Thank you for your interest in the UM Computer Science – LSA program!

The fast rate of innovation in computer technology has created many new, exciting opportunities for students with Computer Science undergraduate degrees. Employment opportunities include positions in: game design, medicine, computer graphics, security, business management, consulting, software engineering, computer systems analysis, data communications administration, robotics, artificial intelligence, machine learning, hardware development, and many others. Major employers of recent graduates include many prominent U.S. corporations and research laboratories, such as Amazon, Apple, AT&T, Cisco, Deutsche Bank, Electronic Arts (EA), Google, IBM, Intel, Microsoft, NASA, and PricewaterhouseCoopers (to name a few). Some students also join (or even found) start-ups! In addition, an undergraduate degree in CS provides opportunities for masters, doctoral, and professional studies in various fields.

Computer science is an exceptional field. Computers have been around for only 60 years while most other scientific disciplines have been around for centuries. Progress in computer science has been extraordinarily rapid during this period, and computers have had a profound impact on society. (Can you envision life without text messaging, cell phones, and WiFi?) Computer science research has provided much of the intellectual foundation and creative energy that has fueled that transformation, and it continues to be an extremely exciting field.

Getting Advice and Information

- Plan to schedule an appointment with a CS Faculty Advisor each term, even if you know what you want to take. Careful planning and frequent review of requirements will help ensure that you will have no problems at graduation time. We have CS Faculty Advisors who will be happy to help you—just make an appointment online: https://www.eecs.umich.edu/eecs/undergraduate/index.html.

- The CS Faculty Advisors based in the EECS department do not provide any advice or guidance on meeting LSA requirements. Please review these periodically with an LSA Advisor. Call 734-764-0332 to make an appointment with the LSA Newnan Advising Office. However, all questions about the CS program requirements should be directed to the CS Faculty Advisors here in the CSE Undergraduate Advising Office.

- The EECS website hosts the most recent program and policy information; this should be your first stop if you have questions about registration, course offerings, time schedules, advising appointments, basic requirements, etc.

- When you declare, you will be added automatically to a CS-LSA email list. Announcements are sent weekly and include information about courses and academic matters, as well as extracurricular opportunities. Declared CS-LSA Majors also have access to the Engineering Career Resource Center, ECRC, for finding internships, co-ops, and jobs!

- Because declaring the CS-LSA Major will impact a LSA student’s U-M tuition, some students avoid declaring as long as possible, and at times purposely avoid the CS Faculty Advisors. This is a bad idea! Some students end up making mistakes in pursuing requirements that cost them an extra term (or more), and in some cases, tuition has been retroactively charged. Always seek advice early and often to use your time, energy, and tuition most expediently.

- Contact Information: Computer Science Undergraduate Advising Office, 2808 Beyster Bldg., North Campus, ugadmin@eecs.umich.edu, (734) 763-6563. You can also email cslsaadvisor@umich.edu.

THIS DOCUMENT DESCRIBES THE COMPUTER SCIENCE PROGRAM REQUIREMENTS FOR STUDENTS IN THE COLLEGE OF LITERATURE, SCIENCE, AND THE ARTS (LSA)

EECS offers two paths to the Computer Science undergraduate degree: one for students with the College of LSA (CS-LSA) and another for students in the College of Engineering (CS-Eng). For more information, please see: http://www.eecs.umich.edu/undergraduate/cs_vs_clsa.html or contact the CSE Undergraduate Advising Office.
Pre-Declaration Requirements
To declare the Computer Science Major (CS-LSA), a student must first complete 4 pre-declaration requirements with a final letter grade posted on their transcript.

- Math 115
- Math 116
- EECS 203 (or Math 465 or Math 565)
- EECS 280
- Must achieve a 2.5 GPA among the pre-declaration courses and obtain at least a “C” in each course.

Performance in these courses is indicative of aptitude for the CS program, and students who do not perform well should reconsider continuing. Students may repeat each pre-declaration requirement once, for a maximum of two attempts in each requirement, and only the final grade will be used to compute the pre-declaration GPA. Only requirements with grades of "C+" or below can be repeated for this purpose. If you are having trouble achieving the pre-declaration GPA, it is vital to meet with a CS advisor without delay. If all pre-declaration requirements are satisfied by transfer credit, a student must receive a final letter grade of a "B-" or better in a CS Core course at U-M Ann Arbor before declaring.

Core Courses
1. Computer Science (all three of the following): EECS 281, EECS 370, and EECS 376.
2. Probability & Statistics (one of the following): STATS 250, STATS 280, STATS 412, STATS 426, EECS 301, EECS 401, ECON 451, IOE 265, or TO 301.

Upper Level CS Technical Electives (ULCS)
16 credits must be in approved Upper Level CS Electives. ULCS electives cover a wide variety of topics in computing. All are challenging and substantial courses. ULCS electives must be selected from the following list of EECS courses. Rarely will any course transfer in as a ULCS elective. See pg. 7 for more assistance in selecting your ULCS with CS-LSA Tracks.

373 Design of Microprocessor Based Systems
381 Object-Oriented and Advanced Programming
388 Introduction to Computer Security
427 VLSI Design I
442 Computer Vision
445 Introduction to Machine Learning
467 Autonomous Robotics
470 Computer Architecture
475 Introduction to Cryptography
477 Introduction to Algorithms
478 Logic Circuit Synthesis and Optimization
[481 Software Engineering*]
482 Introduction to Operating Systems
483 Compiler Construction
484 Database Management Systems
485 Web Database and Information Systems
486 Information Retrieval & Web Search
487 Interactive Computer Graphics
489 Computer Networks
490 Programming Languages
492 Introduction to Artificial Intelligence
493 User Interface Development
[494 Computer Game Design and Development*]

*EECS 481 and 494 may be used as ULCS credit only if taken in Winter 2017 or before.

Note: A EECS course may only count towards one requirement- either ULCS or Capstone, not both.

Capstone Course
Students must take an approved EECS CS course listed below to fulfill the Capstone (443 for students pursuing a CS Honors degree). A Capstone should be taken during one of the final two semesters in order to take the best advantage of technical knowledge gained in all previous courses. Some students prefer the Capstone in their final term to maximize the prior coursework that they can bring to their project, while others prefer it in their next-to-final term so that they can point to this experience during job interviews in their final term. Students pursuing an Honors thesis, or those who wish to take a non-CS Capstone, should schedule an appointment to speak with a CS-LSA advisor.

441 Mobile App Development for Entrepreneurs
443 CS Honors Thesis Course
467 Autonomous Robotics
470 Computer Architecture
473 Advanced Embedded Systems
481 Software Engineering
494 Computer Game Design and Development
497 Major Design Projects

Pursuing Additional Major(s)
Students pursuing CS-LSA in addition to one or more other majors must ensure they have devoted significant, independent work toward each major. To that end, only three courses may be overlapped between requirements for CS-LSA and requirements for any other major. Students should consult with a Faculty Advisor to ensure compliance.
SAMPLE SCHEDULE FOR COMPUTER SCIENCE – LSA

<table>
<thead>
<tr>
<th>Credits</th>
<th>Term 1</th>
<th>T2</th>
<th>T3</th>
<th>T4</th>
<th>T5</th>
<th>T6</th>
<th>T7</th>
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<tr>
<td><strong>Programming Prerequisite Course (must be taken before EECS 280)</strong></td>
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<tr>
<td>EECS 183 Elementary Programming Concepts</td>
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<tr>
<td><strong>Pre-Declaration Reqs. – must have final letter grade posted and 2.5 GPA among these 4 courses to declare (16 hrs.)</strong></td>
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<td>Mathematics 115 Calculus I</td>
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<td>Mathematics 116 Calculus II</td>
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<tr>
<td>EECS 203 Discrete Mathematics&lt;sup&gt;1&lt;/sup&gt;</td>
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<tr>
<td>EECS 280 Programming and Elementary Data Structures</td>
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<tr>
<td><strong>Program Core (16 hours)</strong></td>
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<tr>
<td>EECS 281 Data Structures and Algorithms</td>
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<tr>
<td>EECS 370 Introduction to Computer Architecture</td>
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<td>EECS 376 Foundations of Computer Science</td>
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<tr>
<td>STATS 250, STATS 280, STATS 412, STATS 426, EECS 301, EECS 401, IOE 265, or TO 301</td>
<td>4</td>
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<tr>
<td><strong>Capstone Course (3-4 hours)</strong></td>
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<tr>
<td>Appvd. MDE CS course/CS Honors Thesis course</td>
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<td>4</td>
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<tr>
<td><strong>Upper Level CS Electives (16 hours)</strong></td>
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<td>Upper Level CS Technical Electives&lt;sup&gt;2, 3&lt;/sup&gt;</td>
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<tr>
<td><strong>Total CS-LSA (55-56 hours)</strong></td>
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<td>8</td>
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<td>8</td>
<td>8</td>
<td>4</td>
</tr>
</tbody>
</table>

**LSA Requirements:** See an LSA Advisor in the Newnan Academic Advising Center to discuss these College requirements.

**Notes:**
- C- Rule: Among science, engineering, and mathematics courses, a grade of C- or below is considered unsatisfactory. Credits from a course may only be used to fulfill a single CS degree requirement (no double counting).

<sup>1</sup> Math 465 or Math 565 can be used to satisfy this requirement.
<sup>2</sup> ULCS: Approved Computer Science courses at the 300-level or higher; see page 2 for a list of approved courses.
<sup>3</sup> ULCS: Students completing interdisciplinary tracks must have at least 12 credits of ULCS. See "CS-LSA Tracks" (page 7).

### Major Grading & Repeat Policies

Grades of "C" or better must be achieved in all courses used to satisfy the pre-declaration and other major requirements. A grade of "C-" or below is considered a failing grade and the course must be repeated or substituted with another class. Students are limited to attempting each of the three 200-level courses (EECS 203, EECS 280, EECS 281) at most twice. An attempt includes, but is not limited to, a notation of any letter grade ("A-F"), withdraw ("W"), Pass/Fail ("P"/"F"), Transfer ("T"), or Incomplete ("I") posted on your U-M transcript. At most one attempt from Summer 2014 and earlier will count against this limit. Exceptions to this rule can be granted by the CS-LSA Chief Program Advisor only in extraordinary circumstances.

### CS Honors Program

The Honors Program in Computer Science is open to LSA students completing the Computer Science B.S. degree program. Students can earn an Honors degree in Computer Science without having been enrolled in the LSA Honors Program in the first and second years at U-M. Students are responsible for finding a faculty mentor whose research area aligns with their interest(s) and who is willing to oversee the thesis project. A summary of requirements is below; see the CS Honors Program handout for more detailed information:

- 3.2 or higher GPA in Math 115, Math 116, EECS 203, and EECS 280
- 3.5 GPA in the CS major (see page 7)
- Must complete a CS Honors thesis course (EECS 443), write an original thesis that is evaluated and deemed worthy of honors, and give an oral presentation of the thesis
- 3.4 overall UM GPA at time of graduation
Transfer Credit

If you want a CS course taken at another institution to be counted toward a CS major requirement, you should work with Undergraduate Admissions to have the course and its credits appear on your transcript. Normally, if LSA grants credit, your transcript will reflect this as “Departmental Credit” with a course number ending in “X” such as “EECS 201X”. You cannot request course equivalency for a course not yet on your transcript, so make sure that this has occurred before continuing on to the next step. After the course is on your transcript, you may come to the CS advising office to request that the “Departmental Credit” be changed to an EECS course you believe is equivalent. The process involves filling out a form, and providing detailed material about the course that you took, including syllabus, book, handouts, and especially the assignments and exams that you submitted and received back with grades. These materials will be evaluated to determine whether the course you took covers similar material at sufficient depth to be considered equivalent.

CS courses at U-M are considered more intensive than courses with similar names and topics at most other institutions. Therefore, unless the material supplied clearly demonstrates that you took a similarly demanding course, it is unlikely that equivalency will be granted. It is very rare for any course to transfer in as a ULCS elective; in the rare case where it does transfer, note that a student cannot receive transfer credit for more than one ULCS elective.

Decisions about equivalency for courses in other subjects (math, science, etc.) are up to those departments. We cannot evaluate a course in another subject even if the course is part of our requirements.
Pay particular attention to…

**Mental health.** If you are feeling stressed, depressed or just need someone to talk to, there are many places to find support on campus. For more information, see: https://www.uhs.umich.edu/stressresources

**Information from friends.** Your friends can be a good source of information on some topics, like the workload in courses they have taken. Sometimes this information is timely and correct, but often it is confused and garbled rumors. We have multiple programs, old and new sets of rules, and sometimes grant individual exceptions to requirements when it makes sense for an individual student's plan of study. Thus if you hear something of interest, don't assume it is right—contact the CSE Advising Office for the correct version.

**The rules stated in the Program Requirements, and the prerequisite chains for EECS courses.** Our program has a full schedule, so mistakes in understanding requirements or course sequencing can cost you additional semesters.

**Course sequencing and workload.** We periodically ask students about the workload associated with CS classes, and the survey results are available at http://www.eecs.umich.edu/eecs/undergraduate/survey/. Survey results are summarized below. However, note there is considerable variance for courses because different students find different aspects of courses challenging (writing complicated programs, understanding mathematical concepts, etc.).

- *Extremely heavy (average workload > 3 on 4 point scale):* 373, 381, 467, 470, 482, 494
- *Heavy (2.5-3 on 4 point scale):* 281, 442, 445, 477, 483
- *Moderate (1.75-2.5 on 4 point scale):* 203, 280, 370, 376, 388, 441, 475, 478, 481, 484, 485, 487, 489, 492, 493, 497
- *Light (1-1.75 on 4 point scale):* 183, 285, 496

CS courses can be more demanding relative to many courses at the University, so we advise students to avoid overloading themselves. For most CS students, a load of 2 CS courses in the same semester is normal, but that can vary based on the combination of CS courses chosen (e.g., a CS course with an extremely heavy load should only be paired with one with a moderate load or less), as well as what non-CS courses are being taken at the same time. We encourage students to talk with faculty advisors and peer advisors if they have questions about the course load they are considering.

**EECS 203 & EECS 280:** Taking EECS 203 (Discrete Structures) [note: MATH 465 or 565 are acceptable alternatives] and EECS 280 (Programming) simultaneously often works well, and these are the two prerequisites for the "gateway" course, EECS 281 (Data Structures and Algorithms). However, note that EECS 183 is a prerequisite for EECS 280.

**Take EECS 281 as soon as you can,** and declare the Computer Science major during that semester if you plan to take ULCS courses the following term. Because the ULCS electives are open only to declared CS majors, declaring will allow you to register for the Upper Level Electives the next semester, which will help you get the choices you want as you finish the program.

All of our ULCS electives are challenging and substantial courses, and cover a wide variety of topics in computing. The best way to choose your electives is to consider the kind of work or career path you want to pursue after getting your degree, and then choose the electives that will help you do it (see "CS-LSA Tracks" on page 7).

**EECS 498:** This is the generic number for "Special Topics" courses. Individual sections may be approved by the Department to count as ULCS credit (prerequisites and class information is posted on the UG website); do not assume these courses will count for any requirement unless explicitly indicated by the Department.

If you are interested in Operating Systems and Networks (EECS 482/489), taking EECS 370 (Computer Organization) at the same time as EECS 281 will enable you to register the next semester for EECS 482 (Operating Systems), which is the prerequisite for EECS 489 (Networks).

If you are interested in taking an additional non-required Math course, we recommend a linear algebra course such as MATH 217, MATH 417, or MATH 214. The content will be helpful if you are considering Machine Learning or Robotics.
Research & Involvement Opportunities

Majoring in Computer Science at UM provides many exciting opportunities. These include:

**Research: Pursue an Independent Study or Honors Thesis.**

A great deal of leading-edge academic research is carried out at UM. If you show that you can do the work, you can get involved in this type of research as an undergraduate, which will provide you with extraordinarily valuable training for future work in the field. EECS 399 and EECS 499 (independent study) are both Directed Study courses that allow you to work with a faculty member in their research lab. It is a great way to get a letter of reference for grad school. If one of your professors is doing work that is interesting to you, approach him or her to discuss this possibility. It is usually most valuable to do a 499 relatively late in your program, when you have acquired knowledge and skills that contribute to the work, and have a clearer picture of what areas you are most interested in. (But keep in mind that most grad school applications are due late December.) Students who have a strong background in research, academics, and have a faculty mentor, should consider enrolling in the CS Honors Program thesis course.

**Teaching: Become an Instructional Aid.**

Primarily undergraduates lead discussion sections for EECS 183, EECS 203, EECS 280, and ENGR 100 (CSE-based). As a section leader, you will have the chance to teach the next generation of CS majors and get them excited about computing. If you have done well in your CS courses and have an aptitude for and interest in teaching, you may consider pursuing the Instructional Aid opportunity.

**Mentoring: Become a Peer Advisor.**

Share your experiences with other undergraduates. There are opportunities at the department and college level as well as through numerous student organizations. See the CSE Undergraduate Advising Office.

**Getting Involved: Join an EECS Student Group.**

- **CSE Scholars**: CSE Scholars at the University of Michigan is a student society for computer science and engineering students (CS-Eng, CS-LSA, and CE). CSE Scholars seeks to build a challenging and supportive diverse community of scholars. [http://www.eecs.umich.edu/~cseschol](http://www.eecs.umich.edu/~cseschol)

- **HKN (Eta Kappa Nu)**: Strives to help progress the engineering student body through leadership, scholarship, and service. HKN helps members by providing networking and educational opportunities. [http://hkn.eecs.umich.edu](http://hkn.eecs.umich.edu)

- **IEEE (Institute of Electrical and Electronics Engineers)**: The UM campus branch of IEEE hosts social events, conducts community service events, and brings in technical speakers for meetings and recruiting purposes. [http://ieee.eecs.umich.edu](http://ieee.eecs.umich.edu)

  A handout profiling other CS student groups is available at the Undergraduate Advising Office, 2808 Beyster.

**Getting Experience: Internships, Co-ops, and Job Opportunities.**

Many companies hire students for internships upon completion of EECS 281 (for some, even after EECS 280). Since CSE graduates are in great demand, many companies believe in getting potential hires into their company very early.

When looking for that perfect internship, co-op, or permanent job, your first step should always be to check in with the Engineering Career Resource Center (ECRC) to review their list of opportunities. The department forwards all job and internship postings to this office (see: [http://career.engin.umich.edu](http://career.engin.umich.edu)). Note that CS-LSA students have full access to the ECRC once they are declared.

The October and January Job Fairs are great places to interview for internships; make sure you register with the Engineering Career Resource Center (ECRC) - [http://career.engin.umich.edu](http://career.engin.umich.edu) for more information.
A good way to choose your ULCS electives is to have an idea about the kind of work or career path you want to pursue after getting your degree, and then to choose the courses that will help you achieve your goals. A student can work with an advisor to identify the combination of electives tailored to his or her needs. For some of the more established and anticipated paths, however, we have predefined the CS-LSA tracks listed below that provide a coherent group of elective courses appropriate for those paths. Note that if you take a 500-level course to satisfy the requirements of a track that you successfully complete, then the course can count towards your ULCS credit requirements.

The CS-LSA Tracks are optional and a student does not have to pursue any track, and instead can select other combinations of approved ULCS courses selected with an advisor’s advice. CS-LSA Tracks do not appear on the student’s transcript or diploma; however, the CSE Undergraduate Advising Office can provide a letter stating a student has completed a specific track within the CS-LSA major plan. All final grades need to be posted to receive a CS-LSA Track completion letter.

**Artificial Intelligence:** AI is a broadly based multidisciplinary area comprising theoretical, experimental, and applied investigations of intelligent systems. Required: 1) EECS 492; 2) EECS 445 or 545; 3) one of EECS 442, 467, 543, 545, 595, 692; and 4) a 4th ULCS of student’s choice.

**Bioinformatics:** Computation plays an increasingly important role in modern biology. This is an interdisciplinary track. Required: three ULCS courses- 1) at least two of: EECS 477, 484, 485, 492; 2) a 3rd ULCS course of student’s choice; 3) BIOINF 527; and 4) BIOLOGY 305 or MCDB 310. This track is not open to Biology Majors.

**Data and Information:** Fast information storage and retrieval are crucial to many computer applications, and manipulating large data collections on servers or networks pose difficult challenges for computer professionals. Required: 1) EECS 484; 2) EECS 485; 3) one of EECS 477, 482, or 492; and 4) a 4th ULCS of student’s choice.

**Economics and Computation:** As social and market interactions become more computational, computer science has adopted more traditional economic concepts such as decentralized decision-making and allocation of resources. This is an interdisciplinary track. Required: 1) at least one of: EECS 492 or EECS 547; 2) at least two of: EECS 475, 485, 492, 547, 588; 3) ECON 401; and 4) one of: ECON 406, 409, 431, 442. This track is not open to Economics Majors.

**Robotics and Vision:** Until recently most robots were stationary manufacturing devices, but they are rapidly evolving into mobile information gathering and decision making platforms, with vision being perhaps their most important information gathering capability. Required: 1) EECS 467; 2) EECS 442; 3) one of: EECS 492, EECS 445, 542, 543, 567, 568; and 4) a 4th ULCS course of student’s choice.

**Security:** Security for hardware, software, and networked systems is one of the fastest growing areas of computer science. Required: 1) EECS 388; 2) EECS 475 or 575; 3) EECS 482, 484, or 485; and 4) a 4th ULCS of student’s choice.

**Software Development:** Designing and developing large software systems is a formidable engineering challenge and is the primary enterprise of the software industry. Required: 1) EECS 381; 2) EECS 477; 3) EECS 481; and 4) a 4th ULCS of student’s choice.

**Software Systems:** Software systems are the tools and applications we use when we compute. Required: 1) at least three of: EECS 482, 483, 484, 489; and 2) a 4th ULCS of student’s choice.

**Theory of Computation:** Research on mathematical foundations has enormously influenced the development of computer science, yielding advances in data management, communications, security, and may other areas. This is an interdisciplinary track. Required: 1) EECS 477; 2) one of: EECS 475, 480, EECS 445; 3) one of: EECS 574, 575, 586; and 4) two of the following: Math 412, 465, 425, 475, Stats 426, IOE 510, 512, 518, and EECS 550. This track is not open to Math Majors.

* If a course is used as a CS-LSA Major Core Course, it may not also count for a CS-LSA Track course (no double counting).
# Computer Science–LSA: Progress Sheet

**First Name:**

**Last Name:**

**UMID:**

**Uniqname:**

**Date:**

## Pre-Declaration Requirements: 16 Credits

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<thead>
<tr>
<th>Course</th>
<th>Hrs.</th>
<th>Term</th>
<th>Grade</th>
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<td>MATH 115</td>
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<tr>
<td>MATH 116</td>
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<td>EECS 203*</td>
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<td>EECS 280</td>
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*or Math 465/565

## Pre-Declaration GPA: (2.5 required):

## Upper Level CS Electives: 16 Credits

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<th>Hrs.</th>
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## CS Program Core: 16 Credits

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<td>EECS 376</td>
<td>4</td>
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<td>STATS 250*</td>
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</tbody>
</table>

*STATS 280, STATS 412, STATS 426, EECS 301, EECS 401, ECON 451, IOE 265, or TO 301 can also fulfill this requirement.

## Capstone Course: 3-4 Credits

## LSA College Requirements

**College Requirements:** Students must consult with their LSA College Advisor, 1225 Angell Hall, to discuss LSA college requirements.

## TOTAL CTP:

**CS Major GPA:**

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**Calculating Your CS Major GPA:** GPA=MHP/MSH

You must include all EECS courses: EECS 203, EECS 280, CS Program Core, ULCS, Capstone course (CS MDE course or CS honors thesis course), and Stats 250/412/approved Stats requirement course. Do not include Math 115/116. **You must have an overall CS Major GPA** of at least 2.0 in order to graduate!

*MHP = Michigan Honors Points

*MSH = Michigan Semester Hours

*Can be found on your U-M transcript (official or unofficial).