

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-quaexam.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, preferably in the third or fourth semester. The Examination must be held by the end of the 7th semester in the case of MSc -> 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 and format of the Examination,
- Recommendations for membership of the Examining Committee (see specifications below).

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 or a designated member of the Bioinformatics Program Committee, who is not a member of the student's Advisory Committee),
- Two (2) members of the Advisory Committee (suggested by the Advisory Committee), only one of whom may be the Advisor or Co-Advisor,
- Two (2) members of the Bioinformatics Graduate Faculty who are not members of the Advisory Committee, with one member having computational (or like) expertise and the other having biological (or like) expertise.

- Excluding the Chair, the Examination Committee should comprise a balance between the biological sciences and the computational, mathematical, or statistical sciences. Typically, 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 QE 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. This document should include:

- Abstract
- Literature review
- Identification of gaps in knowledge and/or available computational tools
- Research Proposal
- Discussion of the broader context of the research and future research directions beyond the PhD timeframe
- Reference List
- Tables and Figures (if suitable)

The document should be prepared with 2.5-cm margins, 12-point font (Calibri or Time New Roman or another font that is easy to read), 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.

Procedure:

1. The Qualifying Examining Committee must first be formed. The makeup of the Qualifying Examining Committee can be found in Section III. After receiving suggestions from the student's Advisory Committee regarding Examining Committee members and an abstract from the student (of approximately 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. Next, students are encouraged to 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.
3. At least four weeks prior to the examination date, the candidate submits their written document electronically to the Bioinformatics Graduate Program Assistant, who will then circulate the document to all Examining Committee members.
4. The oral examination will occur approximately four weeks after submission of the written document. Within these four weeks, the Examining Committee will send their feedback to the Examining Committee Chair. Most importantly, each Examining Committee member will provide a judgment of whether the written component was completed satisfactorily, as well as a basis for this judgment. A judgement of satisfactory does not preclude the Examining Committee members from later passing suggestions to the student about the literature review and research plans. The Examining Committee Chair will then collate the judgements to make a decision about whether the written component was completed successfully or not. On the day of the oral exam, the Examining Committee Chair announces the decision to the student and the Examining Committee and provides the comments of committee members. There are several possible outcomes:
 - a) If the entire Examining Committee (or all but one member) judges the written component to be satisfactory, then the oral examination will proceed.
 - b) If two or more Examining Committee members judge that the written component was not completed satisfactorily, then the student fails and the oral examination will not proceed. However, students will be given a second attempt to pass the written exam. The date for the second attempt will be negotiated with the student, but it should normally be within 4 months of the first attempt. The second attempt begins at stage 2 of the procedure listed above, although the research program to be proposed will most likely be an improved version of the failed program rather than a completely different program.

- c) If the student is on their second attempt to pass the exam, and the revised written component is deemed unsatisfactory, then the exam is a failure. At this time, the student will be asked to withdraw from the PhD in Bioinformatics program.

Oral component:

The oral exam involves the student and entire Examining Committee, 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. 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. During the deliberation process, each Examining Committee member provides an independent judgment of whether the oral component was completed satisfactorily (note: abstention = unsatisfactory). If all, or all but one, agree that the oral was satisfactory, then the student passes the oral component of the exam.

If the oral 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. The date for the second oral will be negotiated with the student, but it should normally be within 4 weeks of the first oral. The second oral will be based on the written component that has already been deemed satisfactory by the Examining Committee.

If the second oral is judged as unsatisfactory by two or more members, then the student fails the exam. At this time, the student will be asked 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 of improvement. Students are encouraged to approach the Qualifying Examination as a learning process and opportunity for expansion.

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