



## (2007-) 2009 Computer Science Program – LSA MINOR

Electrical Engineering & Computer Science Department  
Undergraduate Advising Office - CSE  
2808 CSE Bldg., [ugadmin@eecs.umich.edu](mailto:ugadmin@eecs.umich.edu), 734.763.6563

### Welcome to the Electrical Engineering and Computer Science Department!

Working toward your minor in Computer Science is a smart way to broaden your horizons and make yourself more marketable to employers. As a Computer Science Minor, you are welcome (and encouraged) to visit with your LSA-CS Minor Advisor each semester or so to check on your progress and seek advice about academics and computer-related career opportunities.

### Getting information about the LSA Computer Science Minor:

Students interested in pursuing an academic minor in Computer Science can meet with a LSA Computer Science Minor Advisor to discuss the minor. You may schedule advising appointments on North Campus or Central Campus.

- On North Campus, you can make an appointment online at <https://www.eecs.umich.edu/eecs/undergraduate/index.html> or through the EECS Undergraduate Advising Office by stopping in at 2808 CSE.
- On Central Campus, students can contact the LSA Advising Center at 1255 Angell Hall, or by calling (734) 764-0332.

### Declaring the LSA Computer Science Minor:

At the time you declare, you should have satisfied the prerequisites to the minor, and either have taken or be currently taking one or more of the core courses. You must declare before you can take any of the electives. To declare, schedule an advising appointment on North Campus.

### Prerequisites to the Academic Minor:

- MATH 115, and
- prior programming experience: EECS 183, ENGIN 101, or equivalent.

### Academic Minor Program:

16 credits of courses as follows:

#### 1. Three Core Courses (4 credits each):

- EECS 203: Discrete Mathematics
- EECS 280: Programming and Introductory Data Structures
- EECS 281: Data Structures and Algorithms

#### 2. Electives:

At least **one** 4-credit elective selected from:  
EECS 482, 483, 484, 487, 490, 492, or 493

[Course Descriptions follow.]

### Questions about the LSA Computer Science Minor?

Contact:

Professor Brian Noble, Chief Program Advisor ([clsaadvisor@umich.edu](mailto:clsaadvisor@umich.edu))  
Anna Cihak, Advising Office Staff ([cihak@umich.edu](mailto:cihak@umich.edu))  
EECS-CSE Undergraduate Advising Office (UAO)  
2808 CSE Bldg.  
Phone: (734) 763 – 6563

## **COURSE DESCRIPTIONS:**

### **I. Minor Prerequisites:**

**MATH 115. Calculus I** *Prerequisite:* 3-4 years HS math including trigonometry. *I, II, IIIa, IIIb (4 credits)* The course presents the concepts of calculus from four points of view: geometric (graphs), numeric (tables), symbolic (formulas), and verbal descriptions. Students will develop their reading, writing and questioning skills, as well as their ability to work cooperatively. Topics include functions and graphs, derivatives and their applications to real-life problems in various fields, and an introduction to integration. The classroom atmosphere is interactive and cooperative. Both individual and team homework is assigned.

**EECS 183. Elementary Programming Concepts** *Prerequisite: none. (Credit for only one: EECS 183, ENGR 101) I, II (4 credits)* Fundamental concepts and skills of programming in a high-level language. Flow of control: selection, iteration, subprograms. Data structures: strings, arrays, records, lists, tables. Algorithms using selection and iteration (decision making, finding maxima/minima, searching, sorting, simulation, etc.) Good program design, structure and style are emphasized. Testing and debugging. Not intended for Engineering students (who should take ENGR 101), nor for CS majors in LSA who qualify to enter EECS 280.

**ENG 101. Introduction to Computers and Programming** *Prerequisite: prior or concurrent enrollment in Math 115 or equivalent. I, II (4 credits)* Algorithms and programming in C++ and MATLAB, computing as a tool in engineering, introduction to the organization of digital computers.

### **II. Minor Program Core Courses [each of the following]:**

**EECS 203. Discrete Mathematics** *Prerequisite: MATH 115. I, II (4 credits)* Introduction to the mathematical foundations of computer science. Topics covered include: propositional and predicate logic, set theory, function and relations, growth of functions and asymptotic notation, introduction to algorithms, elementary combinatorics and graph theory, and discrete probability theory.

**EECS 280. Programming and Introductory Data Structures** *Prerequisite: MATH 115 and prior programming experience. I, II (4 credits)* Techniques and algorithm development and effective programming, top-down analysis, structured programming, testing, and program correctness. Program language syntax and static and runtime semantics. Scope, procedure instantiation, recursion, abstract data types, and parameter passing methods. Structured data types, pointers, linked data structures, stacks, queues, arrays, records, and trees.

**EECS 281. Data Structures and Algorithms** *Prerequisite: EECS 203 and EECS 280. I, II (4 credits)* Introduction to algorithm analysis and O-notation; Fundamental data structures including lists, stacks, queues, priority queues, hash tables, binary trees, search trees, balanced trees and graphs; searching and sorting algorithms; recursive algorithms; basic graph algorithms; introduction to greedy algorithms and divide and conquer strategy. Several programming assignments.

### **III. Minor Program Electives [at least one from the following]:**

**EECS 482. Introduction to Operating Systems** *Prerequisite: (EECS 281 and EECS 370) or graduate standing. I, II (4 credits)* Operating system design and implementation: multi-tasking; concurrency and synchronization; inter-process communication; deadlock; scheduling; resource allocation; memory and storage management; input-output; file systems; protection and security. Students write several substantial programs dealing with concurrency and synchronization in a multi-task environment, with file systems, and with memory management.

**EECS 483. Compiler Construction** *Prerequisite: EECS 281 or graduate standing. I (4 credits)* Introduction to compiling techniques; including parsing, algorithms, semantic processing and optimization. Students implement a compiler for a substantial programming language using a compiler generating system.

**EECS 484. Database Management Systems** *Prerequisite: EECS 281 or graduate standing. I, II (4 credits)* Concepts and methods for the design, creation, query and management of large enterprise databases. Functions and characteristics of the leading database management systems. Query languages such as SQL, forms, embedded SQL, and application development tools. Database design, integrity, normalization, access methods, query optimization, transaction management and concurrency control and recovery.

**EECS 487. Interactive Computer Graphics** *Prerequisite: EECS 281 or graduate standing. I, II (4 credits)*

Computer graphics hardware, line drawing, rasterization, anti-aliasing, graphical user interface (GUI), affine geometry, projective geometry, geometric transformation, polygons, curves, splines, solid models, lighting and shading, image rendering, ray tracing, radiosity, hidden surface removal, texture mapping, animation, virtual reality, and scientific visualization.

**EECS 490. Programming Languages** *Prerequisite: EECS 281. II (4 credits)* Fundamental concepts in programming languages. Course covers different programming languages including functional, imperative, object-oriented, and logic programming languages; different programming language features for naming, control flow, memory management, concurrency, and modularity; as well as methodologies, techniques, and tools for writing correct and maintainable programs.

**EECS 492. Introduction to Artificial Intelligence** *Prerequisite: EECS 281 or graduate standing. I, II (4 credits)* Fundamental concepts of AI, organized around the task of building computational agents. Core topics include search, logic, representation and reasoning, automated planning, decision making under uncertainty, and machine learning.

**EECS 493. User Interface Development** *Prerequisite: EECS 281 or graduate standing. II (4 credits)* Concepts and techniques for designing computer system user interfaces to be easy to learn and use, with an introduction to their implementation. Task analysis, design of functionality, display and interaction design, and usability evaluation. Interface programming using an object-oriented application framework. Fluency in a standard object-oriented programming language is assumed.

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## LSA Academic Minor Information:

[Per: <http://www.lsa.umich.edu/bulletin/chapter3/minors>, Retrieved: 09/10/09]

An academic minor will require no less than 15 credits of course work, will show structure and coherence, and will contain some upper-level courses. At least 10 out of the 15 credits must be taken in-residence. Students who declare and complete an approved academic minor will receive a notation on their student transcript but not on their diploma.

### Policies for the Academic Minor (Effective Fall 2008)

- Each A.B. or B.S. student who wishes to complete an approved academic minor must develop a plan for the academic minor in consultation with a department or program advisor, who must also approve it.
- After developing a plan for an academic minor with the student, the program or department advisor has the academic minor entered on the student's record.
- The academic minor is not an option available to students earning the B.G.S. degree.
- An individually designed academic minor is not allowed.
- Courses in the academic minor must be elected for a grade.
- Students may not elect a concentration and an academic minor, or two academic minors, in the same department or program, unless a specific exemption to this policy is noted in the academic minor description in this Bulletin.
- No course may be used to satisfy the requirements of more than one academic minor.
- Students may not use more than one course to meet both the requirements of an academic minor and the prerequisites or requirements of a concentration.
- If the academic minor has prerequisites, courses used as prerequisites to a concentration may also count as prerequisites to the academic minor.
- Advanced Placement credits may not be used to meet the requirements of an academic minor, but may be used to meet prerequisites.
- Courses elected to meet the requirements of an academic minor also may be part of the student's area distribution plan.
- A student must earn an overall GPA of at least 2.0 in the academic minor, including any prerequisites.
- Courses that are part of a student's academic minor may also meet the Language Requirement, the Upper-Level Writing Requirement, the Race & Ethnicity Requirement, or the Quantitative Reasoning Requirement.
- Students may not complete an academic minor after graduation, and an academic minor may not be converted to a concentration after graduation.

## COMPUTER SCIENCE LSA: 2004 (-2009) Minor Progress Sheet

Last Name:						First Name:																													
UMID:						Unique Name / Email:																													
Trans. Inst.:						Date:																													
<b>Pre-Minor (Declaration) Requirements</b> Courses or equivalent to those below:						<b>College Requirements</b>																													
Subj.	Nbr.	Hrs.	Term	Grade	Note:	<i>LSA students must consult with their LSA college advisor in Angell Hall to discuss college requirements. Engineering students should meet with their program advisor.</i>																													
MATH	115	4																																	
EECS	183	4																																	
<b>CS Minor Program Core: 12 cr. min.</b> All courses below:						<table border="1" style="width: 100%; height: 40px; border-collapse: collapse;"> <tr><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td></tr> </table>																													
Subj.	Nbr	Hrs	Term	Grade	Note:																														
EECS	203	4																																	
EECS	280	4																																	
EECS	281	4																																	
<b>Upper-Level CS Elective: 4 cr. min.</b> Choose <b>one</b> from below:						<b>Program/Concentration Requirements</b>																													
EECS	482	4				<i>Students should meet with their Program or Concentration Advisors to discuss major requirements and how they may interact with the minor.</i>																													
EECS	483	4																																	
EECS	484	4																																	
EECS	487	4																																	
EECS	490	4																																	
EECS	492	4																																	
EECS	493	4																																	

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