2014-2015 LONG SIGNATURE SHEET

Proposal Number: CIS 4-16-15

Proposal Title: New course and revisions to the CIS PhD program

Originating Department: Bioinformatics & Genomics; Computer Science; Software & Information Systems

TYPE OF PROPOSAL: UNDERGRADUATE_____ GRADUATE__X____ UNDERGRADUATE & GRADUATE____
(Separate proposals sent to UCCC and Grad. Council)

DATE RECEIVED	DATE CONSIDERED	DATE FORWARDED	ACTION	SIGNATURES
			Approved	**DEPARTMENT CHAIR** Mary Lou Maher (SIS) Mary Lou Maher
			Approved	**COLLEGE CURRICULUM COMMITTEE CHAIR** Yaorong Ge
			Approved	**COLLEGE FACULTY CHAIR (if applicable)** N/A
			Approved	**COLLEGE DEAN** Mankel Perez Quinones Manuel Perez Quin
			Approved	**GENERAL EDUCATION** (if applicable; for General Education courses)
			Approved	**HONORS COLLEGE** (if applicable; for Honors courses & programs)
			Approved	**UNDERGRADUATE COURSE & CURRICULUM COMMITTEE CHAIR** (for undergraduate content)
10/14/15	11/3/15	11/20/15	Approved	**GRADUATE COUNCIL CHAIR** (for graduate content) Dennis Livsay Dennis Livesay
				FACULTY GOVERNANCE ASSISTANT (Faculty Council approval on Consent Calendar)
				FACULTY EXECUTIVE COMMITTEE (if decision is appealed)

Revised 05/06/14
OAA/mjw

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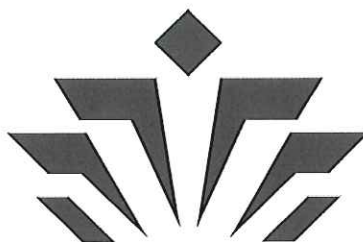| DATE RECEIVED	DATE CONSIDERED	DATE FORWARDED	ACTION	SIGNATURES
10/1	10/1	10/1	Approved	**DEPARTMENT CHAIR** _B. Enbro (CS)_
			Approved	**COLLEGE CURRICULUM COMMITTEE CHAIR**
			Approved	**COLLEGE FACULTY CHAIR (if applicable)**
			Approved	**COLLEGE DEAN**
			Approved	**GENERAL EDUCATION** (if applicable; for General Education courses)
			Approved	**HONORS COLLEGE** (if applicable; for Honors courses & programs)
			Approved	**UNDERGRADUATE COURSE & CURRICULUM COMMITTEE CHAIR** (for undergraduate content)
			Approved	**GRADUATE COUNCIL CHAIR** (for graduate content)
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(Separate proposals sent to UCCC and Grad. Council)

DATE RECEIVED	DATE CONSIDERED	DATE FORWARDED	ACTION	SIGNATURES
9/29	9/29	9/29	Approved	**DEPARTMENT CHAIR** (Binf)
			Approved	**COLLEGE CURRICULUM COMMITTEE CHAIR**
			Approved	**COLLEGE FACULTY CHAIR (if applicable)**
			Approved	**COLLEGE DEAN**
			Approved	**GENERAL EDUCATION** (if applicable; for General Education courses)
			Approved	**HONORS COLLEGE** (if applicable; for Honors courses & programs)
			Approved	**UNDERGRADUATE COURSE & CURRICULUM COMMITTEE CHAIR** (for undergraduate content)
			Approved	**GRADUATE COUNCIL CHAIR** (for graduate content)
				FACULTY GOVERNANCE ASSISTANT (Faculty Council approval on Consent Calendar)
				FACULTY EXECUTIVE COMMITTEE (if decision is appealed)

Revised 05/06/14
OAA/mjw

UNC CHARLOTTE

LONG FORM
COURSE AND CURRICULUM PROPOSAL

*To: Chair of Graduate Council

From: Dr. Dennis Livesay

Date: September 29, 2015

Re: New course and revisions to the CIS PhD Program

The Long Form is used for major curriculum changes. Examples of major changes can include:

Undergraduate: Major changes include new undergraduate degrees, minors, concentrations, certificates, and changes to more than 50% of an existing program (Note: changing the name of an academic department does not automatically change the name(s) of the degree(s). The requests must be approved separately by the Board of Governors.)

Graduate: Major changes include new graduate courses, major changes to an existing graduate course or major changes to an existing graduate program

Submission of this Long Form indicates review and assessment of the proposed curriculum changes at the department and collegiate level either separately or as part of ongoing assessment efforts.

*Proposals for undergraduate courses and programs should be sent to the Undergraduate Course and Curriculum Committee Chair. Proposals related to both undergraduate and graduate courses, (e.g., courses co-listed at both levels) must be sent to both the Undergraduate Course and Curriculum Committee and the Graduate Council.

I. HEADING AND PROPOSAL NUMBER

    A.   **HEADING.** Place a three line double-spaced heading containing the following information at the top of the first page of the proposal and beginning at the left margin:

University of North Carolina at Charlotte

Revisions to the requirements of the Computing and Information Systems (CIS) PhD program + creation of a new course

Course and curriculum revision proposal from the College of Computing and Informatics

    B.   **PROPOSAL NUMBER.** Place the proposal number in the upper right corner of page one of the proposal. The proposal number will consist of the abbreviation of the originating unit and the date the proposal was approved by the unit, e.g., BIO 7-24-02. If more than one proposal is passed on a specific date, assign alpha suffixes to distinguish them (e.g., BIO 7-24-02a and BIO 7-24-02b). Submit multiple courses as a single proposal when possible.

    C.   **TITLE.** Indicate a brief descriptive title for the proposal, e.g., *"Establishment of a Minor in Communication Studies."*

New course and revisions to the CIS PhD program

II. CONTENT OF PROPOSALS

    A.   **PROPOSAL SUMMARY.**

        1. **SUMMARY.** State clearly and concisely the actions proposed (e.g., "the Biology Department proposes to add four new elective courses to the undergraduate curriculum: BIO 2222, BIO 3456, BIO 2345, and BIO 3210).

Overview: This proposal makes three major changes to the Computing and Information Systems (CIS) program requirements, specifically the proposal:

- substantively revises the Qualifying Exam (QE) format
- creates a series of concentration-specific core courses
- creates a new course called *Foundations of Health Informatics* (which will be a core course in one of the concentrations).

Core courses have never been explicitly required by two of the three concentrations; however, they are currently "implicitly" required by the old QE format. That is, students in practice had to take these courses to have a reasonable chance of passing the QE. The updated QE format is more tailored to each student's research interests, so core classes have been defined to maintain a cohesive structure to the program's curriculum.

Specific Details: The current QE includes two parts: an original written research contribution and a written topic examination. A faculty QE committee is formed for each student, which evaluates the original research contribution. Based on the discretion of the committee, an oral defense of the contribution may be requested. The second part of the exam is a written examination that covers three topic areas that largely map to specific courses. There is widespread consensus among the CIS program faculty that the current QE format does not foretell dissertation research success and there is too much variability in what is considered an appropriate original research contribution. As such, we propose the following changes:

- Revise the original written research contribution so that it now becomes a written survey of the student's research area that summarizes the dissertation topic area at a high level and identifies the most promising areas of research. This exercise would provide the student a comprehensive overview of the field, help them identify the important questions, and pinpoint areas where they could have an impact. The survey is also expected to form the basis of the students' dissertation, meaning this is content that would likely constitute the opening chapter of their dissertation.

- This process would start as an assignment in the ITSC 8110, *Introduction to IT Research* course, which is the only didactic course currently required of all CIS students. The course would teach the process of writing such a survey (similar to what it already covers), and an early version of the survey would be a class assignment. This targeted training will further improve the quality and impact of the exercise.

- The student's will present and orally defend the survey to his/her QE Committee. The defense will include questions related to the student's broader research area to ensure sufficient mastery of the area.

- The student's research advisor is a non-voting member of the QE Committee. However, he/she will provide a written evaluation of the student's research progress to the QE Committee, which will be considered as part of the QE Committee's deliberation.

- Replacing the current written examination with course requirements that map directly to the current QE topics areas ensures that students have sufficient breadth in the discipline, consistent with a Ph.D. in CIS. Core courses will be implemented in the Computer Science (CS) and Software and Information Systems (SIS) concentrations. (Note that the Bioinformatics (BINF) concentration already has core class requirements.) All but one of these classes are already offered, the proposal to create the *Foundations of Health Informatics* (ITIS 8700) is bundled into this proposal. This course will be cross-listed as ITIS 6700; the attached syllabus explicitly includes additional work for the ITIS 8700 students.

B. JUSTIFICATION.

  1. Identify the need addressed by the proposal and explain how the proposed action meets the need.

     Summarized above.

  2. Discuss prerequisites/corequisites for course(s) including class-standing, admission to the major, GPA, or other factors that would affect a student's ability to register.

     Not applicable.

  3. Demonstrate that course numbering is consistent with the level of academic advancement of students for whom it is intended.

     Not applicable.

  4. In general, how will this proposal improve the scope, quality and/or efficiency of programs and/or instruction?

This proposal provides an improved mechanism to gauge student preparedness for success within dissertation research. Moreover, the points of connection (starting from the *Introduction to Information Technology Research* class, to the QE Research Survey paper, and ultimately to the Dissertation) provide an improved mechanism to ensure that students are successful throughout their research process and—more critically—writing of their dissertation.

  5. If course(s) has been offered previously under special topics numbers, give details of experience including number of times taught and enrollment figures.

     Not applicable.

C. IMPACT. Changes to courses and curricula often have impacts both within the proposing department as well as campus-wide. What effect will this proposal have on existing courses and curricula, students, and other departments/units? Submit an Impact Statement that fully addresses how you have assessed potential impacts and what the impacts of this proposal might be. Consider the following:

  1. What group(s) of students will be served by this proposal? (Undergraduate and/or graduate; majors and/or non-majors, others? Explain). Describe how you determine which students will be served.

     CIS Doctoral Students

2. What effect will this proposal have on existing courses and curricula?
   a. When and how often will added course(s) be taught?

   This proposal has no effect of course offerings with the exception of the proposed *Foundations of Health Informatics* (ITIS 8700) course, which will be offered annually in the spring.

   b. How will the content and/or frequency of offering of other courses be affected?

   Not applicable.

   c. What is the anticipated enrollment in course(s) added (for credit and auditors)?

   The anticipated enrollment in the proposed *Foundations of Health Informatics* (ITIS 6700/ITIS 8700) course is 25-30 students.

   d. How will enrollment in other courses be affected? How did you determine this?

   This proposal is expected to have minimal impact on course enrollments because, while these courses are not currently listed as explicit core requirements, the current QE requires that students take them. In addition, the proposed ITIS 8700 course is expected to have minimal impact because its material is largely orthogonal to other CIS program courses.

   e. Identify other areas of catalog copy that would be affected, including within other departments and colleges (e.g., curriculum outlines, requirements for the degree, prerequisites, articulation agreements, etc.)

   Not applicable.

III. RESOURCES REQUIRED TO SUPPORT PROPOSAL.

When added resources are not required, indicate "none". For items which require "none" explain how this determination was made.

   A. PERSONNEL. Specify requirements for new faculty, part-time teaching, student assistants and/or increased load on present faculty. List by name qualified faculty members interested in teaching the course(s).'

   None.

B. **PHYSICAL FACILITY.** Is adequate space available for this course?

Yes.

C. **EQUIPMENT AND SUPPLIES:** Has funding been allocated for any special equipment or supplies needed?

Not applicable.

D. **COMPUTER.** Specify any computer usage (beyond Moodle) required by students and/or faculty, and include an assessment of the adequacy of software/computing resources by available for the course(s).

Not applicable.

E. **AUDIO-VISUAL.** If there are requirements for audio-visual facilities beyond the standard classroom podiums, please list those here.

Not applicable.

F. **OTHER RESOURCES.** Specify and estimate cost of other new/added resources required, e.g., travel, communication, printing and binding.

Not applicable.

G. **SOURCE OF FUNDING.** Indicate source(s) of funding for new/additional resources required to support this proposal.

Not applicable.

IV. **CONSULTATION WITH THE LIBRARY AND OTHER DEPARTMENTS OR UNITS**

A. **LIBRARY CONSULTATION.** Indicate written consultation with the Library Reference Staff at the departmental level to ensure that library holdings are adequate to support the proposal prior to its leaving the department. (Attach copy of *Consultation on Library Holdings*).

See attached.

B. **CONSULTATION WITH OTHER DEPARTMENTS OR UNITS.** List departments/units consulted in writing regarding all elements outlined in IIC: Impact Statement, including dates consulted. Summarize results of consultation and attach correspondence. Provide information on voting and dissenting opinions (if applicable).

Not applicable.

C. HONORS COUNCIL CONSULTATION. In the case of Honors courses or Honors programs indicate written consultation with the Honors Council (if applicable).

Not applicable.

V. INITIATION, ATTACHMENTS AND CONSIDERATION OF THE PROPOSAL

A. ORIGINATING UNIT. Briefly summarize action on the proposal in the originating unit including information on voting and dissenting opinions.

Interim Associate Dean of Graduate Programs Livesay discussed the issues related to the QE format and creation of core classes personally with many stakeholders during AY 14-15. This culminated in a meeting with the Chairs and concentration coordinators (or their representatives) on October 29, 2014. The outcome of these discussions was a proposal to substantively revise the QE format in a way that is reflected in this proposal, which was discussed and approved at a meeting of the CIS program faculty on April 16, 2015. Subsequently, the Software & Information Systems and Computer Science departments approved the exact list of concentration specific core classes (the Department of Bioinformatics & Genomics already had a set of required core courses).

B. CREDIT HOUR. (Mandatory if new and/or revised course in proposal)
Review statement and check box once completed:
☒ The appropriate faculty committee has reviewed the course outline/syllabus and has determined that the assignments are sufficient to meet the University definition of a credit hour.

C. ATTACHMENTS.

1. CONSULTATION: Attach relevant documentation of consultations with other units.

2. COURSE OUTLINE/SYLLABUS: For undergraduate courses attach course outline(s) including basic topics to be covered and suggested textbooks and reference materials with dates of publication. For Graduate Courses attach a course syllabus. Please see Boiler Plate for Syllabi for New/Revised Graduate Courses.

3. PROPOSED CATALOG COPY: Copy should be provided for all courses in the proposal. Include current subject prefixes and course numbers, full titles, credit hours, prerequisites and/or corequisites, concise descriptions, and an indication of when the courses are to be offered as to semesters and day/evening/weekend. Copy and paste the current catalog copy and use the Microsoft Word "track changes" feature (or use red text with "strikethrough"

formatting for text to be deleted, and adding blue text with "underline" formatting for text to be added).

    a. For a new course or revisions to an existing course, check all the statements that apply:

    ____ This course will be cross listed with another course.
    ____ There are prerequisites for this course.
    ____ There are corequisites for this course.
    ____ This course is repeatable for credit.
    ____ This course will increase/decrease the number of credits hours currently offered by its program.
    ____ This proposal results in the deletion of an existing course(s) from the degree program and/or catalog.

For all items checked above, applicable statements and content must be reflected in the proposed catalog copy.

    b. If overall proposal is for a new degree program that requires approval from General Administration, please contact the facultygovernance@uncc.edu for consultation on catalog copy.

4. ACADEMIC PLAN OF STUDY (**UNDERGRADUATE ONLY**): Does the proposed change impact an existing Academic Plan of Study?
☐ Yes. If yes, please provide updated Academic Plan of Study in template format.
☐ No.

5. STUDENT LEARNING OUTCOMES (UNDERGRADUATE & GRADUATE): Does this course or curricular change require a change in Student Learning Outcomes (SLOs) or assessment for the degree program?
☐ Yes. If yes, please provide updated SLOs in template format.
☒ No.

6. TEXTBOOK COSTS: It is the policy of the Board of Governors to reduce textbook costs for students whenever possible. Have electronic textbooks, textbook rentals, or the buyback program been considered and adopted?
☐ Yes. Briefly explain below.
☒ No. Briefly explain below.

With the exception of the one new course, the classes affected by this proposal are unchanged.

IMPORTANT NOTE: A Microsoft Word version of the final course and curriculum proposal should be sent to facultygovernance@uncc.edu upon approval by the Undergraduate Course and Curriculum Committee and/or Graduate Council chair.

J. Murrey Atkins Library

Consultation on Library Holdings

To: Dr. Dennis Livesay

From: Dr. Melanie Sorrell

Date: 10/2/2015

Subject: ITIS 6700/8700 Foundations of Health Informatics

Summary of Librarian's Evaluation of Holdings:

Evaluator: Dr. Melanie Sorrell   Date: 10/2/2015

Check One:
1. Holdings are superior   _____
2. Holdings are adequate   __x__
3. Holdings are adequate only if Dept. purchases additional items.   _____
4. Holdings are inadequate   _____

Comments:
This is a proposal for a new graduate level degree course, which includes projects and reports. Library holdings should be adequate to support student research for this program (see list of items held by subject heading below). Students will have access to relevant databases including PubMed, Web of Science, Academic Search Premier, ACM Digital Library, IEEE Xplore Digital Library, and the Wiley Online Library.

LC Subject Heading	Total items held
Medical informatics	504 monographs
Health policy	2,469 monographs
Data mining	1,476 monographs
Big data	109 monographs
Data Interpretation, Statistical	84 monographs
Computer Security	2,027 monographs
Machine Learning	Journal title
Health Informatics Journal	Journal title

Melanie Sorrell

Evaluator's Signature

10/2/2015

Date

20145-20156 Graduate Catalog: Ph.D. in Computing and Information Systems

The Ph.D. in Computing and Information Systems (CIS) program has ~~four~~ five concentrations~~track options~~: Bioinformatics (BINF) Business Information Systems and Operations Management (BISOM), Computer Science (CS), Software and Information Systems (SIS), and an Interdisciplinary ~~Track~~ concentration (INT). The Program is staffed with a multidisciplinary faculty and offers opportunities for students to develop advanced competencies in a number of CIS-related fields. Faculty from the Departments of Computer Science, Software and Information Systems, Bioinformatics and Genomics, and Business Information Systems and Operations Management form its core. Students, in cooperation with faculty advisors, design flexible programs of study tailored to address individual career goals.

Students who aspire to academic research and teaching can benefit from a strong research faculty of international stature and exposure to practical applications of their specialties. Others seeking employment in industry, commerce, or government are afforded the opportunity to participate in high-quality applied research.

General Admission Requirements

Admission is competitive. Preference is given to applicants with strong credentials and appropriate undergraduate and/or professional preparation. Specific admission requirements for the program include:

1. A baccalaureate degree from a recognized institution. Students must show evidence of preparation in their chosen field sufficient to ensure profitable graduate study.
2. A satisfactory past academic performance as usually reflected by a grade point average of (or equivalent to) at least 3.0 (on a 4.0 scale) on courses related to the chosen field of Ph.D. study.
3. Excellent GRE or GMAT scores.
4. Applicants whose native language is not English must score at least 83 on the Internet-based version, 220 on the computer-based version, or 557 on the paper-based version of the Test of English as a Foreign Language (TOEFL). In addition, they will be required to take an English Proficiency Examination prior to the beginning of the first semester of study. Students who do not pass this examination must pass ENGL 1100 (English as a Foreign Language) with a grade of B or higher.
5. A one-page essay that addresses the following:
   a. The applicant's motivation
   b. Area(s) of research interest
6. Three letters of reference from professionals working in the applicant's field of interest that address the applicant's previous experience and potential to do research.

Further documentation that will support the application may include: evidence of scholarly and creative activity, including publication list; awards; results in national or international contests related to computing and information systems and the like.

Highly qualified individuals who may not meet all the required prerequisites may be admitted with a clear agreement to make up the prerequisites.

~~Track~~ Concentration Specific Additional Admission Requirements

Additional admission requirements for Business Information Systems and Operations Management, and Software and Information Systems ~~tracks~~ concentrations include:

1. Adequate understanding of software/information systems analysis, design, and implementation
2. Evidence of college-level skills in mathematical logic and data analysis (e.g., statistics, differential and integral calculus, discrete math, linear algebra)

Additional admission requirements for the Computer Science ~~track~~ concentration include:

~~Coursework~~

Coursework: Incoming students should possess a Master's or at least a Bachelor's degree in Computer Science, Computer Engineering, or a closely related discipline. Specifically, students should have demonstrable knowledge in at least four of the following areas:

1. Algorithms and Data Structures
2. Theory of Computation
3. Programming Language Concepts
4. Computer Architecture
5. Operating Systems
6. Software Engineering and Design

Course requirements may be satisfied through prior undergraduate or graduate work, or by a satisfactory score on the Computer Science Subject GRE examination. Admission into the Computer Science track is highly competitive. Thus, satisfying the requirements listed above does not guarantee admission.

Exceptionally strong students from other disciplines will be considered and may be allowed to make up the deficiencies at the discretion of the CS Ph.D. Admissions Committee.

~~Research~~

Research: Prior research experience and strong recommendation letters (preferably from university faculty or researchers at corporate labs) will be a significant consideration in evaluating the applicant's research potential. Research experience maybe demonstrated via publications, Bachelor's or Master's theses. A good match with faculty research interests as well as faculty input to the Admissions Committee will play a significant role in the final decision. Potential applicants are encouraged to communicate with research faculty regarding their interests.

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Application Deadlines

Application deadlines are in accordance with UNC Charlotte Graduate School deadlines. However, to ensure full consideration for financial support, applications must be received by September 1st for Spring admission and February 1st for Fall admission.

Degree Requirements

The Ph.D. in Computing and Information Systems program prepares students to be well-rounded professionals in the broad discipline of Computing and Information Systems (CIS). The degree of Doctor of Philosophy is granted for performance of original research resulting in significant contributions to the discipline's body of knowledge. Students are admitted into a ~~track~~ concentration within the program by one of the participating units:

1. Department of Computer Science
2. Department of Software and Information Systems

3. Department of Bioinformatics and Genomics
4. Department of Business Information Systems and Operations Management

The Ph.D. in Computing and Information Systems program also has an interdisciplinary ~~track~~ concentration in which CIS is applied to different disciplines. Students in the interdisciplinary ~~track~~ concentration are admitted into one unit but are expected to complete some coursework in a complementary discipline in addition to the minimum core requirements of their chosen unit. Students in the interdisciplinary ~~track~~ concentration must have co-advisors from their chosen unit and the complementary discipline. The detailed requirements are provided below. Failure to satisfy the requirements may result in the student's termination from the program.

Minimum Hours

To earn a Ph.D. degree, students in all ~~tracks~~ concentrations must complete at least 72 post-baccalaureate credit hours. This includes at least 18 hours of dissertation research and at least 9 hours of coursework completed at UNC Charlotte. A limited amount of transfer credit is allowed (see below for details). Students are expected to acquire a sufficiently broad body of technical knowledge in the discipline as well as a deep understanding of a specialized area. Such courses will be defined by the student's advisor(s). Students are expected to excel in all coursework. Graduation requirements mandate that students must achieve a minimum grade point average of 3.0 to graduate. Receiving more than two C grades or a grade of U in any course will result in a suspension from the program.

Introduction to Computing and Information Systems Research

First-year students must take ITSC 8110 (Introduction to Computing and Information Systems Research) in the first Fall semester. This course will be jointly taught by CIS Ph.D. faculty in all the ~~tracks~~ concentrations, providing new students an overview of the CIS research areas and opportunities at UNC Charlotte.

Only when there is an unavoidable schedule conflict between ITSC 8110 and another Ph.D. level course that a student has to take, the student can make a request to take ITSC 8110 in the second Fall semester. Such a request must be justified and signed by the student's initial Ph.D. advisor and endorsed by the Ph.D. Program Director.

Graduate Research Seminar

Students must sign up for and receive credit for ITSC 8699 (Graduate Research Seminar) every semester that they are in the Ph.D. program until the semester after they pass the proposal defense, unless they are enrolled in ITSC 8110.

If there is a legitimate reason that a student has to do part of his/her Ph.D. research in a different site during a regular semester, then he/she must first make a request to be exempted from taking ITSC 8699 for the period that he/she is visiting the other site. Such a request must be well justified and signed by the student's Ph.D. advisor and endorsed by the ~~Track~~ Concentration Coordinator. The period of exemption should not exceed one semester. Exceptions must be approved by the Ph.D. Steering Committee.

Research Advisor~~(s)~~ and Qualifying Exam Committee

Each Ph.D. student is assigned a temporary academic advisor~~(s)~~ within a ~~track~~ concentration when admitted to the program. Before the end of their fourth semester in the program, students should select a Research Advisor~~(s)~~, and, in consultation with their Research Advisor~~(s)~~, form a Qualifying Exam Committee. The Qualifying Exam

Committee should include at least three ~~IT~~ CIS Doctoral Faculty members, plus the student's , ~~including the~~ Research Advisor~~(s)~~ who ~~who~~ is a ~~chair(s)~~ nonvoting member of the Qualifying Exam Committee. The Qualifying Exam Committee ~~should~~ must be approved by the ~~Track~~ Concentration Coordinator.

Qualifying Exam

Each student must pass a qualifying exam, given and evaluated by the student's Qualifying Exam Committee. The purpose of the Qualifying Exam is to ensure that the student will have sufficient capability for doing dissertation-level research leading to a Ph.D. degree.

Each student must prepare a written research survey that describes the research area the student is expected to do his/her dissertation research in. Copies of the research survey must be provided to the committee at the time of filing the Qualifying Examination application, which must be at least two weeks prior to the exam. The student must present the research survey and defend it in a manner accepted by the Qualifying Exam Committee. Prior to the oral defense of the research survey, the student's advisor is required to submit a written evaluation of the student's research and academic progress to the Qualifying Exam Committee, with a copy also provided to the ~~Track~~ Concentration Coordinator. The Qualifying Exam will be graded on a Pass/Unsatisfactory basis, based on the corresponding rubrics by the Qualifying Exam Committee. A pass decision must be unanimous.

The student must pass the Qualifying Examination in at most two attempts within three years of the date of first enrollment into Ph.D. study at UNC Charlotte. A student who fails the Qualifying Exam twice will be terminated from the Ph.D. in Computing and Information Systems program.

~~Each student must pass a qualifying exam, given and evaluated by the student's Qualifying Exam Committee. The purpose of the qualifying exam is to ensure that the student will have sufficient core knowledge, breadth of knowledge, and research capability for doing dissertation-level research leading to a Ph.D. degree.~~

~~The Qualifying Examination consists of two mandatory components: a written examination component and an original written research contribution component. Each track holds the written examination at least twice a year and announces the time of exam at least two months in advance. The student must file a Qualifying Examination Application at least one month before the written examination takes place. The Qualifying Examination Committee will decide the content of the written examination, which must span at least three different subject areas as required by the student's track. The written examination should be approved by the Track Coordinator. Grading is based on a published rubric with the passing grade being 75.~~

~~Copies of the original written research contribution must be submitted at the time of filing the Qualifying Examination Application. The Qualifying Examination Committee will evaluate the original research contribution in writing based on a published rubric and grade it on pass/fail basis. At the discretion of the Qualifying Examination Committee, a student may be requested to give an oral presentation of his/her original research contribution.~~

~~Results for both components will be reported within two weeks of the date of the written examination. The student must pass both components of the Qualifying Examination in at most two attempts within three years of the date of first enrollment into Ph.D. study at UNC Charlotte. Exceptional performance on one component cannot be substituted for a failure on the other component. If either component is failed, then only that component needs to be re-taken. A second failure of a given component will result in the termination of the student's enrollment in the Ph.D. program.~~

Dissertation Committee

After passing the qualifying exam, the student should set up a Dissertation Committee of at least four graduate faculty members, which include at least three Ph.D. in Computing and Information Systems faculty members. This Committee may, but is not required to, consist of the same faculty members as the Qualifying Exam Committee. Ordinarily, the chair of this committee will be the student's advisor(s), who must be a member of the ~~a~~ CIS Ph.D. program faculty ~~member~~ and will ensure that the composition of the committee is appropriate. Committee members from outside the University must be appointed Associate Graduate Faculty members at UNC Charlotte. The Dissertation Committee must be approved by the ~~Track~~ Concentration Coordinator. After identifying and obtaining the signatures of the CIS faculty who will be serving on the Committee, the Dissertation Committee Form must be sent to the Graduate School for the appointment of the Graduate Faculty Representative. This appointment may take as long as four weeks. If there is need to change committee members later, a formal written request must be first submitted to the CIS Ph.D. Steering Committee with a clear explanation of the rationale for change. Upon approval by the CIS Ph.D. Steering Committee, a revised Committee form (above) must be submitted.

Proposal Defense

Each student must present and defend a Ph.D. dissertation proposal after passing the qualifying exam and within ten semesters since entering the Ph.D. program. The proposal defense will be conducted by the student's Dissertation Committee and will be open to the CIS Ph.D. faculty and students. The student shall provide copies of the written proposal to the Committee members at least two weeks before the scheduled defense. At the discretion of the Dissertation Committee, the defense may include questions that cover the student's program of study and background knowledge in the area of the proposal. The proposal defense will be graded on a Pass/Unsatisfactory basis, according to the corresponding rubrics by the Committee. A pass must be a unanimous decision by the Committee members; otherwise, the proposal defense fails. A student may retake the proposal defense if he/she cannot pass it the first time, and should consult the ~~Track~~ Concentration Coordinator before the second attempt. The

second failed defense of a dissertation proposal will result in the termination of the student's enrollment in the Ph.D. program. It is expected that the student first take the proposal defense by the ninth semester after they are enrolled, in order to provide time for a second attempt should the first one fail.

Ph.D. Candidacy

A doctoral student advances to Ph.D. candidacy after the dissertation proposal has been successfully defended.

Dissertation

Each student must complete a research program approved by the student's Dissertation Advisor(s) that yields a high quality, original, and substantial piece of research. The Ph.D. dissertation describes this research and its results. The dissertation defense is a public presentation. A written copy of the dissertation must be made available to each member of the student Ph.D. Dissertation Committee, to the Ph.D. Steering Committee, and to the UNC Charlotte Library, at least three weeks before the public defense. The date of the defense must be publicly announced at least three weeks prior to the defense. The student must present the dissertation and defend it in a manner accepted by the Dissertation Committee. The dissertation will be graded on a Pass/Unsatisfactory basis, based on the corresponding rubrics by the Dissertation Committee. A pass decision must be unanimous and must be approved by the Dean of the Graduate School. A student who fails the defense of a dissertation twice will be terminated from the Ph.D. in Computing and Information Systems program.

Progress Report and Evaluation

By every January, each student is required to submit a written progress report for the previous year, and the advisor(s) is required to submit a written evaluation of the student to the ~~Track~~ Concentration Coordinator, with a copy to the Program Director. A rubric is used for evaluation of progress. Failure to make satisfactory progress may result in discontinuation of the student's graduate assistantship and suspension from the program.

Residency Requirements

Each student must satisfy the residency requirement of one continuous full-time year (i.e., two consecutive semesters with the student being enrolled for at least nine graduate credit hours in each semester) after being admitted to the Ph.D. degree program.

Transfer Credit

In accordance with rules of the UNC Charlotte Graduate School, students are allowed to transfer up to 30 semester hours of graduate credit earned at UNC Charlotte or other recognized graduate programs. In cases of applicants with records of exceptionally high quality, the CIS Ph.D. Steering Committee, at its discretion, may request that the Graduate School approve transfer credit beyond the limit set by the Graduate School. To receive transfer credit, students must file a written request and submit all necessary documents to the ~~Track~~ Concentration Coordinator.

~~Track~~ Concentration Specific Additional Degree Requirements

Bioinformatics ~~Track~~

In addition to the general requirements of the CIS Ph.D. program, students must also take the following courses ~~P~~prior to the ~~q~~Qualifying ~~e~~Exam~~, all students must take the following courses~~:

- ~~ITSC~~ BINF 8100 Biological Basis of Bioinformatics
- BINF~~ITSC~~ 8101 Energy and Information in Biological Modeling
- BINF ~~ITSC~~ 8110 Introduction to Computing and Information Systems Research
- BINF ~~ITSC~~ 8111 Bioinformatics Programming I
- BINF ~~ITSC~~ 8112 Bioinformatics Programming II
- BINF ~~ITSC~~ 8200 Statistics for Bioinformatics
- BINF ~~ITSC~~ 8201 Molecular Sequence Analysis
- BINF ~~ITSC~~ 8202 Computational Structural Biology
- ~~ITSC 8203 Genomics, Transcriptomics, and Proteomics~~
- ~~ITSC 8211 Design and Implementation of Biological Databases~~
- ~~ITSC~~BINF ~~8880~~ 8911 Laboratory ~~Individual Study (lab rotation)~~ ~~(taken twice)~~Rotation I
- BINF 8912 Laboratory Rotation II~~)~~

Students with exceptionally strong backgrounds in specific disciplines may be excused from one or more of the required didactic classes (except ITSC 8110) at the discretion of the Bioinformatics ~~Track~~Concentration Coordinator.

Business Information Systems and Operations Management Track

In addition to the general CIS Ph.D. ~~in Computing and Information Systems~~ requirements, students must also:

1. Take at least 36 hours of coursework approved by the student's Research Advisor(s). At least 9 hours of graduate coursework must be taken at UNC Charlotte. (Exceptions to minimum course hour requirements may be granted by the Department's Graduate Affairs Committee upon the recommendation of the student's advisor. Such a request should only be granted based on overwhelming evidence that the student has excellent background knowledge to conduct high quality research in Computing and Information Systems.)
2. Complete at least 18 hours of dissertation research.

Computer Science ~~Track~~

In addition to the general CIS Ph.D. requirements, students must also:

~~In addition to the general Ph.D. in Computing and Information Systems requirements, students must also:~~

1. Take at least 6 ~~hours~~ credits of Pre-dissertation Research (ITSC 8990) during the students' first four semesters under the direction of one or more CIS Ph.D. Graduate Faculty members.
2. Take at least two courses from group A (6 credits) and at least two courses from group B (6 credits). The GPA of these four core courses must be 3.5 or better. ~~Advanced versions of core courses may be used as substitutes only for those students who completed any of core courses and have transfer credit. The core courses must be completed within three years of the date of first enrollment into Ph.D. study at UNC Charlotte.~~Core course requirements must be met within the first 30 credit hours of entering the program.

Group A:
ITCS 8107 Formal Languages and Automata
ITCS 8114 Algorithms and Data Structures
ITCS 8165 Coding and Information Theory
ITCS 8156 Machine Learning
ITCS 8132 Modeling and Analysis of Communication Networks

Group B:
ITCS 8120 Computer Graphics

ITCS 8150 Intelligent Systems
ITCS 8160 Database Systems
ITCS 8166 Computer Communications and Networks
       ITCS 8182 Computer System Architecture
       ~~ITCS 8107 Formal Language and Automaton~~
       ~~ITCS 8114 Algorithm and Data structure~~
       ~~ITCS 8165 Coding and Information Theory~~
       ~~ITCS 8156 Machine Learning~~
       ~~ITCS 8132 Modeling and Analysis of Communication Network~~

       ~~Group B:~~
       ~~ITCS 8120 Computer Graphics~~
       ~~ITCS 8150 Intelligent Systems~~
       ~~ITCS 8160 Data Base Systems~~
       ~~ITCS 8166 Computer Communication and Network~~
       ~~ITCS 8182 Computer System Architecture~~

~~2.   Take at least 30 hours of coursework approved by the student's Research Advisor(s). At least 9 hours of graduate coursework must be taken at UNC Charlotte. (Exceptions to minimum course hour requirements may be granted by the Department Graduate Committee upon the recommendation of the student's Dissertation Committee. Such a request should only be granted based on overwhelming evidence that the student has excellent background knowledge to conduct high quality research in Computing and Information Systems.)~~

3.   Complete at least 18 hours of dissertation research.

Interdisciplinary ~~Track~~

The coursework requirements of this ~~track~~ concentration depend on the chosen unit and complementary discipline. Students are required to complete the core requirements of the chosen unit and select a minimum of two graduate courses from a complementary discipline with the approval of their advisors.

Software and Information Systems ~~Track~~

In addition to the general CIS Ph.D. ~~in Computing and Information Systems~~ requirements, students must also:

1.   Take at least 6 hours of Pre-dissertation Research (ITSC 8990) during the students' first four semesters under the direction of one or more CIS Ph.D. Graduate Faculty members.

    Students must take three of the following four classes. The GPA for these courses must be greater than 3.6. Advanced versions of the core courses can be used as substitutes upon permission from both the student's academic advisor and the program coordinator. Core course requirements must be met during the first 30 credit hours within the program.

    ITIS 8180 Foundations of Health Informatics
    ~~Take at least 30 hours of coursework approved by the student's Research Advisor(s). At least 9 hours of graduate coursework must be taken at UNC Charlotte. (Exceptions to minimum course hour requirements may be granted by the Department Graduate Committee upon the recommendation of the student's Dissertation Committee. Such a request should only be granted based on overwhelming evidence that the student has excellent background knowledge to conduct high quality research in Computing and Information Systems.)~~ITIS 8200 Principles of Information Security and Privacy
    ITIS 8400 Principles of Human-Computer Interaction
    ITIS 8520 Network Science
    ~~ITIS 8xxx Foundations of Health Informatics~~

3. 2. Complete at least 18 hours of dissertation research

ITIS 6180. Foundations of Health Informatics. (3) Cross-listed as ITIS 8180. Pre-requisites: Graduate standing in computer science, information technology, health informatics, or related discipline. This course provides an overview of foundational concepts and methods in healthcare systems, technologies, and policies that are critical for successful research in health informatics. Students will explore recurring themes, issues, and applications most frequently encountered in the field. The course will be technical and rigorous and will involve both theoretical analysis and substantial projects. The topics covered will include an overview of issues, systems and technologies in health informatics and in-depth discussion of data standards, data integration, data analytics, and evaluation methods. Students who take this course will gain the skills and knowledge necessary to conduct research in health informatics.

ITIS 8180. Foundations of Health Informatics. (3) Cross-listed as ITIS 6180. Pre-requisites: Graduate standing in computer science, information technology, health informatics, or related discipline. This course provides an overview of foundational concepts and methods in healthcare systems, technologies, and policies that are critical for successful research in health informatics. Students will explore recurring themes, issues, and applications most frequently encountered in the field. The course will be technical and rigorous and will involve both theoretical analysis and substantial projects. The topics covered will include an overview of issues, systems and technologies in health informatics and in-depth discussion of data standards, data integration, data analytics, and evaluation methods. Students who take this course will gain the skills and knowledge necessary to conduct research in health informatics.

ITIS-8180/6180 Foundations of Health Informatics

Course Description

This course provides an overview of foundational concepts and methods in healthcare systems, technologies, and policies that are critical for successful research in health informatics. Students will explore recurring themes, issues, and applications most frequently encountered in the field. The course will be technical and rigorous and will involve both theoretical analysis and substantial projects. The topics covered will include an overview of issues, systems and technologies in health informatics and in-depth discussion of data standards, data integration, data analytics, and evaluation methods. Students who take this course will gain the skills and knowledge necessary to conduct research in health informatics. (Spring, 3 credit hours)

Pre-requisites

Students in the computer science or information systems graduate program or in related graduate programs who have taken courses in data structures, algorithms, and database at undergraduate or graduate level or with permission from instructor

Course Objectives

- Understand the main issues, systems, technologies, and policies in health and healthcare
- Understand and apply fundamental concepts and theories of health informatics
- Understand and apply fundamental methods critical to health informatics research

Like any other skill, your understanding of these concepts will develop only through extensive reading, writing, and practice.

Main Topics
- Overview of issues in health and health care
- Overview of systems, technologies, and policies in health care
- Health data standards and characteristics
- Health data integration and data warehousing
- Advanced programming for data analytics (Python, R)
- Machine learning and text mining of health data
- Evaluation and experimentation in health informatics (qualitative and quantitative study design and analysis)
- Health data security and privacy

Additional topics may include
- Fundamental mathematical and statistical methods for health data analysis
- Medical signal and image processing

Instruction Method

This course will use a combination of classroom instruction, hands on experiments and projects.

Expectations

- Work hard
- Show up on time
- Participate actively
- Address issues proactively

Course Material

Reference Books:

"*Methods in Biomedical Informatics*", 1st Edition,

> By Indra Neil Sarkar, Academic Press, ISBN -13: 978-0124016781
> ISBN-10: 0124016782

"*Information Retrieval: A Health and Biomedical Perspective*", Second Edition,

> By William R. Hersh, Springer-Verlag, New York, ISBN 0-387-95522-4

"*Principles of Health Interoperability HL7 and SNOMED*", Second Edition,

> By Tim Benson, Springer, London, ISBN 978-1-4471-2800-7

> E-textbook at:

> https://librarylink.uncc.edu/login?url=http://link.springer.com/openurl?genre=book&isbn=978-1-4471-2800-7

"*Principles of Data Integration*",

> By AnHai Doan, Alon Halevy, Zachary Ives, Elsevier, ISBN 978-0-12-4160444-6

> E-textbook at:

> http://librarylink.uncc.edu/login?url=http://www.sciencedirect.com/science/book/9780124160446

Reading List:
A list of seminal articles will be available on the Course Web Site

Assignments and Grade Determination

Exams (20%)	Quizzes on the concepts studied in the previous weeks. Mid-term and final exams will be given to assess understanding of concepts and methods if needed. Alternatively, a more extensive project may take the place of one or both of the exams.
Projects (60%)	There will be two small projects and one final project. The projects will give you the opportunity to explore one or more concepts in more depth and apply these concepts in small realistic applications. The final project will be a group project and will be more comprehensive.

	For students in ITIS 8180: An additional report that describes one of the topics that is not covered in class
Homeworks (20%)	You will have homework assignments due for almost every class period.
Attendance	You are expected to attend every class meeting. See below.
Class Participation	Required. See below.

Final letter grades are assigned as follows:

A = 90% or above
B = 80% or above
U = below 80%

Additional requirements for ITIS-8180

The students in ITIS-8180 will be required to complete an extra project assignment, which is usually an additional report that describes one of the topics that is not covered in class.

Class Preparation

This class is designed so that we can spend our limited, valuable class time answering questions, working out problems, and advancing what you already should have learned on your own while preparing for class. That means that you are expected to learn most of the basic material on your own before we meet for class. If you regularly attend class unprepared, please drop this course now and register for another. If you regularly attend class prepared, you're going to learn a lot.

Attendance

You are expected to attend (and participate positively in) every class meeting.

Positive Class Participation

Positive class discussion and activity is perhaps the most important factor in making the course interesting and fun. Those of you who have a documented (with the University) learning disability that would prevent you from participating in class discussion should notify me early on. Those of you who feel that your learning style is not conducive to participating in class discussion should see me no later than the end of the first week of class.

Late Policy

Your assignments are considered late if they are not completed by the stated due date and time. If your assignment is late, you will usually have seven additional days to complete it for late credit (depending on whether anything contrary has been stated in the syllabus or assignment instructions.) Late credit equals a 20 point (or approximately a 20%) reduction to the grade you would have received. For example, if you would have received a grade of 90% for completing a particular assignment, you will receive a grade of 70%.

Extensions

Should you desire an extension for some reason, you must discuss it with me <u>before</u> the assignment is due.

Academic Integrity

I have a zero-tolerance policy with regard to academic dishonesty. Clear evidence of academic dishonesty will result minimally in an automatic failing grade for the course, regardless of your other grades, and I will refer the matter to the proper authorities. Please do not ruin your chances for employment with an organization of which you would very much like to be a part because you were in some way academically dishonest.

For additional information, please see The Code of Student Academic Integrity:
http://www.legal.uncc.edu/policies/ps-105.html#V

Topics and Assignments

The latest reading and assignments list is always available on the course web site. We will likely update this list as we proceed throughout the semester. You are responsible for getting up-to-date information on the current readings and assignments.