GUIDELINES FOR Ph.D. QUALIFYING EXAMINATION IN BIOINFORMATICS

I. General Overview:

For general information regarding the Ph.D. Qualifying Examination process at the University of Guelph, see: https://www.uoguelph.ca/registrar/calendars/graduate/current/degreg/degreg-phd-qualexam.shtml. Further details about the procedures for Qualifying Examinations in Bioinformatics can be obtained from the Bioinformatics Graduate Program Assistant.

The specific procedures and requirements for the Bioinformatics Qualifying Examination are discussed below.

II. Scheduling the Qualifying Examination:

The Qualifying Examination is completed **before** the end of the fifth semester. The Examination must be held by the end of the 7th semester in the case of MSc to PhD transfer students. The Qualifying Examination process is initiated at a meeting between the student and their Advisory Committee. The Advisory Committee discusses the Examination with the student and prepares the following:

- A detailed assessment of the student's ability and potential to pursue research at the PhD level,
- Recommendations regarding the timing of the Examination,
- Recommendations for membership of the Examining Committee (see specifications below).
- Recommendations for the topics of the Examination

The Committee's recommendations are submitted in writing to the Bioinformatics Graduate Studies Coordinator (or designate). This assessment of research ability must be endorsed by all members of the Advisory Committee.

III. The Qualifying Examining Committee Membership:

The Bioinformatics Graduate Coordinator appoints a student-specific, five-member Qualifying Examining Committee which includes:

- The Chair (typically the Director of Bioinformatics or the Bioinformatics Graduate Coordinator, otherwise a designated member of the Bioinformatics Program Committee who is not a member of the student's Advisory Committee),
- Two members of the Advisory Committee (suggested by the Advisory Committee),
- Two members of the Bioinformatics Graduate Faculty who are not members of the Advisory Committee, with one member having biological expertise, the other having

informatics (e.g., computational, mathematical, and/or statistical proficiencies) expertise. The Advisory Committee is encouraged to suggest potential members.
- Excluding the Chair, the Examination Committee shall comprise a balance between biology and informatics as much as is possible. At least two different academic departments should be represented.

IV. Objectives and Format:

The overall objective of the Qualifying Examination process is to assess the student's knowledge of their subject area and related fields. To this end, the Bioinformatics Qualifying Examination comprises:

- A written component in which the student prepares a document that includes a literature review, proposal for the PhD research, and a discussion of the broader context of the research,
- A short oral presentation prior to the questions (maximum 20 minutes) in which the student summarizes their research plans,
- An oral component in which the student answers questions based on the written component and related topics, and
- An evaluation of the student's ability and promise as a researcher, considering the examination components as well as the letter provided by the Advisory Committee.

This format has a number of advantages. First, it will allow students to spend time critically appraising the literature in their research area. Second, it will provide students with experience summarizing information, identifying gaps in knowledge and in available bioinformatics tools, and developing hypotheses (or plans for bioinformatic tool development) based on the primary literature and previous findings from their research to date. Third, it will give them experience in placing their doctoral research in a broader scientific context; implications and further research directions beyond the timeframe of their PhD should be discussed. Overall, the qualifying examination affords an opportunity for students to study and integrate knowledge in solving scientific problems. It is hoped that this opportunity will allow students to approach their thesis research from a new and broader scientific perspective. The Qualifying Examination also allows a broader committee to assess and comment upon the student's research potential and the suitability of the research in bioinformatics, beyond the Advisory Committee.

Successful completion of the qualifying exam requires a satisfactory evaluation by the examination committee on all three components: written, oral, and evaluation of research potential.

V. Written component:

For this exam, candidates will be required to submit a written document of approximately 15-20 pages in length, not including Title page, Table of Contents (optional), Reference List, Tables, or Figures. The document should be prepared with 2.5-cm margins, 12-point font (preferably Calibri or Time New Roman), and 1.5 line spacing. The reference list should be consistently formatted using a referencing style suitable for the discipline. Numbered references should not be used. Students are advised to submit their proposal in PDF format. This document should include:

- Title page
- Abstract (250-300 words)
- Literature review
- Identification of gaps in knowledge and/or available computational tools
- Research Proposal (with specific aims and methods)
- Discussion of the broader context of the research and future research directions beyond the PhD timeframe
- Reference List
- Tables and Figures (if suitable)

The Literature review and background should be ~3/4 of the total length, while the Research Proposal and broader discussion would be ~1/4 of the total length.

Procedure:

1. The Qualifying Examining Committee must first be formed as described in Section III. After receiving suggestions from the student's Advisory Committee regarding Examining Committee members and an abstract from the student (~300 words), the Bioinformatics Graduate Coordinator will verify the proposed composition of the committee. The names and email agreement of the Examining Committee members must be documented (as per Section II) and submitted to the Bioinformatics Graduate Program Assistant.

2. In consultation with the Advisory Committee and the Student, the Chair shall pick a tentative date for the defence.

3. Next, the student may arrange an individual meeting with each member of the Examining Committee to discuss the overall research plan, the scope of the proposal, and possible directions for the program of research. Examining Committee Members may choose to provide recommended topics for study as well as specific readings to the candidate. Faculty acknowledge that research is a collaborative activity, but no member of the Advisory Committee or Examining Committee will comment on drafts of the written component.

4. **At least four weeks** prior to the examination date, the candidate will submit their written document electronically to the Bioinformatics Graduate Program Assistant, who will then circulate the document to all Examining Committee members.

5. The oral examination will occur approximately four weeks after submission.

Oral component:

The oral exam involves the student and the Examining Committee members, who will join in person if possible or otherwise using a telecommunication device (e.g., TEAMS, WebEx). In unforeseen circumstances where a committee member is unable to attend, the Chair will attempt to receive questions to ask on behalf of the absent member, to be answered by the student to the

satisfaction of the examiners. If more than one examiner is not able to participate, then the exam is to be rescheduled.

The qualifying exam oral component begins with the student's presentation of a maximum of 20 minutes. The oral exam next proceeds, involving questions and answers between the Examining Committee and student. Each examiner will be allowed 20 minutes of questioning and answering in the first round, and 15 minutes in the second round. During this time, the candidate will be given an opportunity to demonstrate an understanding of scientific methods, the literature related to their discipline, the rationale for the hypotheses or bioinformatics research design, the expected results, the potential pitfalls of the proposed research, an understanding of alternative approaches to the question and analysis of the results, and an ability to communicate the significance and broader context of the findings or new bioinformatics tool or algorithm. The total time period for the presentation and oral examination is not to exceed three hours.

At the end of the question period, the candidate will be asked to step out of the room while the Examining Committee deliberates. The Chair will provide a copy of the Advisory Committee letter for all Examiners to read. During the deliberation process, each Examining Committee member provides a single, independent judgment on all three components of the Qualifying Exam (written component, oral component and research potential). If all, or all but one, agree that the Qualifying Exam was satisfactory, then the student passes the Qualifying Exam. An abstention from voting is an unsatisfactory vote.

If the Qualifying Exam is judged as unsatisfactory by two or more members, then the student fails the exam. However, students will be given a second attempt to pass the oral component, and if required by the committee, the written component as well. The date for the second exam will be negotiated with the student, and should normally be within 3 months from the first exam. An attempt should be made to keep the exam committee the same. If the second exam is judged as unsatisfactory by two or more members, then the student fails the exam. At this time, the student will be required to withdraw from the PhD in Bioinformatics program.

If successful, the student will proceed with their research as a PhD Candidate in Bioinformatics. Even if a student has passed, the Examining Committee may recommend further readings, or possibly even coursework, if a specific area is deemed requiring improvement. Students are encouraged to approach the Qualifying Examination as a learning process and opportunity for growth.

Document last revised: 2024/03/11