2008 Biomedical and Health Informatics PhD Qualifying Exam

Purpose:
The purpose of the qualifying exam is to determine whether a student is ready to form a Dissertation Supervisory Committee. Successful completion of the qualifying exam is required before students can proceed with the formation of their Supervisory Committee.

Prerequisites:
Students cannot schedule their qualifying exam until they have successfully completed core courses and have received a letter indicating satisfactory annual progress. In 2008, we will schedule the qualifying exam during the late Winter or early Spring quarter with date to be determined in collaboration with students taking the exam.

Assessment:
The qualifying exam assesses students'

- knowledge of the breadth of the biomedical and health informatics field (as defined by scope below)
- ability to synthesize material across the field
- ability to clearly and concisely express their reasoning skills in the context of research and practice of biomedical and health informatics
- ability to present their reasoning skills in both oral and written form
- ability to answer unanticipated questions (within the scope as defined below)

The qualifying exam will consist of a written and an oral component. Skills pertaining to synthesis of material and presentation of reasoning will be addressed and refined in core courses.

Scope and field:
The scope of the qualifying exam is defined and limited. It is defined by the curriculum that the student took (acknowledging that the curriculum is a dynamic entity that may change or expand over time).

In addition to the material covered by the curriculum there will be limited defined sources that will provide additional material to be included in the scope of the exam. These additional sources are: "Biomedical Informatics: Computer Applications in Health Care and Biomedicine", 2006, Shortliffe & Cimino, "Public Health Informatics and Information Systems" 2002 O'Carroll & Yasnoff et al, and as list of readings related to biology and informatics (see last page). Students are welcome to but not required to include information outside of this scope, but use of such additional information is not necessary for passing the exam.

Format:
Written exam
The written component is a take-home, open-book/Internet common exam. The written exam should be your own sole-authored work; treat it as you would a sole-authored publication. General discussion with others is permitted, but asking for input from others on the specific questions on the exam is not. You should receive no critiques or feedback by anybody on the document itself. Students will have 7 days in which to complete the exam, but the expectation is that it will take about 20 hours to complete satisfactorily. There will be three questions total: two will be common to all students and one will be the student's choice from a list of 2-3 questions. The page limit for

the responses to the exam will be 15 pages (roughly 5 pages per question) with 12 point font, 1" margins, single spaced.

Oral Exam:
The oral component of the exam is a closed session where the student is expected to answer questions from multiple faculty members. The oral exam will be related to the written exam questions and will thus occur approximately a week after the written exam is turned in and graded. The format will consist of each faculty member in turn having a chance to ask the student a series of questions.

Committee:
The qualifying exam committee for the 2008 exam will consist of Ira Kalet (Chair), David Masuda, Peter Tarczy-Hornoch, George Demiris, Ann Turner and Jim Brinkley. The committee will use the syllabi of the core courses and the scoping text books or chapters while they are creating the written exam. They will solicit feedback from other faculty on the clarity and appropriateness of the written questions that they create.

Grading:
All students will take both the written and oral portions of the exam. Evaluation will take into account performance on both parts. The written exam will be submitted electronically and distributed to the committee members who will be blinded to the identity the students (e.g. exams will be labeled student 1..n). The committee members will independently each grade each student's response to each question. The committee will then meet to come up with an overall grade for each student for each question and for each students written exam overall. Each student will be graded individually and not in comparison to others. The oral exam performance will be discussed by the committee for each student immediately after the student completes the oral exam. The performance of specific questions and overall performance on the oral exam will be discussed as well as an overall grading for the exam overall. As per below grading is Pass, Conditional Pass, Fail for the exam overall. For each question, the committee will prepare a grading rubric. The purpose of the rubric will not be to define the "right" answer, but to highlight likely concepts that should be covered in adequate and superlative answers. This means that not every bullet point in a grading rubric will have to be included precisely, and as well that concepts not in the rubric may well prove to be workable answers.

Outcome:
After completion of the oral and written component of the exam, the faculty will meet to determine the outcome. Specific feedback will be provided to each student about their performance on the various components of the qualifying exam. Possible outcomes of the exam are: (1) pass, (2) conditional pass with certain conditions/reservations requiring further study, (3) a fail. If students pass the qualifying exam, the faculty have determined that they are ready to identify their own area of research and to form their Supervisory Committee. If a student passes conditionally or does not pass the qualifying exam, the faculty must identify where the student has deficiencies and provide guidance to the student to overcome those deficiencies. The student will need to rectify those deficiencies either by retaking the qualifying exam if he/she failed or by satisfying an alternative requirement if he/she received a conditional pass.. Students are not allowed to form their Supervisory committee until they have passed the qualifying exam.

Biology and Informatics Readings:

Anatomy and principled ontologies

Rosse C, Mejino JLV. A reference ontology for bioinformatics: the Foundational Model of Anatomy. Journal of Bioinformatics. 2003;36(6):478-500
http://sigpubs.biostr.washington.edu/archive/00000135/

Imaging informatics

Brinkley JF, Greenes RG. Imaging and structural informatics. In: Shortliffe EH, Cimino JJ, editors. Biomedical Informatics: Computer applications in health care and biomedicine. 3 ed. New York: Springer; 2006. p. 344-378.
http://sig.biostr.washington.edu/share/sigweb/pubs/MIBookEd3Chp9.pdf

Physiology and simulation

Hunter PJ, Borg TK. Integration from proteins to organs: the Physiome project. Nature Reviews: Molecular Cell Biology 2003;4:237-243
http://sig.biostr.washington.edu/share/sigweb/pubs/Hunter2003a.pdf

Biochemistry and metabolic pathways

Karp P. Pathway databases: a case study in computational symbolic theories. Science 2001;293(2040-2044) http://sig.biostr.washington.edu/share/pubs/KarpScience2001.pdf

Proteins

.Berman H, Henrick K, Nakamura H, Markley JL. The worldwide Protein Data Bank (wwPDB): ensuring a single, uniform archive of PDB data. Nucleic Acids Res 2007;35(Database issue):D301-D303
http://nar.oxfordjournals.org/cgi/reprint/35/suppl_1/D301

Henikoff S, Henikoff JG. Protein family databases. In: Encyclopedia of Life Sciences, www.els.net; 2001. http://sig.biostr.washington.edu/share/sigweb/pubs/Henikoff2001.pdf

DNA

Benson DA, Karsch-Mizrachi I, Lipman DJ, Ostell J, Wheeler DL. GenBank. Nucleic Acids Res 2006;34(D16-D20)
http://sig.biostr.washington.edu/share/sigweb/pubs/BensonGenBank2006.pdf

Pertsemlidis A, Fondon JWI. Having a BLAST with bioinformatics (and avoiding BLASTphemy). Genome Biology 2001;2(10):reviews2002.1-reviews2002.10
http://www.pubmedcentral.nih.gov/articlerender.fcgi?tool=pubmed&pubmedid=11597340

GeneOntologyConsortium. Creating the gene ontology resource: design and implementation. Genome Res 2001;11(8):1425-33.
http://sig.biostr.washington.edu/share/sigweb/pubs/GO2001.pdf.

Gene Expression

Stoeckert CJ, Causton HC, Ball CA. Microarray databases: standards and ontologies. Nature Genetics 2002;32:469-473
http://sig.biostr.washington.edu/share/sigweb/pubs/Stoeckert2002.pdf

Quackenbush J. Computational analysis of microarray data. Nature Reviews: Genetics 2001;2:418-427
http://sig.biostr.washington.edu/share/sigweb/pubs/QuackenbushMicroArrayAnalysis2001.pdf

Systems biology

Louie B, Mork P, Martin-Sanchez F, Halevy AY, Tarczy-Hornoch P. Data integration and genomic medicine. Journal of Biomedical Informatics 2006;40(1):5-16
http://sig.biostr.washington.edu/share/sigweb/pubs/Louie2006.pdf

Ideker T, Galitski T, Hood L. A new approach to decoding life: Systems Biology. Annual Review of Genomics and Human Genetics 2001;2:343-372
http://sig.biostr.washington.edu/share/sigweb/pubs/IdekerRev2001.pdf

Molecular and cell biology – encompasses all of the above except the first three categories

Galperin MY. The molecular biology database collection: 2006 update. Nucleic Acids Res 2006;34(Database issue):D3-D5 http://nar.oxfordjournals.org/cgi/reprint/34/suppl_1/D3

The above article is an overview of the over 900 molecular biology databases listed in the online catalog of databases maintained by Nucleic Acids Research at http://www.oxfordjournals.org/nar/database/c/. In the reading list we have only included a few of these to look at in any depth. You are not required to know any of the others, but this paper and link will give you the context in which all these databases should be seen.