review differs from the more typical *ad hoc* literature review in that the author defines and follows a review protocol to ensure that all relevant studies are included in the literature review. A systematic literature review is a structured, repeatable process for identifying and analyzing all available literature to answer one or more specific research questions.

A systematic review protocol contains the following information:
1. **Research question**(s) to be answered by the literature review;
2. **Source selection criteria** – which databases or search engines will be used for the search along with a rationale;
3. **Search string**(s) to be entered into the search engines;
4. **Inclusion/Exclusion** criteria – how will you decide which papers are included and excluded from the review along with a rationale; and
5. **Data Extraction Form** – based on the research question(s) a list of data that should be extracted from each paper

The systematic review process is:
1. Enter each search string into each database or search engine.
2. Analyze the results of Step 1 to identify which papers should be included in the review. Start with titles, then abstracts, then full papers. Keep detailed notes about which papers were excluded and why.
3. For each paper that remains in the review, complete a data extraction form.
4. Have your advisor read and extract data from a randomly selected subset of the papers (approx. 5%-10%).
5. Compare the student's data extraction forms with the advisor's data extraction forms and identify any problems with interpretation of the questions or data extraction items.
6. After data has been extracted and validated, use the data extraction forms to answer the research question(s).

2. Format

Reports may be formatted using the guidelines of various journal publishers. The maximum length of the report is dependent upon which formatting guidelines are chosen: IEEE TSE format – 14 pages, Elsevier format – 20 pages.