Area II: Computer Science

Guide to Graduate Study in Area II

Welcome to Area II!

Graduate study in computer science at MIT is centered in Area II of the Department of Electrical Engineering and Computer Science, EECS, where about 40 faculty members specialize in teaching and research directly related to the theory, design, and application of digital computer hardware and programming. This document meant for print purposes, contains the basic 'road-map' material which may be helpful to new graduate students who did not attend MIT as undergraduates.

Area II faculty chair, **Randy Davis**
Spring, 2009

Caption for header image above is on page 3 of this document.

Computer Science Programs

Academic programs for graduate students in the field of computer science lead to the Master of Engineering, Master of Science, Engineer's, and either Doctor of Philosophy or Doctor of Science degree. These programs are meant to prepare students for industrial, educational, governmental, and research positions. Either the Master of Science degree or the Master of Engineering degree (or an equivalent) is required for the Doctoral degree programs.

A thesis based on original work is required for each of the degrees in computer science. For detailed information on degree requirements consult Departmental Memoranda **3903** (Master's program) and **3800** (Doctoral program), available in hardcopy form from the EECS Graduate Office. 38-444 or online at: **http://www.eecs.mit.edu/grad/**.

- Complete The Technical Qualifying Examination (TQE) and a Research Qualifying Examination (RQE); details below.
- Complete the requirements for a Master's degree.
- Complete a minor program consisting of two subjects approved by the student's Doctoral Committee and Area Chair.
- Complete any additional graduate subjects (up to two) required by the Doctoral Committee.
- Carry out a teaching assignment as approved by the Doctoral Committee.
- Write and present a thesis proposal to the Thesis Committee.
- Complete a doctoral thesis and defense.

Several of the requirements require approval of the student's Doctoral Committee. Ideally, this is the student's Thesis Committee, composed of a Ph.D. thesis supervisor and at least two Ph.D. thesis readers. Students are encouraged to form thesis committees as early as they can, preferably by the time of the RQE. If a thesis committee does not exist by the time of the RQE, then the RQE committee (with input from the graduate faculty counselor) will evaluate the student's courses, plans for a minor, and plans for a teaching assignment at the time of the RQE. Also, if a thesis committee does not exist by the term following the RQE, then the department will appoint a temporary doctoral committee.

Computer science is a rapidly evolving field, and much of its knowledge and discipline is best acquired by direct involvement in research. Active research apprenticeship at an early stage is regarded as a vital part of the graduate program of every student, and early affiliation with an appropriate research group is important. For a list of faculty and research staff that supervise graduate research see **http://www.eecs.mit.edu/supervisors.html**

Qualifying Examinations

As part of the Doctoral program, every student must complete two formal examinations.

The Technical Qualifying Examination (TQE) requires students to demonstrate competence in three different subject areas: Systems, Theory, Artificial Intelligence and Point to Point Protocol. Students should complete all components of the TQE by the end of their third term in residence. Details on the TQE may be found below.

The objective of the Research Qualifying Examination (RQE) is to monitor students' research progress as well as skills in presentation, both written and oral, and assess fitness to pursue a PhD. Students should aim to complete the RQE by the end of their second year in residence.

For more information on examinations, refer to Departmental memorandum **3800** on the Doctoral program and to memoranda **3805** Technical Qualifying Examination and **3806** Research Qualifying Examination available from the Area II website **http://projects.csail.mit.edu/area2/public/** or the EECS Graduate Office.

The TQE in Area II

The TQE requires that a student demonstrate competence in four graduate subjects, selecting at least one subject from each of three groups (see Table below). Competence in each subject can be demonstrated by earning at least an A- grade. If a student gets two or more grades less than A-, an oral examination will be required on all subjects for which the grade is less than A-. Each subject grade less than a B- also requires an oral examination in that subject.

GROUP I	Systems: (6.821 or 6.827) (6.824 or 6.829 or 6.830) (6.375 or 6.823 or 6.831**)
GROUP II	Theory: (6.840 or 6.842 or 6.875) (6.852) (6.854 or 6.856)
GROUP III	Artificial Intelligence: (6.345 or 6.863 or 6.864 or 6.866 or 6.869) (6.437 or 6.438 or 6.825 or 6.867) (6.831** or 6.839* or 6.878)

*6.839 may be chosen as a second subject in Artificial Intelligence but not as the only subject in Group III.
** 6.831 may be chosen as a second subject in Systems or in Artificial Intelligence but not as the only subject in Group I or Group III.

Each student, with the aid of his or her graduate counselor, should formulate a plan for satisfying the TQE requirement. This plan should be submitted to the EECS Graduate Office (38-444), on form **3805** (at the end of the TQE Memo, **3805**), by registration day of the second semester. Each student should plan to complete TQE subjects no later than the end of the third semester.

TQE oral exams, if needed, should be taken after all four subjects have been completed, usually by the end of the third semester.

The RQE in Area II

The RQE is normally taken on or near completion of a Master's research project or comparable research experience--- preferably at the end of the third graduate term, and in not later than the end of the fourth graduate term.

The Area II Chair appoints a two person RQE Committee. The student will provide the committee, two weeks prior to the exam, a conference-style (less than 20 double-spaced pages) paper based on original research by the student (usually the SM or MEng thesis). The RQE Committee conducts an oral examination in which the student is asked to present his/her research and to defend it in discussion. See Memo **3806** for more details.

Graduate Subjects

Systems		**Theory**		**Artificial Intelligence**	
6.263	Data communications networks	6.336	Introduction to Numerical Algorithms	6.345	Automatic Speech Recognition
6.371	Introduction to VLSI Systems	6.337	Numerical Methods of Applied Mathematics	6.825	Techniques in Artificial Intelligence
6.821	Programming Languages	6.338	Parallel Scientific Computing	6.833	Human Intelligence Enterprise
6.823	Computer System Architecture	6.840J	Theory of Computation (grad version of 6.045)	6.834	Intelligent Embedded Systems
6.824	Distributed Computer Systems Engineering	6.841J	Advanced Complexity Theory	6.836	Embodied Intelligence
6.826	Principles of Computer Systems	6.844	Computability Theory of and with Scheme	6.838	Advanced Topics in Computer Graphics
6.827	Multithreaded Parallelism: Language and Compilers	6.852J	Distributed Algorithms	6.839	Advanced Computer Graphics
6.829	Computer Networks	6.854J	Advanced Algorithms	6.863J	Natural Language and the Computer Representation of Knowledge
6.837	Computer Graphics	6.855J	Network Optimization	6.866	Machine Vision (graduate version of 6.801)
6.846	Parallel Processing: Systems Architecture and Applications	6.856J	Randomized Algorithms	6.867	Machine Learning and Neural Networks
6.857	Network and Computer Security	6.859	Combinatorial Optimization	6.868J	The Society of Mind
		6.875J	Cryptography and Cryptanalysis	6.871	Knowledge-based Applications Systems

Graduate Subjects, continued					
Systems		**Theory**		**Artificial Intelligence**	
		6.876J	Advanced Topics in Cryptography	6.872J	Medical Computing
				6.873J	Biomedical Decision Support
				6.878	Advanced Computational Biology: Genomes, Networks, Evolution

Research in Computer Science

Perhaps the most important facet of graduate education in Area II is involvement in original research.

The primary laboratory concerned with computer science research is the **Computer Science and Artificial Intelligence Laboratory**, CSAIL (http://www.csail.mit.edu/). The Laboratory for Computer Science and the Artificial Intelligence Laboratory merged on July 1, 2003 to form CSAIL. Over 750 personnel, including approximately 85 faculty and research supervising staff and over 300 graduate students, are affiliated with CSAIL. In addition, there are several research groups in the **Laboratory for Information and Decision Systems**, LIDS (http://lids.mit.edu/), the **Research Laboratory of Electronics**, RLE (http://www.rle.mit.edu/) and the **Media Laboratory**, which make extensive and sophisticated use of computers and digital technology in their work.

To facilitate involvement in research, entering students are urged to associate as soon as possible with a research group within a laboratory. This association is readily changed if a student's interests change.

Summaries of computer science research in Area II can be found at: **http://www.csail.mit.edu/node/39**.

Lists of the faculty members in Area II including their research interests can be found online at:
http://www.eecs.mit.edu/grad/area2/faculty.html.

Header image, page one of this document: EECS Area II Prof. **Antonio Torralba** and his team have been developing very short codes or numerical representations that can be derived from individual images to enable automated cataloging of the billions of images on the Internet. Current to future applications of this work range from automatic indexing of digital images through downloadable software to making true machine vision possible in the future--enabling robots to make sense of visual (numeric) data from their cameras and use this to locate themselves. For more information see: **http://people.csail.mit.edu/torralba/tinyimages/** and the May, 2008, MIT News Office **article**.

EECS website spotlights featuring EECS graduate students, including the graduate/undergraduate student research team, pictured below and headed by Prof. David Karger to develop a new organizing software, available at **http://groups.csail.mit.edu/haystack/listit/**.
Read more: **http://www.csail.mit.edu/node/546** and **http://www.eecs.mit.edu/spotlights/gradstudents_researchST09.html**.