PhD Qualifying Exam
Effective Fall 2020

1. Purpose

Each doctoral student must satisfy the PhD qualifying requirement, which consists a written document either describing original research (Track 1) or surveying a particular research area (Track 2) that is accompanied by a public oral presentation. The purpose of the qualifying exam is to allow the faculty to assess the PhD student's ability to conduct PhD-level research in Computer Science. The written document and oral presentation allow the faculty to examine how well the PhD student understands key ideas and is able to discuss those ideas in a question and answer session.

2. Qualifying Exam Options

PhD students, in consultation with their advisor, can choose one of the following options for completing their qualifying exam.

2.1 Track 1 - Student submits and presents a published peer-reviewed paper

This track is for students who have already been successful in publishing a research paper, while at UA, in a peer-reviewed venue.

<u>Written Document</u>

The chosen paper has to meet the following conditions:
1. The student's advisor has to approve the paper and confirm that it is published in a high-quality, peer-reviewed venue.
2. The student has to be the lead author and advisor (or other co-authors) must certify that the student did the large majority of the work in the paper.
3. The student will submit the paper to their committee as the written document.

Because the paper has already been accepted in a high-quality, peer-reviewed venue, the student's committee will not conduct an evaluation of the paper itself.

<u>Oral Presentation</u>

The student will be required to deliver a 20-minutes conference-style presentation of the research contained in the paper. The committee members will then have 20 minutes to question the student regarding the contents of the paper and presentation to ensure the student is able to adequately communicate the research and answer questions about it. The presentation and subsequent question/answer session will be the primary factor in evaluating the success of the qualifying exam.

The committee will then assign the student a score of either *Pass* or *Fail* based on the student's presentation of the paper and ability to answer questions about the research.

2.2 Track 2 - Student conducts a literature review

This track is for students who have not yet been successful in publishing a paper in a peer-reviewed venue. In this case, the student will prepare a publication-quality literature review on a topic relevant to the student's anticipated PhD research.

<u>Written Document</u>

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

The written document will be evaluated as follows:
1. The Graduate Director will run a plagiarism check on the submitted document.
2. The Graduate Director and Department Head will review each submitted paper to ensure it is complete and passes a minimum standard (relative to the evaluation rubric). Any paper that does not meet the standard will result in a failed qualifying exam.
3. If the paper passes the initial screening, it will then be sent to the committee for review.
4. The committee will be given 2 weeks to review the document.
5. Each committee member will rate the paper as either Fail, Needs Modification, or Pass
   - *Fail* - The paper is not up to our standards. The student fails the exam without a presentation.
   - *Needs Modification* – The paper needs minor modifications. The student will have 1 week to update the paper based on the committee's comments. The committee will review the modified paper and assign it a Pass or Fail.
   - *Pass* – The paper does not need further modifications.

<u>Oral Presentation</u>

Once a student's paper has received a score of *Pass* from the committee, the student can proceed to the oral presentation phase. The student will present a 20-minute discussion of the work contained in the paper. The committee and other faculty will have 20-minutes to ask the student detailed questions about the papers included in the review along with the student's synthesis of those papers.

The committee will assign the student a Pass or Fail for the exam.

3. Process

To ensure quality and consistency across all qualifying exams, we will use the following process:
1. Papers are due to the Graduate Director on the 1st day of class
2. The Graduate Director will schedule all qualifying exams to occur together in the same session (or multiple sessions if there are a large number of exams)
3. Each student will be allocated 40 minutes (20 for the presentation and 20 for questions)
4. All faculty in attendance will remain after the last presentation to deliberate and make decisions on all exams
5. To pass, the student must receive a positive vote from 2/3 of the faculty who vote

Appendix A

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

The paper itself should be composed of the following five **suggested** sections:

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.

Analysis of each Core Paper

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.

Synthesis of the 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.

Overview of the Current State of the Art (additional references)

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.

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.

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

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).

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.