Computer and Information Science, Ph.D.

COLLEGE OF SCIENCE AND TECHNOLOGY (http://cst.temple.edu)

About the Program

The Computer and Information Science Ph.D. program prepares a student to undertake independent research leading to science and engineering advances in computer and information sciences. The program is structured around the Ph.D. dissertation, with coursework and seminars designed to attain the requisite quality of the dissertation. An important criterion for the dissertation is that it be publishable in a recognized journal and presentable at international conferences.

Time Limit for Degree Completion: 7 years

Campus Location: Main

Full-Time/Part-Time Status: Students complete the degree program through classes offered after 4:30 p.m. The degree program can be completed on a full- or part-time basis.

Areas of Specialization: The Ph.D. program focuses on four research tracks:

1. Artificial Intelligence and Applications, which is concerned with systems that exhibit intelligent behavior;
2. Computer and Network Systems, which covers systems programming, operating systems, and system architectures, including networks and distributed systems;
3. Information Systems, which focuses on systems that provide information to improve the performance of organizations; and
4. Software Systems, which is dedicated to the creation of software and its associated methodologies.

Job Prospects: Graduates typically find employment in universities, industry, or government agencies.

Non-Matriculated Student Policy: Non-matriculated students are permitted to take a maximum of two graduate-level CIS courses.

Financing Opportunities: Teaching Assistants teach two undergraduate laboratory sections each term under the direction of a faculty lecturer. Assistantships provide a stipend and full-time tuition.

Admission Requirements and Deadlines

Application Deadline:

Fall: December 15
Spring: August 1

Applications are reviewed as they are received. Late applications will be considered for admission.

APPLY ONLINE to this graduate program.

Letters of Reference:

Number Required: 3

From Whom: Letters of recommendation should be obtained from Computer Science faculty and professionals.

Coursework Required for Admission Consideration: The applicant is required to have a solid background in Computer and Information Science and related disciplines. In addition, acceptance by a Ph.D. Graduate Faculty member in at least one open track is required. To find a faculty advisor, prospective students should contact Graduate Faculty whose research interests are similar to their own. The list of faculty can be found at http://www.temple.edu/cis/directory/.

Master's Degree in Discipline/Related Discipline: A master's degree is not required.

Bachelor's Degree in Discipline/Related Discipline: A baccalaureate degree in Computer Science, Information Science, Mathematics, Science, or Engineering is required. The applicant's undergraduate program must include a considerable amount of coursework in Computer and Information Science.

Statement of Goals: Approximately 500-1,000 words include your specific interest in Temple's program; your research goals; your future career goals; and your academic and research achievements.

Standardized Test Scores:
**Computer and Information Science, Ph.D.**

GRE: Required. Scores should minimally be in the 75th percentile on the quantitative section and 25th percentile on the verbal section for a combined total score of at least 297.

For applicants whose native language is not English, the TOEFL, IELTS, or PTE Academic exam is required:

TOEFL: 85 iBT or 563 PBT minimum

IELTS: 7.0 minimum

PTE Academic: 58 minimum

A score of 45 or greater on the Test of Spoken English (TSE) or a score of 28 or greater on the TOEFL iBT Speaking section is required for international applicants who wish to be considered for a Teaching Assistantship.

Resume: Current resume required.

Advanced Standing: Advanced standing credit is determined by the CIS Graduate Committee. Requests for, and decisions on, advanced standing are normally not made until after the student has satisfactorily completed the CIS Ph.D. Qualifying Examination and formed a Doctoral Advisory Committee. The maximum number of advanced standing credits awarded is 24.

**Program Requirements**

**General Program Requirements:**

*Number of Credits Required to Earn the Degree*: 48

**Required Courses:**

<table>
<thead>
<tr>
<th>Track-Specific Courses ¹</th>
<th>24</th>
</tr>
</thead>
<tbody>
<tr>
<td>Other CIS Courses ²</td>
<td>24</td>
</tr>
<tr>
<td>CIS 9182</td>
<td>Independent Study</td>
</tr>
<tr>
<td>or CIS 9282</td>
<td>Independent Study</td>
</tr>
<tr>
<td>CIS 9991</td>
<td>Project in Computer Science</td>
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<tr>
<td>CIS 9994</td>
<td>Preliminary Examination Preparation</td>
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<tr>
<td>CIS 9998</td>
<td>Pre-Dissertation Research</td>
</tr>
<tr>
<td>CIS 9999</td>
<td>Dissertation Research</td>
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</tbody>
</table>

**Total Credit Hours**: 48

¹ Required and elective courses are identified in the course lists below for each of the four tracks: Artificial Intelligence and Applications, Computer and Network Systems, Information Systems, and Software Systems.

² Select no more than 8 courses from those identified. Note that at least 1 credit of coursework (or research experience) outside of the Department of Computer and Information Sciences is required. To fulfill this 1-credit minimum requirement, students enroll in CIS 9182 or CIS 9282, an Independent Study course. This requirement can be waived for students with adequate work experience.

**Artificial Intelligence and Applications Track**

**Core Courses**

All are required for the Qualifying Exam:

CIS 5511 Programming Techniques

CIS 5526 Machine Learning

CIS 5603 Artificial Intelligence

**Didactic Courses**

Select five, choosing at most four for inclusion in the Qualifying Exam:

CIS 5513 Automata and Formal Languages

CIS 5525 Neural Computation

CIS 5527 Data Warehousing, Filtering and Mining

CIS 5538 Text Mining and Language Processing

CIS 5543 Computer Vision

CIS 5617 Computer Networking and Communication

CIS 9590 Seminar in Advanced Topics in Computer Science

CIS 9601 Computer Graphics and Image Processing
<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
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</thead>
<tbody>
<tr>
<td>CIS 9615</td>
<td>Design and Analysis of Algorithms</td>
</tr>
<tr>
<td>CIS 9618</td>
<td>Web Applications Development</td>
</tr>
<tr>
<td>CIS 9651</td>
<td>Artificial Intelligence, Heuristic Models, and Education</td>
</tr>
<tr>
<td>CIS 9664</td>
<td>Knowledge Discovery and Data Mining</td>
</tr>
<tr>
<td>CIS 9665</td>
<td>Advanced Topics in Data Base Systems</td>
</tr>
</tbody>
</table>

**Total Credit Hours** 24

### Computer and Network Systems Track

#### Core Courses
Select at least two for inclusion in the Qualifying Exam:
- CIS 5511 Programming Techniques
- CIS 5512 Operating Systems
- CIS 5513 Automata and Formal Languages
- CIS 5617 Computer Networking and Communication
- CIS 5642 Computer Architecture

#### Didactic Courses
Select at most five for inclusion in the Qualifying Exam:
- CIS 5526 Machine Learning
- CIS 5603 Artificial Intelligence
- CIS 5636 Ad Hoc Networks
- CIS 5637 Network & Information Security
- CIS 5639 Wireless Network and Communication
- CIS 5644 Distributed Systems
- CIS 9615 Design and Analysis of Algorithms
- CIS 9618 Web Applications Development
- CIS 9664 Knowledge Discovery and Data Mining
- CIS 9665 Advanced Topics in Data Base Systems
- CIS 9666 Advanced Networks and Client-Server Computing
- CIS 9669 Distributed and Parallel Computer Systems

**Total Credit Hours** 24

### Information Systems Track

Select a minimum of one and up to three theory area topics for inclusion in the Qualifying Exam:
- CIS 5511 Programming Techniques
- CIS 9615 Design and Analysis of Algorithms
- STAT 8003 Statistical Methods I

Select a minimum of one and up to three systems area topics for inclusion in the Qualifying Exam:
- CIS 5512 Operating Systems
- CIS 5516 Principles of Data Management
- CIS 5617 Computer Networking and Communication
- CIS 5644 Distributed Systems
- CIS 9666 Advanced Networks and Client-Server Computing

Select a minimum of two and up to four track-specific topics for inclusion in the Qualifying Exam:
- CIS 5525 Neural Computation
- CIS 5526 Machine Learning
- CIS 5527 Data Warehousing, Filtering and Mining
- CIS 5603 Artificial Intelligence
- CIS 9590 Seminar in Advanced Topics in Computer Science
- CIS 9618 Web Applications Development
- CIS 9664 Knowledge Discovery and Data Mining
- CIS 9665 Advanced Topics in Data Base Systems
- CIS 9668 Design and Development of E-Commerce Systems
Total Credit Hours

24

Software Systems Track

Core Courses

All CIS courses are required for the Qualifying Exam:

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>CIS 5511</td>
<td>Programming Techniques</td>
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</tr>
<tr>
<td>CIS 5512</td>
<td>Operating Systems</td>
<td>3</td>
</tr>
<tr>
<td>CIS 5513</td>
<td>Automata and Formal Languages</td>
<td>3</td>
</tr>
<tr>
<td>CIS 5516</td>
<td>Principles of Data Management</td>
<td>3</td>
</tr>
<tr>
<td>CIS 5617</td>
<td>Computer Networking and Communication</td>
<td>3</td>
</tr>
<tr>
<td>CIS 9615</td>
<td>Design and Analysis of Algorithms</td>
<td>3</td>
</tr>
<tr>
<td>CIS 9618</td>
<td>Web Applications Development</td>
<td>3</td>
</tr>
<tr>
<td>Elective</td>
<td></td>
<td>3</td>
</tr>
</tbody>
</table>

Total Credit Hours 24

Elective requires approval of the Software Systems Track Chair.

Additional Requirements:

Ph.D. Qualifying Examination:
The Qualifying Examination tests the student on the fundamentals of Computer and Information Science and the basic body of knowledge in a track. It consists of a written exam on theory and algorithms, systems, and track-specific material. The Qualifying Exam is offered twice a year, usually in late January and late June.

Culminating Events:

Preliminary Examinations:
The goal of the preliminary examinations is to test the research skills and knowledge of the student and the appropriateness and feasibility of the proposed research. The exams are completed in two stages:

- Prelim I consists of written and oral components testing advanced track knowledge and in-depth knowledge of the research area. It includes a literature review of the area. Prelim I is open only to the Doctoral Advisory Committee and members of the department. It is to be taken within one year of passing the Ph.D. Qualifying Examination.
- Prelim II consists of written and oral components to assess the appropriateness of the research, including approach and methodology. It is designed to ensure that the selected research problem is of reasonable scope and significance and that the proposed dissertation is feasible. The written portion of Prelim II should be of sufficient quality to be publishable as a department technical report. This exam is open to the public.

The Doctoral Advisory Committee evaluates the preliminary examinations. Each member votes to pass or fail the student. In order to pass, a majority of the committee members must agree that the exam has been satisfactorily completed. The successful completion of the preliminary examinations produces a written understanding among the student, faculty advisor, and Doctoral Advisory Committee, specifying the work to be done to obtain final approval of the dissertation.

Students who are preparing to do their preliminary examinations should confirm a time and date with the Chair of their Doctoral Advisory Committee and register with the Administrative Coordinator one month prior to the date. The student and Chair receive confirmation of the time, date, and room of the examination.

Dissertation Proposal:
The dissertation proposal demonstrates the student's knowledge of and ability to conduct the proposed research. The proposal should consist of:

1. the context and background surrounding a particular research problem;
2. an exhaustive survey and review of literature related to the problem; and
3. a detailed methodological plan for investigating the problem.

The proposal should be finished and approved no more than one year after completing coursework. Upon approval, a timeline for completing the investigation and writing process are established.

Dissertation:
The doctoral dissertation is an original empirical study that makes a significant contribution to the field of Computer and Information Science. It should expand the existing knowledge and demonstrate the student's knowledge of research methods and a mastery of her/his primary area of interest. Dissertations should be rigorously investigated; uphold the ethics and standards of the Computer and Information Science field; demonstrate an
understanding of the relationship between the primary area of interest and the broader field of Computer and Information Science; and be prepared for publication in a professional journal.

The Doctoral Advisory Committee is formed to oversee the student’s doctoral research and is comprised of at least three Graduate Faculty members. Two members, including the Chair, must be from the Department of Computer and Information Sciences. Committee compositions must be approved by the CIS Graduate Committee. The Chair is responsible for overseeing and guiding the student’s progress, coordinating the responses of the committee members, and informing the student of her/his academic progress.

The Dissertation Examining Committee evaluates the student’s dissertation and oral defense. This committee is comprised of the Doctoral Advisory Committee and at least one additional Graduate Faculty member from outside the Department of Computer and Information Sciences. The Outside Examiner should be identified no later than the beginning of the term in which the student will defend the dissertation. The committee evaluates the student’s ability to express verbally her/his research question, methodological approach, primary findings, and implications. The committee votes to pass or fail the dissertation and the defense at the conclusion of the public presentation.

If a student needs to change a member of a committee, the new member must be approved by the CIS Graduate Committee and registered with the Administrative Coordinator and the Graduate School.

Students who are preparing to defend their dissertation should confirm a time and date with their Doctoral Advisory Committee and register with the Administrative Coordinator at least 30 days before the defense is to be scheduled. The student and Chair receive confirmation of the time, date, and room for the examination.

The Administrative Coordinator sends the Graduate School a completed “Announcement of Dissertation Defense” form, found at http://www.temple.edu/grad/forms/, at least 10 days before the defense. The department posts flyers announcing the defense.

**Contacts**

**Program Web Address:**
http://www.temple.edu/cis/graduate/

**Department Information:**
Dept. of Computer and Information Sciences
313 Science and Education Research Center
1925 N. 12th Street
Philadelphia, PA 19122-1801
cisadmit@temple.edu
215-204-8450

**Mailing Address for Application Materials:**
Dept. of Computer and Information Sciences
313 SERC (035-10)
1925 N. 12th Street
Philadelphia, PA 19122-1801

**Department Contacts:**

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