COMPUTER SCIENCE

Discipline Coordinator
Yugyung Lee, (816) 235-5932, leeyu@umkc.edu

Computer Science faculty who are members of the doctoral faculty.

Computer Science is a discipline in the Interdisciplinary Ph.D. (http://catalog.umkc.edu/colleges-schools/graduate-studies/interdisciplinary-phd-program) Program administered by the School of Graduate Studies.

Note: The discipline-specific requirements listed here are in addition to the requirements listed in Interdisciplinary Ph.D. Application Procedure and Minimum Criteria for Admission and Minimum Interdisciplinary Ph.D. Academic Regulations and Degree Requirements.

Discipline-Specific Admission Requirements
A student who meets the minimum discipline requirements stated below will be considered for regular full admission to the Ph.D. program. A student who meets the requirements partially but shows high potential for advanced-level work may be considered for provisional admission. Admission also depends on factors such as number of seats available, resources available in the area of student's interest, availability of advisor, the quality of previous work, etc. A student not qualifying for admission to the Ph.D. program may be automatically considered for admission to the M.S. computer science program.

Academic Preparation
The applicant must have a bachelor’s degree and/or a master’s degree in computer science, computer engineering, electronics, communications engineering or any other field requiring substantial training in at least one of the above fields and in mathematics with a GPA of 3.5 or better on a 4.0 scale, cumulative as well as in the major field; and a GPA of 3.5 or better on a 4.0 scale, in all post-baccalaureate or post-master’s degree work.

Aptitude for Advanced Work
The student must demonstrate an aptitude for advanced-level work through national/international standardized examinations such as the GRE. The expected performance level is the 80th percentile in the quantitative portion of the GRE examination. The student must also show an excellent performance in all of his or her coursework.

Proficiency in English
The student must demonstrate his or her proficiency in oral and written communication in English through national/international standardized English examinations such as TOEFL, verbal portion of the GRE, etc. The expected proficiency level is the 50th percentile in the verbal portion of the GRE or a TOEFL score of 263 or above (230 CBT or 88 iBT). UMKC students may also satisfy this requirement by obtaining an English Proficiency Certification from the English Department. [Note: As per University policy, all international students go through the English proficiency test upon arrival to the campus, regardless of their scores in TOEFL or verbal portion of GRE or any other test. A student's advisor may also require the student to take the above test, irrespective of the student's native language. As a result of this test, the student may be required to improve his or her oral and written communication in English before enrollment in the courses of the chosen disciplines.]

Recommendations
The student must provide at least three recommendation letters, identifying clearly his or her academic achievements and exceptional quality, from the professors from his or her previous institution(s). If the applicant has been out of school for several years, recommendation letters from his or her supervisors (technical) will be acceptable. However, even in this situation, a recommendation letter from his or her last academic institution is highly recommended. A recommendation from a faculty member in the Computer Science Electrical Engineering (CSEE) Department at UMKC must be provided if the student has taken courses from or worked with the CSEE faculty.

Statement of Goals and Objectives
The applicant must provide a 250- to 500-word essay on his or her goals and objectives of pursuing the Ph.D. in the chosen fields. This is an important document for reviewing the application. Applicants, therefore, are advised to provide a clear account of their academic achievements and plans for higher study.

Admission at an Advanced Level
An applicant who has already completed significant graduate coursework (15 or more semester hours of post-master’s work or 30 or more hours of post-bachelor’s work) toward a Ph.D. at another institution must provide reasons for changing institutions. The applicant must also provide a letter of endorsement from a computer science doctoral faculty member indicating willingness to be the student’s research advisor.

Alternate Admission Criteria
The applicant may have received a bachelor’s degree or a master’s degree in computer science, computer engineering, electrical engineering or electronics, or any other related field with substantial training in mathematics. An applicant not meeting the minimum admission requirements, or not having sufficient academic preparation (stated below under prerequisite knowledge) for advanced work in the chosen primary discipline(s), may be
considered for provisional admission by the CSEE Department Ph.D. committee if the committee sees high potential and preparation for advanced work from the rest of the applicant’s credentials. Evidence of high potential might be pertinent work experience, published papers or extremely high achievement in related areas. In any case, the required GPA (or GPAs) must be at least 3.0 on a 4.0 scale, and the coursework deficiencies for doctoral study in computer science must not be more than 18 semester hours. Applicants with an established research or publication record in a quantitative science are encouraged to apply.

**Qualifying Requirements for Full Admission**

**Prerequisite Knowledge**

It is expected that a Ph.D. applicant selecting Computer Science as the primary discipline have the level of preparation represented by the following courses. An applicant with only a B.S. degree in computer science must have at least a GPA of 3.25/4.0 and an applicant with at least a year of graduate work must have at least a GPA of 3.5/4.0 before attempting advanced study.

**Undergraduate Courses**

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<thead>
<tr>
<th>Course Code</th>
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<tbody>
<tr>
<td>COMP-SCI 303</td>
<td>Data Structures</td>
<td>3</td>
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<tr>
<td>COMP-SCI 394R</td>
<td>Applied Probability</td>
<td>3</td>
</tr>
<tr>
<td>COMP-SCI 404</td>
<td>Introduction to Algorithms and Complexity</td>
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</tr>
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<td>Design and Analysis of Algorithms</td>
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</tr>
<tr>
<td>COMP-SCI 5531</td>
<td>Advanced Operating Systems</td>
<td>3</td>
</tr>
<tr>
<td>COMP-SCI 5551</td>
<td>Advanced Software Engineering</td>
<td>3</td>
</tr>
<tr>
<td>COMP-SCI 5570</td>
<td>Architecture of Database Management Systems</td>
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**Length of Time to Complete Qualifying Requirements**

When a student is admitted provisionally, the CSEE Ph.D. Committee will specify, and the UMKC Interdisciplinary Executive Committee will confirm, the conditions and length of time available to satisfy them to achieve full admission status.

**Suggested Compatible Co-disciplines**

Telecommunications and computer networking, electrical and computer engineering, mathematics, physics, chemistry (http://catalog.umkc.edu/colleges-schools/graduate-studies/chemistry) (computational focus), engineering (http://catalog.umkc.edu/colleges-schools/graduate-studies/engineering) (civil and mechanical focus), cell biology and biophysics, molecular biology and biochemistry, oral and craniofacial sciences, pharmaceutical sciences, pharmacology, geosciences, and economics. A co-discipline outside of this list may be considered in exceptional cases.

**Core Program Requirements**

The amount of work required for the Ph.D. depends on the student’s level of preparation. For example, a student entering the Ph.D. program after earning a bachelor's degree may expect to do significantly more work compared to the student who enters after earning a master's degree.

**Computer Science as a Co-Discipline**

A Ph.D. student selecting Computer Science as co-discipline is expected to have the level of preparation represented by the following courses before attempting advanced study:

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A Ph.D. student must clear the qualifying test and comprehensive test before defending his or her dissertation. The discipline’s course requirements and qualifying test procedure is described below.
Discipline Course Requirements and Qualifying Exam

The total Interdisciplinary Ph.D. course credit (didactic) requirement is 30 hours which is divided into (a) primary discipline (12 credits), (b) co-discipline (9 credits), and (c) the remaining 9 credits can be completed either by doing graduate level courses at UMKC in any participating discipline or credits can be transferred from students' previous institutions. This credit transfer must be approved by the CSEE Department Ph.D. committee.

Computer Science as Co-discipline

There is no qualifying exam for student selecting Computer Science as a co-discipline.

Ph.D. Qualifying Exam for Computer Science Discipline

The qualifying exam is conducted to confirm that the student has a sound understanding of the fundamentals of computer science and has developed good problem-solving skills and research potential. This document includes the syllabus and describes the procedure for taking the qualifying exam in the Computer Science discipline.

Eligibility

The student must be fully admitted to the Ph. D program at UMKC. Students admitted provisionally will have to satisfy all requirements stipulated in the letter of admission before being fully admitted.

Duration for Clearing Qualifying Exam

Both full-time and part-time students must take the Ph.D. qualifying exam by the third semester from the date he or she is fully admitted. For example, if a student is fully admitted in the Fall 2015 semester, then he or she must take the qualifying exam by the Fall 2016 semester. Failure to do so will disqualify the student from continuing in the Ph.D. program. Upon consultation with his/her interim adviser, a student may choose to take the qualifying exam earlier than the third semester. If a student fails the qualifying exam in the first attempt then he or she MUST retake it in the subsequent semester. Failure to clear the exam in the second attempt disqualifies the student from remaining in the Ph.D. program with Computer Science as the primary discipline.

Qualifying Exam Dates

Qualifying tests are administered twice a year, on the second Friday of April and November.

Qualifying Exam Procedure

1. Registration: Eligible Ph.D. students must register to take the exam. The registration deadline is March 31 for the April exam and October 31 for the November exam. Eligible students should send an e-mail with the following information to the Student Services Coordinator (Coretta Carter-Muhammad) and the Discipline Coordinator.
   a. Name
   b. Student ID
   c. E-mail
   d. Primary discipline and Co-discipline
   e. Interim advisor's name
   f. Preferred semester for taking the exam.

2. Registration Notification: Students will be notified by e-mail.

3. Taking the Exam: Students take the test on the prescribed date.

   Exam Duration: Four hours.

Exam Format

The qualifying examination consists of two parts: a written part and an oral part. Students only have two attempts to pass the written part. The oral part may not be attempted unless the written part has been passed.

Written Qualifying Examination

A half-day written examination will be given at the exam date. The written examination will cover the following topics: Discrete Structures, Data Structures and Algorithms, Operating Systems, Design and Analysis of Algorithms. A student will answer a set of questions from each topic as indicated on the exam.

Oral Qualifying Examination

Approximately one to two weeks after the written examination, an oral examination will be given. This exam requires that all members of the committee be present and is open to all members of the faculty and students. The exam will be administered by the CS discipline coordinator. First, this exam will be prepared by the members of the doctoral committee at the request of the student’s primary advisor by identifying a set of published manuscripts relevant to the student’s area of advanced study. These manuscripts will be given to the student in the form of a take-home examination at least one week ahead of time. The student will prepare a written summary of the published manuscripts. The contents of the summary are presented to the doctoral committee and the student is questioned about the material. A significant part of the summary and presentation should be
a description of the technical gaps in the previous work and the identification of possible research projects that address these gaps. The examination committee will evaluate the written summary, the oral presentation, and the student's answers.

The written qualifying exam will contain questions from the topics listed below. The questions will be based on the material typically taught in the specified undergraduate and graduate courses. The students must have a sound understanding of these topics and are expected to demonstrate this in their answers.

1. Discrete Structures (Based on COMP-SCI 191 and COMP-SCI 291)
2. Data Structures (Based on COMP-SCI 303) and Algorithms (Based on COMP-SCI 404)
3. Operating Systems (Based on COMP-SCI 431)
4. Design and Analysis of Algorithms (Based on COMP-SCI 5592)

**Ph.D. Qualifying Written Exam Syllabus**
The syllabus lists the main topics in each area. Students are strongly advised to consult the listed textbooks to prepare for the exam.

1. **Discrete Structures**
   - Mathematical induction, Relations, Counting methods (Permutation, Combination, Pigeon-hole principle), Recurrent relations, Graph theory. 
   - **Reference book**
     - *Discrete Mathematics* by Richard Johnsonbaugh.

2. **Data Structures and Algorithms**
   - Basic knowledge of algorithm complexity (Big-Oh, Big-Omega, Big Theta, best, worst, and average case analysis, etc.), Binary trees, Binary search trees, AVL trees, Heaps, B-trees, B+ trees, Graphs, Hashing (Static, Dynamic, and Extendible), Huffman codes, Divide-and-conquer, Searching, Sorting, In-order, Pre-order, and Post-order traversals, Breadth first, Depth first graph traversal, Spanning trees and Shortest path.
   - **Reference books**
     - *Data Structures and Algorithm Analysis in C++* by Mark Allen Weiss, Addison Wesley.
     - *A Practical Introduction to Data Structures and Algorithm Analysis* by Clifford A. Shaffer, Prentice Hall.

3. **Operating Systems**
   - Process management (synchronization, concurrency, deadlock), Memory management, Process and Job scheduling, Performance models (expected behavior), File systems, and IO.
   - **Reference books**
     - *Modern Operating Systems* by Andrew Tanenbaum, Prentice Hall

4. **Design and Analysis of Algorithms**
   - Divide and Conquer method, Dynamic programming, Greedy algorithms, Depth-first and Breadth-first search, Shortest path algorithms, Minimum spanning trees, NP-completeness.
   - **Reference books**

**Exam Result**
After the exam, the committee will cast votes of pass or fail on both the oral and written exams. The minimum passing grade is 70%. Borderline cases will be discussed by the committee. These results are recorded on the Report of the Written and Oral Qualifying Examination form. The Discipline Coordinator will make the result of the exam available within two weeks from the date of the exam.

The result could be one of the following.

1. **Pass**: The student proceeds to the next level of the Ph.D. curriculum. He or she prepares the plan of study and finalizes the composition of his or her supervisory committee. The plan is submitted to the graduate office for approval.
2. **Fail**: If a student fails then he/she must retake and clear the exam in the subsequent semester. Failure to clear the exam in the second attempt disqualifies the student from remaining in the Ph.D. program with CS as the primary discipline.

**Requirements for Comprehensive Exams**
The comprehensive exam is administered by the student's supervisory committee. A student can either take a written test or opt for an oral presentation covering both primary and co-discipline areas. Discussion with and agreement from the student’s supervisory committee is required before choosing the desired option.

The candidates should contact the CSEE Division office and the chair of their doctoral committee for additional information.
Financial Aid

All admitted international and non-resident Ph.D. students automatically receive financial aid in the form of significantly reduced fees. In addition, they can apply to various forms of financial aid (such as graduate research assistantships, graduate teaching assistantships, graduate fellowships) through the CSEE Department and the School of Graduate Studies. Note that a GTA can only be awarded to a student after the student has successfully demonstrated his or her teaching potential to a committee and has successfully passed the English language test. Contact the discipline coordinator for more information.