COMPUTER SCIENCE, MS

The University of Alabama's Computer Science Department offers interdisciplinary graduate programs leading to master's and doctoral degrees.

Students in the master's degree program may pursue either a thesis or non-thesis option.

Research activity in the department includes active investigations in software engineering, cyber security, big data analytics, distributed autonomy and human-computer interaction, networking and its applications, and computer science education.

Admission Requirements

In addition to meeting the admission requirements established by the Graduate School (Admission Criteria), students applying for graduate study in the department must also meet the following general requirements:

1. demonstrated competence in programming
2. completion of the equivalent of the department's undergraduate core computer science curriculum
3. demonstration, by an appropriate score on the general test of the Graduate Record Examination, of competence in the discipline of computer science

See the Admission Criteria section of this catalog for more information.

Each student must submit scores from the Graduate Record Examination general test. This requirement may be waived for a student who graduated with a GPA of 3.0 or higher on a 4.0 scale from an institution accredited by the CAC Accreditation Commission of ABET, 111 Market Place, Suite 1050, Baltimore, MD 21202-4012 – telephone 410-347-7700. It is strongly recommended that each student submit a score from the GRE Subject Exam in Computer Science, particularly students who wish to be considered for funding opportunities.

Additional details of these requirements may be obtained directly from the department. Applicants who present most but not all of these qualifications may be considered for conditional admission.

Degree Requirements

Master of Science

Departmental degree requirements for the MS degree, which are in addition to those established by the College and by the Graduate School, are as follows for Plan I and Plan II students:

- Each Plan I candidate must earn a minimum of 24 semester hours of credit for coursework, plus a six-hour thesis under the direction of a faculty member.
- Each Plan II candidate must earn a minimum of 30 semester hours of credit for coursework, which may include a three-hour non-thesis project under the direction of a faculty member.
- Unlike the general College of Engineering requirements, graduate credit may not be obtained for courses at the 400-level.

Master of Science - Thesis Option (Plan I)

Code and Title		Hours
Core Course Requirements		
Select One Course from each of the Three Areas		
Software Courses:		3
CS 503	Programming Languages	
CS 507	Software Interface Design	
CS 515	Software Design & Development	
CS 516	Testing and Quality Assurance	
CS 534	Compiler Construction	
CS 545	Software Reverse Engineering	
CS 600	Foundatns Software Engr	
CS 603	Organz Program Languages	
CS 630	Empirical Software Engineering	
Systems Courses:		3
CS 526	Intro Operating Systems	
CS 538	Computer Comm & Networks	
CS 548	Network Security	
CS 567	Computer Systems Architecture	
CS 581	High Performance Computing	
CS 606	Analys Operating Systems	
CS 613	Adv Computer Comm & Networks	
CS 618	Wireless Mbile Netrwrk Protocl	
Theory Courses:		3
CS 570	Computer Algorithms	
CS 575	Formal Languages & Machines	
CS 602	Adv Formal Lang & Machin	
CS 612	Advanced Data Structures	
Thesis Course Requirements		
CS 599	Thesis Research	6
Elective Courses		**15**
Select CS courses but no more than 12 hours from the following courses		
CS 591	Special Topics In CS	
CS 592	Independent Study	
CS 691	Special Topics	
CS 692	Independent Study	
Courses taken outside of CS are subject to the approval of the student's advisor		
Total Hours		**30**

Additional Requirements:

- The student will select a thesis advisor and a thesis committee. The committee must contain at least four members, including the thesis advisor. At least two members are faculty of the Computer Science department, and at least one member must be from outside the Department of Computer Science.
- The student will develop a written research proposal. This should contain an introduction to the research area, a review of relevant literature in the area, a description of problems to be investigated, an identification of basic goals and objectives of the research, a methodology and timetable for approaching the research, and an extensive bibliography.
- The student will deliver an oral presentation of the research proposal, which is followed by a question-and-answer session that is open to all faculty members and which covers topics related directly or indirectly to the research area. The student's committee will determine whether

the proposal is acceptable based upon both the written and oral presentations.

- The student will develop a written thesis that demonstrates that the student has performed original research that makes a definite contribution to current knowledge. Its format and content must be acceptable to both the student's committee and the Graduate School.
- The student will defend the written thesis. The defense includes an oral presentation of the thesis research, followed by a question-and-answer session. The student's committee will determine whether the defense is acceptable.
- The student will complete an oral comprehensive exam. This exam is scheduled with the Department Head prior to the semester in which the student intends to graduate.
- Other requirements may be specified by the Graduate School and by the College of Engineering.

Master of Science - Non-Thesis Option (Plan II)

Code and Title		Hours
Core Course Requirements		
Select One Course from each of the Three Areas		
Software Courses:		3
CS 503	Programming Languages	
CS 507	Software Interface Design	
CS 515	Software Design & Development	
CS 516	Testing and Quality Assurance	
CS 534	Compiler Construction	
CS 545	Software Reverse Engineering	
CS 600	Foundatns Software Engr	
CS 603	Organz Program Languages	
CS 630	Empirical Software Engineering	
Systems Courses:		3
CS 526	Intro Operating Systems	
CS 538	Computer Comm & Networks	
CS 548	Network Security	
CS 567	Computer Systems Architecture	
CS 581	High Performance Computing	
CS 606	Analys Operating Systems	
CS 613	Adv Computer Comm & Networks	
CS 618	Wireless Mbile Netrwrk Protocl	
Theory Courses:		
CS 570	Computer Algorithms	
CS 575	Formal Languages & Machines	
CS 602	Adv Formal Lang & Machin	
CS 612	Advanced Data Structures	
Elective Courses [1]		**24**
No more than 12 hours from the following courses		
CS 591	Special Topics In CS	
CS 592	Independent Study	
CS 691	Special Topics	
CS 692	Independent Study	

Courses taken outside of CS are subject to the approval of the student's advisor

Total Hours	**30**

Footnotes

[1] The student may elect to replace 3 hours of course work with 3 hours of CS 598 Non-Thesis Research. This course should be proposed in writing in advance, approved by the instructor, and a copy placed in the student's file. The proposal should specify both the course content and the specific deliverables that will be evaluated to determine the course grade.

Additional Requirements:

- The student will complete an oral comprehensive exam. This exam is scheduled with the Department Head prior to the semester in which the student intends to graduate.
- Other requirements may be specified by the Graduate School and by the College of Engineering.

Master's Degrees

The primary purpose of master's degree programs is to provide students with subject matter at an advanced level in their fields of study. Master's degrees are designed to assist students either to continue their graduate studies or to meet the goals of their professions. In most cases, master's programs also help students become familiar with methods of independent investigation.

Program Requirements

Two plans are offered for the master's degree:

Plan I. Candidates for the master's degree under Plan I must earn a minimum of 24 semester hours of credit in coursework plus earn a minimum of 6 additional hours of thesis research hours, for a total of 30 hours.

Plan II. Candidates for the master's degree under Plan II must earn a minimum of 30 semester hours of coursework credit and pass the comprehensive examination or complete a culminating or "capstone experience" as described under the Comprehensive Examinations section below.

Both plans require a minimum of 18 semester hours in the major subject.   With the approval of the major department, the remainder of the coursework may be completed in either the major or a related field.

In some divisions and in many departments of the University, candidates are required to do their work under Plan I. Candidates working under Plan II may be required to participate successfully in seminar or problem courses that will give them an acquaintance with the methods of research and an appreciation of the place and function of original investigation in the field.

Residency Requirements

A student's program at the master's level must provide sufficient association with the resident faculty to permit individual evaluation of the student's capabilities and achievements.

Graduate Credit

A student must be admitted to the Graduate School and must register as a graduate student in order to receive graduate credit. Approval for graduate registration must be obtained from program advisors prior to registration.

Graduate Credit for Noncredit Experiences

All course credit used toward a UA graduate degree must be taught at the graduate level. No graduate credit may be earned by correspondence study or for experiential learning not conducted under the direct supervision of graduate faculty of The University of Alabama. UA does not offer graduate credit for noncredit workshops, seminars, continuing education experiences, professional development, internships, work/life experience, and so forth.

Transfer of Credit

Courses of full graduate-level credit earned in a regionally accredited institution where a student was enrolled in the graduate school may be submitted for review for inclusion in a master's degree program. Evaluation of credit for transfer will not be made until after the student has enrolled in the Graduate School of The University of Alabama. Acceptance of credit requires the approval of the student's advisory committee and the dean of the Graduate School. Only courses in which a student earned a "B" grade or better may be transferred. Thesis Research (599) may not be transferred in from an outside institution.

In some cases, foreign educational credentials may not meet the Graduate School's criteria for transfer of credit. It may be necessary for students in this situation to secure an evaluation of their credentials from World Education Services Inc. (WES), an external foreign credential evaluation service. Additional information on their services can be found at their website.

A student initiates at the Graduate School's website a Request for Transfer of Graduate Credit earned at another institution. It is also the student's responsibility to assure that the Graduate School receives an official transcript from the other institution where the transfer credit has been requested, well in advance of the final semester.

With the approval of the student's department and the dean of the Graduate School, the greater of 12 hours or 25 percent of the required coursework for a master's degree may be transferred from another institution. The approved transferred coursework must be earned during the six-year period (18 fall, spring and summer semesters) preceding the semester of admission to the UA master's program. Departments may have more restrictive timelines. Revalidation or recertification of graduate credits that will be more than 18 semesters old at the time of UA master's program completion is not an option.

Please note that some departments allow fewer than 12 hours of graduate transfer credit. Be sure to check with your department's graduate coordinator regarding your department's transfer policy.

400-Level Courses

A maximum of 6 semester hours of 400-level course credit may be accepted for a master's degree program. The department needs to submit the Approval of 400-Level Course Work for Master's Credit through the UA DocuSign system in myBama and is approved by the Graduate School prior to the semester in which the 400-level coursework will be taken.

Time Limit

All requirements for the master's degree must be completed during the six years (18 fall, spring, and summer semesters) immediately preceding the date on which the degree is to be awarded. There is no provision for an extension of the time limit beyond six years for master's students.

Thesis

A thesis evidencing research capacity, independent thought, and the ability to interpret materials is required of all master's degree candidates who pursue Plan I. The subject chosen must be in the major field and must be approved by the graduate committee of the major department or school and by the head of the student's major department or division.

A thesis committee must consist of at least three members appointed by the dean of the Graduate School. Students set up their committee through the Graduate Academic Activities portal on the Graduate School website. The request normally is made as soon as the successful defense of the thesis proposal has been completed. All members of a thesis committee must be members of the Graduate Faculty. The Committee Chair must be a full or associate member of the Graduate Faculty. One member must be from outside the student's major department. The majority of the thesis committee must be full-time regular University of Alabama faculty. If the outside member is not a full or associate member of the UA Graduate Faculty (e.g., a highly qualified person from another university, a business, or industry), the graduate dean needs to appoint that member by approving Affiliate Graduate Faculty status for the specific purpose of serving on the student's thesis committee. Unless there are extraordinary circumstances meriting approval by the graduate dean before the final oral defense of the thesis, all members of the thesis committee must attend the defense.

The candidate must give members of the examining committee a minimum of two weeks to read the thesis before the date of the final oral examination. All members must agree that the student is ready for the final oral thesis defense. A final oral thesis defense is required of all students completing a thesis. All members of the thesis committee must be members of the UA graduate faculty and must attend the final oral thesis defense unless there are extraordinary circumstances warranting the graduate dean's approval of the absence prior to the defense meeting.

The final oral thesis defense is the culminating experience in the master's program. As such, all members of the thesis committee are expected to attend and participate in real time. Virtual attendance via interactive video or teleconference is permitted for off-campus external committee members, but the student and Tuscaloosa campus faculty should attend in person unless extraordinary circumstances dictate the need for virtual attendance. In circumstances where virtual participation is necessary, all participants must follow the Virtual Participation guidelines found below.

Virtual Participation

Scope and Goals

All members of a student's graduate committee are expected to attend and participate, usually in person, in any oral examination as part of the student's graduate (Master's or Doctoral) degree program. Traditionally, oral examinations are conducted with the student meeting their committee while gathered in one physical location on campus. However, the need occasionally arises for virtual participation in the oral examination. In these cases, graduate programs must ensure adherence to the following if any graduate-level oral examination involving the student's entire thesis/dissertation committee includes virtual participation.

- The student's consent must be sought and obtained in advance of conducting the oral examination with virtual participants.
- Virtual participation by committee members *must* include both audio and visual capability so that:
  - each committee member can hear the student and view the student, any presentation slides, and any demonstrations;
  - the student can hear and view each committee member.
- All committee members must participate interactively and in real-time for the *entire* examination, including any preparatory discussion leading up to it, the presentation itself, its discussion and evaluation.

The following sections provide detail on the technical and attendance requirements for an oral examination with virtual participation. Departments and programs may enforce stricter guidelines than those outlined, including an on#campus#only policy if deemed necessary and appropriate.

Technical Requirements

Real-time and fully interactive audio and video communications must be maintained throughout the examination and any related discussion. The audio/video communications facilities must allow the student and all committee members to see and hear each other during the entire examination. There must be adequate provision for the transmission of text, graphics, or writings referenced or generated during the examination (e.g., slides, whiteboard). The use of audio-only communications is not permitted.

In case of technical difficulties or technology failure, the committee will decide whether to continue the examination once the difficulty is resolved, or to cancel the examination and reschedule it for a later date, without prejudice to the student.

If the student or any committee member(s) have a disability that will be impacted by virtual participation, reasonable accommodations should be provided.

Attendance Requirements: campus-based programs

Programs should ensure that students are advised about virtual participation guidelines related to an oral examination, including reference to these guidelines as well as any other program-specific requirements.

It is generally expected that members of a graduate student's committee be physically present with the student for each oral committee examination. However, an oral examination may have virtually participating committee members according to the following rules:

- **Any one member** of the graduate student's committee (excluding the chair / advisor) can participate at a distance without seeking further authorization.
- The **committee chair** will be allowed to participate at a distance only if rescheduling the oral examination for a time when they are on campus would cause hardship to the student. In this case, the committee chair should submit a petition to the Dean of the Graduate School, outlining the reasons leading to the request.
- Similarly, a petition from the committee chair to the Dean of the Graduate School is also required if **more than one committee member** is to participate at a distance. Such petitions will only be considered if rescheduling the oral examination to a time when only one member of the committee would be participating at a distance would cause significant hardship to the student, as outlined in the petition.

All committee members participating virtually must be able to **fully interact** in the oral examination via audio and video capability; participation by viewing a recording of the oral examination is specifically prohibited. All members of the committee, on- or off-site, must participate in the evaluation of the examination; provisions must be made to record their vote and collect their signatures as necessary.

Student participation at a distance in graduate oral examinations involving their committee is generally not allowed for campus-based graduate programs. However, the committee chair and/or the graduate program director, in agreement with the student, may draft a petition to seek permission from the Dean of the Graduate School to conduct such an oral examination. This arrangement will only be considered if the committee chair agrees to it, and if rescheduling the oral examination for a time when the student is on campus would cause great hardship to the student; the petition should clearly outline the extenuating circumstances leading to this need.

Attendance Requirements: online or hybrid programs

An online graduate program is defined as a program in which no aspect of the degree program occurs on-campus, including oral examinations. A hybrid program is defined as a program which has both online and on-campus elements.

For online and hybrid programs that handle oral examinations in an online setting, all committee members as well as the student may participate virtually in the oral examination. However, these programs must fully adhere to the guidelines outlined in the Technical Requirements section above for any oral examination involving the entire committee.

Hybrid programs that require oral examinations to take place on campus must adhere to the guidelines set forth for campus-based programs.

Article Style vs. Journal Format
Article Style.
At the doctoral level, "article-style dissertations" are unified works that include several distinct but related studies of research or creative activity, each of which is of publishable quality. The University does not permit an "article-style thesis" to be presented for a master's degree.

Journal Format.
A "journal-format thesis" is acceptable. Such a thesis follows the format of a particular journal in which the student and advisor want the thesis to be published. To prepare a journal-format thesis, the student uses the journal's "information for authors" or similarly titled guidelines in conjunction with the Graduate School's Student Guide to Preparing Electronic Theses and Dissertations.

All theses are submitted electronically rather than on paper. See the Graduate School's homepage for a link to information on Electronic Theses and Dissertations (ETD) for details.

Theses must comply with the regulations set out in A Student Guide to Preparing Electronic Theses and Dissertations, available on the Graduate School's website. Approval of the thesis by the graduate dean is necessary before graduation.

The thesis should be completed, if possible, while the student is in residence at the University. To request permission to complete a thesis in absentia, the student must, before leaving the University, submit a satisfactory outline of the thesis, as well as evidence that adequate facilities are available where the work will be done, to the head of the student's major department.

Protection of Human Subjects for Research
Scientific research involving human subjects has produced substantial benefits for society, but it also can pose troubling ethical questions. The mission of the University's Institutional Review Board (IRB) for Protection of Human Subjects is to ensure that research involving human subjects is conducted ethically. University and federal policies require that review and approval to use human subjects in research precede the research. In the case of thesis research that involves the use of human subjects in any way, the principal investigator is responsible for contacting the college Human Research Review Committee to obtain approval for the planned research.

Final Thesis Defense
The final oral thesis defense is the culminating experience in the master's program. As such, all members of the thesis committee are expected

to attend and participate in real time. Virtual attendance via interactive video or teleconference is permitted for off-campus external committee members, but Tuscaloosa campus faculty should attend in person unless extraordinary circumstances dictate the need for virtual attendance. The thesis must comply with the regulations in A Student Guide to Preparing Electronic Theses and Dissertations.

"Completed" means submitted to ProQuest after being successfully defended, carefully edited following the defense meeting, and having the Committee Acceptance Form (CAF) signed by all committee members, department chairperson, and graduate dean. A majority of the thesis committee must approve the written thesis and defense before submission to the Graduate School. Following the thesis defense, the Committee Acceptance Form is submitted by the thesis chair through the UA DocuSign system in myBama.

Graduate School deadlines, including each semester's thesis deadline, are available at the Graduate School's homepage. Consult the ETD website for details of ETD submission, including information on what needs to be submitted to the Graduate School. The graduate dean must approve the thesis before the student can be cleared for graduation.

Comprehensive Examinations

In addition to the regular course examinations, a final comprehensive examination representing a "culminating" or "capstone" experience for a degree is required of all candidates for the master's degree (except for those candidates pursuing the Master of Accountancy, the Master of Business Administration, the Master of Library and Information Studies, the Master of Social Work, and the Master of Tax Accounting). The comprehensive examination is a culminating experience in which the student is expected to integrate prior learning. Each department, with approval of the Graduate Council, determines the most appropriate format. The various exams may consist of one or more of the following:

- a written and/or oral examination based on the content of the degree program;

- a thesis and final oral defense;

- a course requiring interpretation and integration of information from previous courses;

- a research paper, a "policy and practice" paper, or equivalent experience;

- a public performance or exhibition along with a contextualizing paper; and/or

- a practicum or internship.

If the comprehensive exam requirement is met with option 1 and/or 2 above, then the examining committee for comprehensive examinations must consist of at least three members of the graduate faculty from that department and appointed by the dean of the Graduate School.
  The examination must be given at least six weeks before the date of graduation (two weeks before for Plan II) and reported promptly to the dean of the Graduate School on appropriate forms. The final report is submitted by the department through the UA DocuSign system in myBama. The form should be submitted when all examinations are completed. A student may take the final oral or written examination only twice. Failing the examination twice results in dismissal from the degree program and the Graduate School.

Application for Graduation

Each candidate for a master's degree must submit an Application for Degree via myBama no later than the last day to register or add a course for the semester (or first term of the summer semester) in which

requirements for the degree are to be completed. That specific date is published each semester at the Graduate School's website under Current Students/Deadlines for Graduate Students.

Second Master's Degree

Six (6) semester hours of eligible credit from one master's degree at The University of Alabama may be applied to the requirements for a second master's degree, but only if the department of the second master's agrees to the courses in the plan of study. Any hours from the previous master's degree must have been earned during the six years (18 fall, spring, and summer semesters) immediately preceding the date on which the second degree is to be awarded. ***Please note that if a student double counts six hours between two master's degrees, no hours may double count toward any additional master's degrees.