Graduate Student Handbook Supplement

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Tufts course requirements for a Master’s and Ph.D. in Computer Science

This document lists important information about course requirements for Master’s and Ph.D. Students. The term “courses” refers to lecture-based classes, independent studies, and research. The first two are denoted by “standard courses” and the latter by “research courses. Both Master’s and Ph.D. course requirements can be satisfied via a varying combination of standard and research courses depending on your interests.

We recommend that Master’s students interested in completing a thesis and Ph.D. students bias their course selection toward research courses.

M.S. in Computer Science (10 total courses, each of 3 SHUs or more)

The flow chart above illustrates the course requirements to get a master’s degree. A box that indicates a range in required courses (e.g., 8-10 standard courses) indicates that some of the required courses can be obtained from a box in a sibling branch (e.g., 0-2 research courses).
**Core Competencies:** By your last semester at Tufts, you must certify that you have background in the areas listed in Appendix E of the handbook and reproduced below. Designated faculty will hold core competency certification sessions during the first two weeks of each semester and can help advise you on completing this requirement.

The competencies can be filled by equivalent classes you may have taken at other universities. Alternatively, you can fill them at Tufts by the courses listed in the sub bullets below. You must have earned at least a B- in a course to satisfy the relevant course-competency requirement. You will not receive graduate course credit for any course numbered less than 1xx.

Core Competency areas include:

- **Computer Architecture and Assembly Language**
  - COMP/CS 40, Machine Structure. *No graduate credit.*
  - COMP/CS 111, Operating Systems
  - COMP/CS 112, Networks & Protocols
  - COMP/CS 116, Computer Security
  - COMP/CS 146, (also EE 126) Computer Engineering
  - COMP/CS 107 (Formerly COMP/CS 181), Compilers

- **Programming Languages**
  - COMP/CS 105, Programming Languages
  - COMP/CS 21, Concurrent Programming. *No graduate credit.*
  - COMP/CS 86, Object-Oriented Programming for GUIs. *No graduate credit.*
  - COMP/CS 121 (Formerly COMP/CS 180), Software Engineering
  - COMP/CS 107 (Formerly COMP/CS 181), Compilers

- **Data structures and analysis of algorithms**
  - COMP/CS 160: Intro to Algorithms (we highly recommend taking this class!)

- **Theory of Computation**
  - COMP/CS 170, Computation theory
  - If you have little math background, try to take Discrete Math (COMP/CS 61) first.

**COMP/CS 191:** This course is a vehicle for doing research. It has similar requirements to the M.S. project (see below).

**COMP/CS 199 (Internship in Computer Science):** This course is a vehicle for international students to complete an internship. It does not count towards the 10 course requirement. Reach out to Professor Ming Chow for more information on this course.

**M.S. Thesis:** The thesis requires a commitment of two semesters total and is completely optional. Some reasons for deciding to do a M.S. thesis may include: 1) you are a M.S. student who wants significant research experience; 2) You want to leave the Ph.D. program with a master’s and retain some official record of your research activity; 3) You want to complete a substantial and polished preliminary research project on the way to a Ph.D. You need to submit a thesis prospectus at the end of the first semester and the thesis document at the end of the second semester. The advisor will select a thesis committee. This committee must include at least three faculty members, including one member from outside the department. You will defend the research via a 45-minute presentation, which the committee will attend. The defense is also open to the public. You will receive a grade only after you finish both semesters.

**M.S. Project:** This indicates you are working on some research with a faculty advisor and is a commitment of one semester. You need to register for COMP/CS 293 or COMP/CS 294 depending on the semester. You should register for 3 SHUs. You may choose to take this option because: 1) you are a M.S. student who wants to complete a research project without the overhead of writing a thesis, or 2) you are a Ph.D. student who
doesn’t want to write a separate master’s thesis. If you do not have an advisor for the project, you need to find one. If your advisor for the project is not your academic advisor, they need to agree to become your advisor. You and your advisor need to agree on the project and any write-up requirements. (Advisors approve the write-up and keep a copy).

COMP/CS 193/194-\(x\) (where \(x > 1\)): These are directed study courses with official names and with two or more students. Your advisor may create them as a vehicle for reading a set of research papers from a conference or understanding a new research area. You can count any number of these as standard COMP/CS classes (likely without a coding component).

**Maintaining Good Standing:** You must maintain a grade average of at least a B, earning no more than one grade below B-, and make continuous progress toward graduation.
Ph.D. Requirements

The flow chart above shows the course requirements for obtaining a Ph.D. If you don’t already have an M.S. degree in computer science or an approved alternative, you must complete these requirements in addition to those for the master’s.

**Core Competencies:** By the time you take quals (see below), you must certify whether you have background in the areas listed in Appendix E of the handbook. (See comments on core competencies in the M.S. section above.)

**TAship:** You have to TA at least one course during your time as a student at Tufts.

**Qualifying Exam:** This is a sanity check to ensure you are making research progress and have adequate background about your research area. The exam involves giving a presentation about some research you’ve conducted + an oral exam on 4-7 research papers. The presentation is typically 30 minutes followed by questions. The oral exam is one hour long.

- **Timing:**
  - Students without M.S.: Take it during your third or fourth semester from entry into the program. You must pass it by the end of your fifth semester at Tufts.
  - Students with M.S.: Take it by the end of your second semester. You must pass it by the end of your third semester at Tufts.

- **Process:**
  - Students select a committee of three members. Two must be insiders of the student’s research area. The third must be outside the student’s research area.
  - Insider committee members choose 4-7 papers related to the student’s research and informs the student of them. These are the papers the student will be evaluated on during the oral exam.
  - Students schedule both the presentation and the oral exam with the committee. These may be done back-to-back on the same day or on separate days.
Prospectus: You must write a document describing the research you plan to conduct for your dissertation and submit it to the CS graduate committee. The prospectus you submit should be about a page long and it must: (1) describe your intended research direction or open problems to be addressed in the thesis research, (2) cite and briefly describe appropriate related work, (3) identify the dissertation advisor, and (4) identify two additional dissertation committee members.

- **Process:**
  - Write the prospectus with input from your Ph.D. advisor.
  - Ask two additional Tufts faculty members apart from your advisor who will serve on your committee. List them in the prospectus.
  - Submit the prospectus to the graduate committee six months after your quals.
  - Your prospectus is a living document and should be updated continuously.

Dissertation Defense: This is when you are done. During a dissertation defense, you give a public presentation on your research, and then answer private questions from your committee members about both the presentation and the dissertation document that describes your research.

- **Process:**
  - Propose a committee, which includes the members from our prospectus committee, one member from another department at Tufts, and one member who is not at Tufts.
  - Write the dissertation document.
  - Schedule a defense date with your committee.
  - Submit the abstract and title for the dissertation to the CS office at least three weeks before the defense date so that the public portion of the defense can be publicized.
  - Submit the full draft of your dissertation to your committee at least three weeks before the defense date so that they have adequate time to review and to provide you with comments.
  - Give your defense!

FAQs for Registering

- **What are the minimum number of “actual” classes I need to take to get an M.S. + Ph.D.?**
  You will need to take 8 “actual” classes. Your M.S. would consist of 7 actual courses, 2 research courses (i.e., COMP/CS 191 and 293 or COMP/CS 295 and 296), and 1 independent study (COMP/CS 193/194-01). Your Ph.D. would consist of 1 actual course, 1 COMP/CS 193/194-01, and the rest would be research credits (191, 297, and 298). It is possible this number could be further reduced by taking named COMP/CS 193-0x classes (x>1), as these count as “actual” classes.

- **Students on RAships and TAships:** You should register for COMP/CS 405-TA or COMP/CS 406-RA to indicate status as a Ph.D. TA or RA. These are special courses that count as 3 SHUs of load, but do not count as credit. You need to register for at least 6 more SHUs of courses (standard or research) to be considered full time. You should not register for more than 10 additional SHUs of courses.

- **How many SHUs should I register for if I’m not on a RAship or TAship?**
  You should register for at least 9 SHUs each semester as a full-time student.

- **What research courses do I register for once I have completed the 60 SHUs required for the Ph.D.?**
  Once you have accrued 60 SHUs, you switch to “COMP/CS 502: Matriculation Continued” rather than registering for more research SHUs.

- **Summer Registration or Matriculation:** Current students who stay for the summer should register for COMP/CS 406-RA as well as COMP/CS 502 – Doctoral Degree Continued. A Ph.D. student who has not yet completed the M.S. degree should register for COMP/CS 406-RA and COMP/CS 401/402 – Master’s Degree Continued. For incoming Ph.D. students who will be here on a temporary visa, they
must have a full-time enrollment of 6 SHUs over the summer. This could include one “standard” course, one “research/independent study” course, plus COMP/CS 406-RA.
Appendix A: Qualifying Exam Contract

Qualifying Exam Contract, Department of Computer Science, Tufts University

Please complete the following form and return to the CS front office by the advertised due date. Please make sure all items requiring a signature are complete as requested.

Student: __________________________________________________________________________
          (print name) (sign) (date)

Email: __________________________________________________________________________

Semester and year of exam (e.g., Fall 2020): __________________________________________

Title of Research Talk: _____________________________________________________________

Research Area(s) of Oral Exam: _______________________________________________________

Insider #1: _________________________________________________________________________
            (print name) (sign) (date)

Insider #2: _________________________________________________________________________
            (print name) (sign) (date)

Outsider: __________________________________________________________________________
           (print name) (sign) (date)

Advisor approval: ___________________________________________________________________
                  (print name) (sign) (date)

Reminders:
  ● At least one insider, and the outsider, must be regular CS faculty; the outsider must have tenure.
  ● The insiders will provide the student with a list of five to seven research papers for the oral exam.
  ● Quals is not complete until the exam has been passed and the M.S./Ph.D. Core Competencies have been satisfied.
  ● Please refer to the grad handbook supplement for the full exam rules.
Appendix B: Prospectus Guidelines

This 1-2 page abstract document must include:

- A brief description of the student’s intended research direction or open problems to be addressed in the thesis research.
- Please write a paragraph or two--- no more than that -- describing what questions you might want to investigate, or what outcomes you might hope to achieve and please don’t just say “I intend to perform research in area X”; on the other hand, the intention is for the text to be relatively short, not putting a huge burden on the student and advisor, but simply serving to confirm that the student is working with the advisor and specifying research directions briefly. Citations to and a description of appropriate related work, intended to demonstrate that the student is familiar with foundational and current work in the field.
- The name of the dissertation advisor, who must be a member of the Computer Science Department (adjunct appointments included) who is a tenure-track faculty member at Tufts University.
- The names of two additional members of the computer science faculty who have agreed to serve on the dissertation committee.

*Please have the advisor sign the prospectus to attest that he or she approves the prospectus.* Unlike the qualifying exam contracts we do not require a signature from other members of the committee; however, you should have secured their agreement before submitting your prospectus.

Since the prospectus is intended to be a living document, you are expected to update or refine your prospectus as part of the annual Grad Review process, or at any other time as you and your advisor see fit.
Appendix C: Registration

The graduate school at Tufts uses registration to track multiple aspects pertaining to courses, service as RA or TA, and part- or full-time status. This has confused some students in the past; here we attempt to clarify all the requirements in one place.

M.S. Students: Fall and Spring

M.S. students must earn 30 SHUs by a combination of at least 10 regular courses of 3 or more SHUs each.

Students who have already completed 10 courses and 30 SHUs but are still working on an M.S. project or thesis should register for one of the Master’s Continuation courses (COMP/CS 401 or COMP/CS 402), whichever is appropriate. This indicates that they are still pursuing their studies but have otherwise completed the credit requirements.

Ph.D. Students: Fall and Spring

Ph.D. students must earn 60 credits for their degree. At least six credits must be composed of at least two regular 100-200 level courses. Four credits are earned by completing the 1-credit COMP/CS 250-1 Departmental Colloquia course in each of four semesters. The rest can be earned by multiple registrations of the Graduate Research courses (COMP/CS 297/298) or by taking other courses approved by the student’s advisor.

Full-time students should register for regular courses as guided by their advisor, and in addition register for the appropriate Graduate Research course each semester when doing dissertation work, for a total of 9 credits per semester. Registration for Graduate Research should be repeated until the student has accumulated 60 credits. This means that, normally, a student will register for 9 credits per semester (including Graduate Research) until they have accumulated 60 credits. Full-time students who have already accumulated 60 credits and are working on their dissertation should register for the appropriate Doctoral Continuation course (COMP/CS 501 or COMP/CS 502). Students on TAships or RAships should register for COMP/CS 405-TA or COMP/CS 406-RA, respectively. These courses represent 3-SHUs of load, but do not count as credit.

Summer Session

Both M.S. and Ph.D. students who are not registered for a full load of summer classes but who are otherwise engaged in either a full- or part-time capacity in their studies – for example, working on their research – should register for one of the Continuation courses. Ph.D. students on TAships or RAships should register for COMP/CS 405-TA or COMP/CS 406-RA, respectively.

The chart on the following page outlines various student study situations and the appropriate course registrations that go with them.
**Appendix D: Chart of Departmental Non-Classroom & Tracking Courses**

<table>
<thead>
<tr>
<th>Who</th>
<th>Situation</th>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Ph.D. Students</strong></td>
<td>Ph.D. students in the <strong>fall</strong> semester who are engaged in dissertation-level research. May register every semester</td>
<td>COMP/CS 297: Graduate Research</td>
<td>1-9</td>
</tr>
<tr>
<td></td>
<td>Ph.D. students in the <strong>spring</strong> semester who are engaged in dissertation-level research. May register every semester</td>
<td>COMP/CS 298: Graduate Research</td>
<td>1-9</td>
</tr>
<tr>
<td></td>
<td>Ph.D. student doing <strong>part-time</strong> doctoral work, not being paid AND not registered for a full load of regular classes (This covers most students during the summer.)</td>
<td>COMP/CS 501-PT: Doctoral Continuation Part Time</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>Ph.D. student doing <strong>full-time</strong> doctoral work, not being paid AND not registered for a full load of regular classes (This covers most students over the summer.) <em>Register for this in addition to COMP/CS 405/COMP/CS 406 if you are a summer TA or RA.</em></td>
<td>COMP/CS 502-FT: Doctoral Continuation Full Time</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>Ph.D. student who is serving as a <strong>TA</strong>. Although this is a 0-credit course it may be used towards the full-time requirement.</td>
<td>COMP/CS 405-TA: Graduate Teaching Assistant</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>Ph.D. student who is serving as an <strong>RA</strong>. Although this is a 0-credit course it may be used towards the full-time requirement.</td>
<td>COMP/CS 406-RA: Graduate Research Assistant</td>
<td>0</td>
</tr>
<tr>
<td><strong>M.S. Students</strong></td>
<td>M.S. student doing part-time master’s work, not being paid for that work and not registered for a full load of regular classes. (This typically applies to students doing research during the summer or who have already completed 10 courses and 30 credits but are still working on an M.S. project or thesis.)</td>
<td>COMP/CS 401-PT: Master’s Continuation Part Time</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>M.S. student doing full-time master’s work, not being paid for that work and not registered for a full load of regular classes. (M.S. students who have already completed 10 courses and 30 credits but are still working on an M.S. project or thesis.) <em>Register for this in addition to your TA tracking course if you are a summer TA or RA.</em></td>
<td>COMP/CS 402-FT: Master’s Continuation Full Time</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>M.S. students in the <strong>fall</strong> semester who are engaged in thesis research.</td>
<td>COMP/CS 297: Graduate Research</td>
<td>1-6</td>
</tr>
<tr>
<td></td>
<td>M.S. students in the <strong>spring</strong> semester who are engaged in thesis research.</td>
<td>COMP/CS 298: Graduate Research</td>
<td>1-6</td>
</tr>
<tr>
<td></td>
<td>M.S. students in the <strong>fall</strong> semester who are engaged in <strong>writing</strong> a thesis.</td>
<td>COMP/CS 295: Master’s Thesis</td>
<td>1-6</td>
</tr>
<tr>
<td></td>
<td>M.S. students in the <strong>spring</strong> semester who are engaged in <strong>writing</strong> a thesis.</td>
<td>COMP/CS 296: Master’s Thesis</td>
<td>1-6</td>
</tr>
<tr>
<td></td>
<td>M.S. students in the <strong>fall</strong> semester who are doing a master’s project</td>
<td>COMP/CS 293: Graduate Special Topics / Master's Project</td>
<td>1-3</td>
</tr>
<tr>
<td></td>
<td>M.S. students in the <strong>spring</strong> semester who are doing a master’s project</td>
<td>COMP/CS 294: Graduate Special Topics / Master's Project</td>
<td>1-3</td>
</tr>
<tr>
<td>International M.S. and Ph.D. Students</td>
<td>This course is only available to international students who are doing an internship. These credits apply to the full-time visa requirement but may not be applied to either the M.S. or Ph.D. degree requirements.</td>
<td>COMP/CS 299: Internship Computer Science</td>
<td>1</td>
</tr>
</tbody>
</table>
Appendix E: Verification of Core Competence: M.S. and Ph.D.

Department of Computer Science, Tufts University

This form serves to document how students in the M.S. and Ph.D. programs have covered (or are planning to cover) the core competence requirement. It should be completed by the student and advisor together, and signed by the advisor. It should then be submitted, preferably in paper form, to the COMP/CS main office, to be reviewed (and approved) by the department by the end of the first week of classes of the semester in which the student will file for graduation. The approved form will be kept in the student’s file. If the coverage plan is changed please submit a new copy for the changed portions.

Student Name:
________________________________________________________________________

Topic: Computer Architecture and Assembly Language. This is covered by:
_____________________________________________________________________________________
_____________________________________________________________________________________
_____________________________________________________________________________________

Faculty Certifier and date: ____________________________________________________________

Topic: Programming Languages (specifically, functional programming and object-oriented programming with inheritance). This is covered by:
__________________________________________________________________________________
_____________________________________________________________________________________
_____________________________________________________________________________________

Faculty Certifier and date: ____________________________________________________________

Topic: Data Structures and Algorithms. This is covered by:
_____________________________________________________________________________________
_____________________________________________________________________________________
_____________________________________________________________________________________

Faculty Certifier and date: ____________________________________________________________

Topic: Theory of Computation. This is covered by:
_____________________________________________________________________________________
_____________________________________________________________________________________
_____________________________________________________________________________________

Faculty Certifier and date: ____________________________________________________________

Approved by: ___________________________________________  Date: ____________
Appendix F: Procedure for Approving Choice of Courses in M.S. for Interdisciplinary Students

Department of Computer Science, Tufts University

A student in the program who has an interdisciplinary focus but who satisfies all the requirements as specified above does not need special approval, and their choice of courses can be vetted directly by their advisor. In some cases, students focusing on an interdisciplinary area of COMP/CS are allowed to take fewer than six COMP/CS courses. This requires prior planning and approval. The student should prepare a document with the following components:

1. A detailed plan for the 10 courses of 3 or more SHUs to be counted for the M.S.
2. The reasoning which explains why this plan makes sense for their specific M.S. education.
3. An explanation as to how they satisfy all the depth and breadth requirements for M.S. in COMP/CS as specified in the handbook.

The completed document should be approved and signed by the advisor. The signed document should be submitted to the COMP/CS main office for approval. Students who want to pursue this option are advised to follow this procedure in advance and as early as possible to make sure their plans for the M.S. form an approved program.