

The Software Engineering Ph.D. Program at Carnegie Mellon

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Contents

1. Introduction and Overview	3
2. Outcomes	4
3. Ph.D. Program Community, Culture, and Mutual Respect	5
3.1. Student Leadership Representation	6
3.2. Preventing Discrimination and Harassment in Our Program	6
4. Advisors	7
5. Directed Research	8
6. Course Requirements	9
6.1. Software Engineering Research Course	9
6.2. Four Area Star Courses	9
6.3. Software Engineering Research Seminar	13
6.4. Twenty-Four Elective Units	13
6.5. Credit for Prior Coursework	14
7. Practicum Requirement	15
7.1. Practicum Presentation, Writing, and Evaluation	16
7.2. Practicum Confidentiality	16
8. Teaching Requirement	16
9. Written and Oral Communication Skills	17
9.1. Writing Proficiency	18
9.2. Speaking Proficiency	18
10. The Thesis Process	19
10.1. Thesis Proposal	19
10.2. Residency Policy	20
10.3. All But Dissertation (ABD) Policy	20
10.4. Time to Degree Policy	21
10.5. Thesis Committee	21
10.6. Thesis	22
10.7. Thesis Defense	22

10.8. Graduation Certification	23
11. Master’s Degrees	23
12. Dual Degree Program with Portugal	24
13. Student Support and Employment	24
13.1. Academic Year Support	24
13.2. Summer Support and Internships	25
13.3. Employment While a Student	25
14. Leave of Absence	25
15. Evaluation of Students’ Progress	26
15.1. Components and Indicators	26
15.2. Outcomes and Recommendations	27
15.3. Grades	27
16. Problems?	28
16.1. Points of Contact	28
16.2. Faculty and Student Ombudspersons	28
17. University Policies	29
17.1. Carnegie Mellon University Statement of Assurance	29
17.2. The Carnegie Mellon Code	29
17.3. Assistance for Individuals with Disabilities	30
17.4. Maternity Accommodation Protocol	30
17.5. Policy Against Sexual Harassment and Sexual Assault	31
17.6. Other University Policies and Procedures	31
References	32
A. Time Estimates	33
B. Outcome to Requirement Mapping	34
C. Key University Resources for Graduate Students and The WORD, Student Handbook	35

1. Introduction and Overview

Software engineering is the branch of computer science that creates practical, cost-effective solutions to computing and information processing problems, preferentially by applying scientific knowledge, developing software systems in the service of mankind [1]. Carnegie Mellon’s Software Engineering Ph.D. program produces graduates who are well-prepared for faculty positions in software engineering, for research positions in industrial laboratories, and for leadership positions in development within the software field. The Ph.D. degree is a certification by the faculty that the student has a broad education in Software Engineering and has performed a substantial piece of original research in the area.

This document is an informal description of the Software Engineering Ph.D. program; herein “we” refers to all the faculty and staff involved in the Ph.D. program. Currently, the Institute Head is [William Scherlis](#), the Director of the Software Engineering Ph.D. program is [Jonathan Aldrich](#), and the Ph.D. Programs Manager is Connie Herold.

To complete the Ph.D. degree, we require that each student:

- Contribute to scientific knowledge in software engineering by engaging in *directed research*. This is the central element of the Ph.D. program, and students should spend at least half their time on research from the first semester onward.
- Develop a broad foundation in software engineering and specific intellectual skills by passing 84 university units worth of *graduate courses*, with certain distribution requirements
- Acquire and demonstrate teaching skills by serving as a *teaching assistant* at least twice
- Acquire and demonstrate oral and written *communication skills* by writing about research and participating in ISR’s Software Research Seminar.
- Demonstrate, through an issue-focused oral presentation and written *practicum report*, an understanding of software engineering that is grounded in practice.
- Write and orally defend a *thesis*, a significant piece of original research related to software engineering. To support effective planning and ensure that the student’s thesis topic is viable, we require them to present a *thesis proposal* in advance.

A distinguishing characteristic of our program is that we encourage and expect students to engage in research from their first day in the Institute. The program is also noted for the unique background of its student community. Many of our students bring significant prior experience in industry that we value, and which they can leverage in their research—while other students may not have this experience themselves, but benefit from those who do. Our community in the Institute for Software Research is also part of the larger community in the School of Computer Science and in the university at large; Appendix C of this document describes university-level resources that may be useful to students.

To help students fulfill the requirements of our program, we provide these educational opportunities:

- An active research environment, with experienced and dedicated faculty advisors
- A large number of *graduate courses* covering various topics within software engineering and related areas in computer science

The entire faculty meet twice a year to evaluate each student's progress. A student demonstrates progress by passing courses, doing directed research, teaching, fulfilling the skills and practicum requirements, and doing thesis work. Because each student's path is different, the order in which students complete the various aspects of the program will vary, though directed research progress is expected every semester. A timeline showing how a typical student in our program might go through the program elements is available in Appendix A. Financial support and permission to continue in the Ph.D. program depend on making satisfactory progress each semester in one or more of these categories.

2. Outcomes

The Ph.D. is a research degree. Accordingly, its desired outcomes focus primarily on capabilities in research and education, together with expectations of capabilities in the subject area of software design and development; we therefore assume some level of the subject area capability in our entering students. This differs from undergraduate and professional masters programs, which focus on proficiency in software design and development. In particular, we expect that the following will be outcomes of the Ph.D. program:

- **Ability to do independent research.** SE Ph.D.s must have the ability to carry out independent research – to select significant practical problems, solve them in creative ways, evaluate them critically, demonstrate the validity of the solution, and gather the resources to carry out the work. This is the absolutely essential capability of a Ph.D.
- **Skill in several research methods.** SE Ph.D.s will have broad knowledge with the research methods of the field, empirical and formal (symbolic) methods, together with the ability to evaluate the application of a research method and to select the appropriate research method for a specific research project.
- **Depth of knowledge in chosen specialty.** SE Ph.D.s are deeply knowledgeable in their specialties. Within their specialties they can evaluate and critique material. They exercise this knowledge both within the discipline and in the public realm.

- **Broad general knowledge of SE.** SE Ph.D.s are broadly knowledgeable in their field. They have software design and development skills, and they are familiar with issues in computer science at large. They exercise this knowledge both within the discipline and in the public realm, and they seek relevant knowledge from other fields.
- **Ability to teach a range of software courses.** SE Ph.D.s will be technical leaders. As such, they will be able to organize a body of knowledge so it can be taught to others and should be able to plan presentations and other activities to teach that material. This requires communication with non-experts as well as experts.
- **Communication skills.** SE Ph.D.s will be able to communicate effectively about technical material both within and outside of their specialization, both to other researchers and also to policy makers and the public.
- **Deep understanding of practical software issues.** SE Ph.D.s will ground their research in a deep understanding of software engineering practice. In addition to basic software design and development skills, they will have an in-depth understanding, drawn from personal observation, of practical software engineering issues. These include the implications of development at scale, the gnarly engineering tradeoffs and conflicts that arise in practice, and the tangle of technical, business, and often policy issues that are imposed by project context.
- **Broad, mature, multidisciplinary perspective.** SE Ph.D.s will be prepared for interdisciplinary collaboration and professional leadership. This depends on their ability to view SE critically; to understand how software-intensive systems interact with larger issues in society, business, socio-economic impacts, and public policy; and to appreciate the perspective of both collaborators and competitors.

A table relating the outcomes above to the program requirements is provided in Appendix B.

3. Ph.D. Program Community, Culture, and Mutual Respect

We are committed to a strong sense of community within the Institute for Software Research as well as the School of Computer Science as a whole. Our community is one of the reasons many students choose to come here. We foster community spirit through close working relationships between students and advisors, among faculty, and among students. Many working relationships turn into friendships for life.

In practice, our students, faculty, and staff volunteer their time, energy, intellect, talent, and other skills to do many of the things that keep our environment running smoothly. These efforts include organizing seminars, serving on

departmental committees, grading for graduate courses, planning and running social activities, giving tours, and hosting visitors. Our Software Engineering Ph.D. students have an impressive record of volunteer leadership not just within the program, but also at SCS and university levels.

3.1. Student Leadership Representation

An important part of our culture is that students have a voice and a vote in decisions about the Ph.D. community. In general, decisions regarding Ph.D. program policies are made by a Software Engineering Leadership committee. The committee is composed of software engineering faculty as well as two Ph.D. student representatives who serve staggered 2-year terms. Decisions in the committee are nearly always made by consensus, but the student representatives are voting members of the committee when consensus is unclear.

3.2. Preventing Discrimination and Harassment in Our Program

An essential aspect of our culture is mutual respect among students, faculty, and staff that are highly diverse, not only in terms of professional and research interests, but also in terms of gender, national origin, religion, sexual orientation, and other demographic characteristics. Words or actions that express discrimination, disrespect, intimidation, or harassment based on race, color, national origin, birth sex, gender identity, handicap or disability, age, sexual orientation, religion, creed, ancestry, belief, veteran status, or genetic information are not acceptable within our community.

We hope that our students will not experience incidents that reflect a breakdown of this culture of mutual respect. But when incidents do occur, it's important to know how they will be handled.

Any incident that rises to the level of harassment or intimidation should be reported to the Office of Student Affairs, which has a [process](#) for dealing with violations of community standards. As Section 17.5 describes, incidents of sexual harassment and sexual assault in particular are handled by the [Office of Title IX Initiatives](#).

Our program has processes in place that support these university-level processes, and supplement them in incidents that may not rise to the level of harassment or intimidation, but nevertheless may have negative effects on our community. Such incidents should be reported to the Ph.D. program director, any software engineering faculty member, the program coordinator, or one of the Ph.D. student or faculty ombudspersons. Student ombudspersons, the SE program coordinator, and SE faculty members are responsible for forwarding such reports to the Ph.D. program director (or, when the director has a conflict, to the faculty ombudsperson) for action.

The program director will gather facts and will take action on all reported instances of discrimination. While we will not tolerate harassment, we also recognize the importance of education in all matters, which includes giving

students a chance to learn from their mistakes, in ways that are consistent with protecting our community's culture.

The minimum action taken will be to talk with the individual responsible for the discriminatory incident, discussing why the incident is inappropriate, what actions may be necessary to ameliorate any damage to the community caused by the incident (e.g. an apology), and discussing the consequences of further incidents. Furthermore, all incidents where a student is responsible will be discussed as part of the Black Friday student evaluation process, while incidents where a non-student is responsible will be referred to appropriate university channels. Any student-initiated discrimination that is severe (e.g. one or more incidents that together have a substantial negative impact on an individual or the community) or is repeated after a previous warning will be incorporated into the student's Black Friday evaluation letter. For severe incidents and second offenses, this letter will at a minimum place the student on probationary status ("n-1"); letters may also specify required amelioration actions or termination from the program. All of this process is in addition to the process that the Dean of Students follows for violations of community standards, as mentioned above; the director will refer cases to the Dean of Students as appropriate.

4. Advisors

Except during their first month in the program, each student has a faculty advisor charged with guiding the education and monitoring the progress of the student through the program. This personal student-advisor relationship ensures that every student receives the necessary faculty mentoring. Throughout the program, the advisor is responsible for guiding the student's research and education. Early in the program, the advisor guides the student along some research initiative and helps with strategic planning for courses and other educational activities. Later, the advisor helps to focus the student's research interests towards a thesis topic. Toward the end of the program, the advisor chairs the student's thesis committee, and helps to select the other members of the committee. The advisor also provides the student with career advice.

How are advisors initially chosen? When students first arrive at CMU, we provide an orientation known as the Immigration Course, in which students learn about the environment at CMU and meet the faculty. Each faculty member provides an introduction to his or her research. Students are expected to identify faculty with related research interests and set up meetings with those faculty in order to discuss a potential advising relationship. After about a month at CMU, students are matched with faculty advisors through what we call the "handshake" process. Students list faculty preferences and faculty list student preferences; the SE Ph.D. Program Director then matches each student with a faculty member, taking into consideration each of their preferences and other factors.

There is flexibility in the kind of relationship a student has with his or her advisor. While the advisor is a student's primary source of guidance, many stu-

dents interact closely with faculty other than their formal advisor, for example as part of a research collaboration. A few students have two co-advisors.

Occasionally evolving research interests and other factors motivate changes in advising relationships. It is OK for students to request a change in advisors. Such changes are approved by the SE Ph.D. Program Director with agreement from the new advisor and a consensus about how to gracefully tie up any loose ends in the previous research project.

Any non-courtesy Tenure Track or Research Track faculty member in SCS may serve as a sole advisor or co-advisor. In addition, faculty in other tracks, or in other schools, can serve as advisors with permission of the SE Ph.D. Program Director.

5. Directed Research

The Software Engineering Ph.D. is first and foremost a research degree, and carrying out directed research is the most important activity for students in the program. We expect students to spend at least half their time on research throughout the program. Accordingly, active students (i.e. those who are not on LOA or ABS status, are not Dual Degree Portugal students while in Portugal, or are not taking a summer vacation semester) must enroll in 9-48 units of Graduate Reading and Research each semester.

During any semester, students studying via an internship experience may substitute up to 36 units of Practicum Internship for these research units. Note that students typically substitute practicum units for research units 3-4 times during their Ph.D. degree program. Substituting more than 4 times requires approval from the Ph.D. program director.

Different students, and different advisors, have different ideas of what directed research means and how progress can be demonstrated. It is the responsibility of both the student and his or her advisor to formulate for each semester a set of reasonable goals, plans, and criteria for success in conducting directed research.

At each semiannual graduate student review meeting, the faculty assess the student's previous semester's research progress and the student's next semester's research plans to ensure that the student is making satisfactory progress. The evaluation of a student's progress in directed research often depends on the student having produced some tangible result; examples include the implementation of pieces of a software system, a written report on research explorations, an annotated bibliography in a major area, or, as part of preparation for doing research, a passing grade in a graduate course (beyond the 84 required units).

Advisors are responsible for supervising this portion of the Ph.D. program, with regular input from other faculty provided at the semiannual student review as well as in more informal settings.

6. Course Requirements

The purpose of completing graduate courses at Carnegie Mellon University is to attain a broad understanding of software engineering and closely related fields, a core set of research skills, and a deep understanding of topics that lead into the student's thesis research. Our requirement is that students complete 84 university units, which is the equivalent of 7 standard 12-unit courses.

Our *core research course*, 17-808, provides an understanding of the Software Engineering field, including important ideas and the major research strategies in use. Certain courses are designated as 'star' courses because they provide a solid foundation in some area. By taking a *star* course in each of the four categories, students acquire breadth through exposure to fundamental knowledge, concepts, and skills in software engineering. Through the equivalent of two elective courses, students typically choose to gain more depth in the student's particular area of research. Some students use electives to gain more breadth by specialized exposure to an area outside of the student's core research area.

6.1. Software Engineering Research Course

The Software Engineering Research Course requirement is fulfilled by taking the 12-unit course 17-808: Software Engineering Research, typically in their first semester in the software engineering Ph.D. program. This course is taught jointly by the software engineering faculty, and is designed to prepare Ph.D. students to do research in software engineering. It introduces important ideas across the breadth of software engineering and the major research strategies of the field. Students will become familiar with the structure of the field; they will learn the seminal ideas and developments that led to current research questions; they will learn to critique research papers to evaluate their claims and evidence; and they will also become familiar with the current software engineering research themes at CMU.

6.2. Four Area Star Courses

Each student must pass one star course from each of four categories:

- SYM: Symbolic mathematical modeling and analysis
- BEH: Human-focused empirical research
- ENG: Design and engineering of software systems
- SOC: The interaction of software with larger issues in society, business, or public policy.

These categories are chosen to ensure that students acquire breadth through exposure to fundamental knowledge, concepts, and skills in software engineering. Each category captures a particular set of knowledge and skills that every software engineering student should possess. At the same time, the choice of courses within the categories gives students the flexibility to customize their course selection to their individual needs.

Star courses are identified as especially appropriate to provide grounding in a topical area or set of research skills within Software Engineering. The criteria for a star course include:

- They provide a broad introduction to a topic or skills relevant to software engineering research, while being deep enough to be appropriate for Ph.D. study.
- They assume only an undergraduate background in the relevant area.
- They use multiple forms of evaluation, such as assignments, exams, projects, or term papers.

6.2.1. Star Course Categories and Approved Courses

The more detailed descriptions of the star course categories, together with the rationale for their selection and the currently-approved courses in each category, are as follows:

- **SYM:** A course whose primary focus is on symbolic mathematical modeling and analysis techniques that are applicable to software artifacts. Students taking a SYM course should engage in symbolic research methods that might include discrete models, proofs, state space exploration, or other software-relevant mathematical topics. Symbolic mathematical techniques are useful in many areas of software engineering research, and more broadly, many students have found them helpful in writing careful definitions and precisely distinguishing among related concepts. The courses currently approved in this category are:
 - 10-701 Machine Learning (Ph.D.-level)
 - 11-727 Computational Semantics for NLP
 - 15-811 Verifying Complex SYstems
 - 15-812 Programming Language Semantics
 - 15-814 Type Systems for Programming Languages
 - 17-819 Program Analysis
 - 17-751 Models of Software Systems
 - 80-610 Formal Logic
- **ENG:** A course with a primary focus on software systems design and engineering. Courses in this category must include (A) significant engagement with software design, (B) consideration of software artifacts at a significant scale and complexity, and (C) exposure to the tradeoffs (such as cost/benefit) at the core of the engineering discipline. The courses currently approved in this category are:
 - 05-830 Advanced User Interface Software
 - 15-712 Advanced Operating Systems and Distributed Systems

- 15-821 Mobile and Pervasive Computing
 - 16-867 Principles of Human-Robot Interaction
 - 17-755 Architectures for Software Systems
 - 17-752 Methods: Deciding What to Design
 - 18-730 Introduction to Computer Security
 - 18-732 Secure Software Systems
 - 18-749 Building Reliable Distributed Systems
 - 15-745 Optimizing Compilers for Modern Architectures
- SOC: A course with a primary focus on how software interacts with larger issues in society, business, or public policy. This requirement is intended to create breadth in the curriculum, pushing students out of a focus on the software system itself (which is what ENG does) to take a course that views software from the perspective of another discipline. The courses currently approved in this category are:
 - 05-820 Social Web
 - 08-631/17-631 Information Security and Privacy
 - 08-733/17-733 Privacy, Policy, Law and Technology
 - 08-805/17-735 Privacy Engineering
 - 18-734 Foundations of Privacy
 - 19-758 Special Topics: Organizational Theory for Engineers
 - 90-802 Information Security: Comparison of US and European Policies
 - 90-880 Strategy and Management of Technological Innovation
 - 95-782 Global eBusiness Strategy
- BEH: A course that is primarily concerned with behavioral science research methods. The course must touch on one or more human-focused empirical research methods that may include case studies, interviews, surveys, human subjects experiments, or mining software repositories. These methods may involve working with subjects directly or inferring information about subjects based on artifacts they have left behind, as in mining software repository research. The course must require students to plan and prototype a sample project using at least one of these research methods in some depth. The courses currently approved in this category are:
 - 05-899D Human Aspects of Software Development
 - 05-821 Applied Research Methods - Qualitative WITH 05-822 Applied Research Methods - Quantitative (6-units each, therefore 2 must be taken)
 - 08-803/17-803 Empirical Methods
 - 08-734/17-734 Usable Privacy and Security
 - 36-743 Statistical Methods for the Behavioral and Social Sciences

6.2.2. Process for Requesting Approval for New Star Courses

The faculty have selected an initial set of approved courses in each category. These are subject to review from time to time to ensure that, if the course content changes, it remains consistent with the purpose of that star.

SE Ph.D. students may request that the faculty approve an additional course in one of the star categories. In general, if the request is approved, the course will be added to the list for other students to take for star credit. When a request is student-initiated, it is the student's responsibility to make a case supporting STAR status. Students should submit a request to the SE Ph.D. Program Director and the SE Ph.D. Program Administrator using the following template:

1. Your name
2. Name and number of the course
3. Course description or URL to course description
4. Which star requirement you want this course to satisfy
5. An indication of approval by your advisor.
6. Evidence, including quotes from the course description and syllabus with supporting links, to demonstrate that the course:
 - (a) Matches the topic and fulfills the particular requirements of the star course category you have requested. Star courses should have some degree of breadth but are not expected to provide comprehensive coverage of a star category.
 - (b) Assumes an undergraduate background in the relevant area—no more and no less
 - (c) Uses multiple forms of evaluation (e.g. assignments, exams, projects, papers, ...)
 - (d) Is appropriate for Ph.D. study in terms of depth and engagement with research. For example, if a course is primarily designed for master's students, a justification should be given that the course is also an appropriate preparation for Ph.D. study. Sometimes a course that is missing engagement with research may be adapted for Ph.D. students through additional or replacement assignments that lead PhD students deeper into relevant research topics

Given sufficient information, requests received by the faculty should generally receive a response within 2 weeks, if the request is made during a regular academic semester. Star credit should generally be requested at least 2 weeks before the end of the semester before taking a course, and preferably 2 weeks before the beginning of the registration period. This ensures students can register for a course before it fills up, and avoid spending time on a course that is not in the end approved.

Courses will not, in general, be approved in two categories, but instead will be approved in the category that best fits the primary emphasis of the course (if any). If any exception to this principle is made, the student must choose which category to apply the course to, and find a different course with which to fulfill

the other requirement.

There is a precedent for approving an independent study for star credit, in the rare case where an appropriate independent study suits the student's needs better than any available course. The approval process is the same in this case, but the proposal submitted by the student should identify who would advise the independent study, what the output of the study will be and how it should be evaluated, the match to the appropriate star category, appropriateness of the course for Ph.D. study in terms of depth and engagement with research, and should indicate advisor approval.

Course curricula may evolve over time, due to the advancing state of knowledge, the changing background and needs of students, or the strengths that a new instructor brings to bear on a course. Therefore, the faculty may re-examine star courses from time to time in order to verify the the course continues to fulfill the requirements for a star. If it does not, star status may be withdrawn for future offerings of the course.

6.3. Software Engineering Research Seminar

All SE Ph.D. students are expected to register for and actively participate in 17-791, the Software Engineering Research Seminar (SSSG) each semester. This seminar course is an opportunity to learn about Software Engineering research in the department and to gain presentation skills. Each student is expected to present twice per year in the seminar.

A student who has a course conflict with SSSG should get approval from their advisor and the SE Ph.D. Program Director; approval is routinely granted but is expected to be rare (typically once or twice in a student's time in the program).

6.4. Twenty-Four Elective Units

Students must also take 24 university units worth of elective courses, at least 12 of which are from graduate courses offered by the School of Computer Science; the other 12 may be from graduate courses offered by the rest of the University. In general, elective graduate courses must be Ph.D. level (university course numbering 700 and above); exceptions to this rule may be made with a note from the student's advisor to the SE Ph.D. Program Administrator.

There is no explicit breadth or depth requirement. Students may use electives to gain additional depth of knowledge in the student's research area, e.g., to complement their directed research or to prepare them for choosing a thesis topic. Students may also use electives to gain additional breadth of knowledge in an area outside of the student's research area.

We strongly advise students to choose electives in consultation with their advisors. The student and his or her advisor are both responsible for making sure that through these 24 elective units the student gains new knowledge, perhaps to fill gaps or to prepare for thesis research.

Students are free to take more than the required number of elective units.

Following is a sample of past electives taken:

- 05-830 Advanced User Interface Software
- 05-899D Human Aspects of Software Development
- 15-816 Modal Logic
- 15-817 Introduction to Model Checking
- 15-819O Program Analysis
- 15-892 Foundations of Electronic Marketplaces
- 17-711 Socio-Technical Ecosystems
- 17-732 Emerging Programming Paradigms
- 17-807 Research Writing For Software Engineers
- 99-452 Language and Culture for Teaching

6.5. Credit for Prior Coursework

Students may request to waive up to two course requirements based on equivalent graduate-level courses they have already taken, or based on industry experience they have acquired, prior to entering the Ph.D. program. The Software Engineering Research course cannot be waived, and no more than 12 units of star courses can be waived.

To apply for a waiver, a student must submit a petition to the Ph.D. Program Coordinator within their first year in the program. A separate petition must be submitted for each course to be waived. The prior course need not be equivalent in content to one of the approved courses in the same category but rather should be equivalent in substance: a student who has done excellent work in an intellectually rigorous graduate course on a computer science topic that we happen not to teach may be granted a waiver if it matches the intent of the corresponding category.

The petitioner must make a case for how prior courses are equivalent in substance, submitting a self-contained justification, a syllabus, and a transcript (translated if necessary). As needed, the petitioner can provide additional support for the case by providing slide excerpts, reading lists, homework assignments, work products, or other supporting artifacts. For star courses, the justification must argue why the course(s) match the intent and expectations of the appropriate star requirement, similar to requests for approval for a new star course (described above). In order to waive a course based on comparable experience, the student should document how the experience demonstrates their systematic knowledge of the relevant material.

Typically, courses may be waived based on rigorous graduate courses taken as part of a Master's degree. For example, a Master's level psychology course might be an appropriate to fulfill the BEH star requirement, and a similar economics course might fulfill the SOC requirement. In rare cases, unusual advanced undergraduate coursework or research experience may be sufficient to waive a course, if the material covered is equivalent in substance to the star courses in question.

These petitions will be considered by the faculty, typically delegated to a

faculty member with expertise in the corresponding star area. The outcome of the petition process will be decided based on provided information on the prior course and the petitioner's performance in it. The faculty may ask appropriate instructors for assistance in this decision or reject the petition with a request for resubmission if insufficient information is provided. If appropriate, the faculty may stipulate conditions on the waiver, such as preparing a supplementary project that exposes the student to software engineering research in the area of the course, and is roughly equivalent in scope to a final project in a typical Ph.D.-level course.

7. Practicum Requirement

An integral part of ISR's software engineering research program is ongoing interaction with industrial-strength software development in a real (not just realistic) setting. Many students already have industrial experience. Those whose prior experience is insufficient may be required to acquire such experience, typically by participating in one or more industrial internships while in the program.

The purpose of the practicum, therefore, is to ground academic study in practice by careful reflection or scientific study of direct experience in software development. Each student will complete one practicum, which is expected to take effort comparable to a 12-unit course. A practicum may take one of the following forms:

- An issue-focused reflection and analysis of a practical software engineering experience of the author
- An empirical study of (some aspect of) the software development process

A practicum of the first type is similar to an experience report, such as those published in the ICSE Software Engineering in Practice track, but is not expected to attain the level of polish or broad applicability that might be expected for formal publication. It is not merely a report of the author's experience. Rather, it is a critical reflection on that experience, focused on a well-defined issue or related set of issues. The practicum should be grounded in experience and careful observation, and possibly data as well. At the same time, it should draw out substantive lessons that might be applied to other similar situations. As an informed reflection, it should be framed in the fundamental concepts of the software engineering literature, which might explain or contradict the student's practical experience. It is not always necessary to have sufficient data for statistical validity, but in all cases the narrative should be clear about the strength of the evidence.

The second category of practicum is in the form of a scientific paper, potentially publishable at a peer-reviewed conference or workshop in the area of empirical software engineering.

7.1. Practicum Presentation, Writing, and Evaluation

The student must produce a self-contained report, written for an audience of entering software engineering PhD students or advanced undergraduates. The target length for the report is about 7-10 pages in a normal technical report format; we expect a typical student will be able to write and revise such a report in approximately a week of work (40 hours). The report should be written in a scientific style: it should have clear definitions, careful distinctions between observations and interpretation, and appropriate comparisons to the scientific literature.

The practicum report must be approved by two faculty members, with an expected cycle for feedback of approximately 3 weeks. Any faculty in the Institute for Software Research are eligible; other faculty may be approved by the SE Ph.D. Program Director.

Normally the practicum will also involve an oral presentation to the Carnegie Mellon Software Engineering community, allowing others to learn from the practicum experience and getting feedback from the community that is often useful for the writeup. Practicums are typically presented in the Software Research Seminar (SSSG).

7.2. Practicum Confidentiality

As with any report on practical experience, practicum papers may be sensitive. Practicum reports must be available to members of the Carnegie Mellon Software Engineering Community without restriction; however, they need not be public beyond the scope of that community. It is the student's responsibility to ensure compliance with any NDAs the student may have signed. As with other papers, it is acceptable to shield the identity of individuals and organizations, as well as details of data about the experience (for example, by removing units from graphs).

Prior practicum reports are available on the password-protected internal SE Ph.D. Program web page, along with informal pragmatic advice on writing the practicum document.

8. Teaching Requirement

The ability to teach is an important skill for all scientists, not only for those who plan to teach after completing their degrees. Teaching skills include the ability to communicate technical material ranging from elementary to advanced, and to communicate technical material to audiences ranging from general to specialized. Thus, we expect students to develop and exercise teaching skills as part of their graduate education.

Students have ample opportunities to present advanced material while working on research projects, by participating in research seminars and by giving practice conference talks. To gain experience in presenting material at an introductory or intermediate level, we require that all graduate students help teach

two courses. The norm is for students to teach one course focused on introductory material in computer science or software engineering, and one course focused on mastery of material (typically an advanced undergraduate or master's course). Teaching assistants typically spend 15-20 hours per week.

SE PhD students who hope to TA should contact the ISR TA coordinator in the semester before the TA-ship would begin to get approval for TAing. There are typically two cases:

- Case 1: The student is looking for a course to TA. The coordinator will normally have a list of courses that are looking for TAs and the student should discuss possible options with the coordinator.
- Case 2: The student has some idea of the course to TA, perhaps having already talked to the instructor. In this case the student should send email to the coordinator requesting to be assigned as a TA that course. The request should include: (a) the course number and title, and whether it is primarily an undergrad, master's or PhD course, (b) whether TAing has been discussed with the instructor, and (c) what role the student would have as a TA in the course (e.g., as part of a team, as the sole TA, etc.).

After serving as a teaching assistant, in order to receive credit for the teaching requirement, the student must obtain a filled out [teaching assistant evaluation form](#) from the course instructor, and provide the SE Ph.D. Program Administrator with a copy of the evaluation.

Students are encouraged to teach more than twice. At the semiannual student review meeting the faculty give special recognition to those who do an outstanding job as a TA and to those who teach beyond the required load. The School of Computer Science and the CMU Eberly Center offer teaching workshops which we encourage students to take advantage of.

9. Written and Oral Communication Skills

To be a well-rounded software engineer, each student should have not just basic knowledge, but also the abilities

- To communicate technical ideas clearly in writing
- To communicate technical ideas clearly orally

We also expect students to be able to program, but there is no formal checkpoint to certify programming skills. It is left up to the advisor and student to make sure the student has the necessary skills.

9.1. Writing Proficiency

To satisfy the writing proficiency requirement, each student must write a scholarly document, as either its sole author or its primary author (if coauthored), that is at least the quality of a Carnegie Mellon technical report. This document must be a scholarly paper with references to the literature that could be submitted for peer review. It may be a technical report, a paper published at or in preparation for a conference or journal, a document written to satisfy a course requirement (e.g. a course project report), or a comprehensive survey paper (e.g. suitable for submission to *ACM Computing Surveys*).

Annotated bibliographies, user manuals, and reference manuals do not qualify because they do not require the same kind of explication, organization, and summarization skills needed to write a conference- or journal-like publication. The paper may not be a practicum document, the thesis proposal, or the thesis. Workshop papers are generally not substantial enough to qualify, though exceptions could be made for workshop papers that are of a scope (and quality) comparable to conference submission.

The writing requirement is evaluated by at least two faculty members and one SCS Ph.D. student who has fulfilled a writing requirement. Any non-courtesy Tenure Track or Research Track faculty member in SCS may be an evaluator. In addition, faculty in other tracks, or in other schools, can serve as evaluators with permission of the SE Ph.D. Program Director, which is typically granted for faculty active in research in a relevant area. One of the reviewers must be a faculty member of ISR, and none of them should be a co-author of the paper being reviewed. These evaluators must read the document and provide written feedback using the [Writing Evaluation Form](#). If the initial draft is not satisfactory, the student must revise the document until the evaluators are willing to give their final approval by signing the form. The student then gives these three (or more) signed forms to the SE Ph.D. Program Administrator, who keeps copies in the student's file and indicates in the student's records that the requirement has been satisfied.

Students are responsible for asking the appropriate faculty members and Ph.D. student to help them with satisfying their writing requirement.

We expect students to be able to satisfy this requirement within their first three years, and prior to their thesis proposal.

Ph.D. students are welcome to enroll in the undergraduate communications course, required of undergraduate computer science majors, to enhance their writing skills; however, taking it is not sufficient in itself to satisfy the written communication skills requirement.

9.2. Speaking Proficiency

At the student evaluation meeting held each semester, the faculty make a judgment to pass students who have demonstrated high speaking proficiency through the presentation(s) they have given in the Software Engineering Research Seminar and other venues. We expect a standard of proficiency typical of good

presentations at an academic conference, or of a respected instructor giving course lectures.

Students who have passed the proficiency requirement still benefit from honing their speaking skills, and so they are expected to continue to attend the Seminar, including active participation and twice-yearly presentations as described in the Software Engineering Research Seminar course requirement (above).

10. The Thesis Process

The thesis must describe a significant piece of original research. It is evidence of proficiency, high attainment, and ability to do research in software engineering.

A more extensive checklist with specific information on the thesis proposal and thesis defense is available at <http://isri.cmu.edu/education/se-phd/docs/thesis-proposal-checklist.pdf>. Every student must read and adhere to these more detailed process rules.

10.1. Thesis Proposal

The student submits a written proposal to the faculty. The student also orally presents the thesis proposal to interested faculty and students in a public colloquium.

A thesis proposal should

- Explain the basic idea of the thesis topic (e.g., the problem to be solved and the approach to solving it)
- Argue why that topic is interesting (e.g., what contributions to the field would be made in carrying out the proposed work)
- State what kind of results are expected
- Argue that these results are obtainable within a reasonable amount of time
- Demonstrate that the student is qualified to perform the proposed work, including an understanding of the area and its literature

The main purpose of the thesis proposal is to convince the faculty that the chosen thesis topic is significant and that the student's approach has a reasonable chance of success. A thesis proposal gives the faculty the opportunity to pass such judgment at the start of the work and not at the end. We want to minimize the chance that a thesis will be turned down when almost completed. We expect students to present their thesis proposals as early as possible, not halfway through writing the thesis. A thesis proposal should be short, about 15–20 pages, and the oral presentation should take about 40 minutes, not including questions.

A thesis proposal should *not* be

- A dry run for the thesis
- A summary or abstract of the thesis
- The first chapter or part of the thesis
- A technical report
- A survey of the field
- An annotated bibliography

Any included list of references or bibliography should serve the purpose of supporting the assessment of the state of the art and the student’s personal qualifications.

To provide ample notice to the public, at least one week in advance of the oral presentation, students should provide the SE Ph.D. Program Administrator with an electronic copy or link to the thesis proposal, an electronic copy of the proposal’s abstract, and a list of the thesis committee members, including the external member. The committee should also be consulted about the readiness of the proposal before announcing the oral presentation. The SE Ph.D. Program Administrator posts the public announcement of the thesis proposal presentation.

Please remember that at least three thesis committee members (including the Chair) must be physically present for the thesis proposal, and the thesis proposal must be held at Carnegie Mellon. The only exception is for students in Ph.D. programs offered jointly with other universities, in which case the thesis proposal may be held remotely, with one Carnegie Mellon member physically present, and the proposal session broadcast to a Carnegie Mellon room open to the public.

Upon completion of the thesis proposal the student must complete a Doctoral Candidate Contractual Agreement Form provided by the Graduate Programs Administrator.

10.2. Residency Policy

Ph.D. students must register as full-time students for a minimum of 2 academic years in total. Full-time students must be resident in Pittsburgh, or, with the approval of their advisor and the program head, at a collaborative site.

10.3. All But Dissertation (ABD) Policy

After the acceptance of a student’s thesis proposal by the thesis committee, and after the student has satisfied all other requirements except for the dissertation and its oral defense, the student is regarded as having “all but dissertation” (ABD) status.

An ABD candidate may choose to continue as a regular student *In Residence*, or, if the residency requirement above is fulfilled, he or she may choose to be *In Absentia* (ABS).

ABS - Off Campus: Students who leave CMU but plan to continue working on the thesis will be classified as ABS. These students should not require substantial use of university resources, but are permitted use of the libraries and consultation with faculty or students as necessary. While a candidate is ABS, he or she is required to pay the university technology fee each semester. No formal enrollment or payment of tuition is required, with the exception of the academic semester in which the degree requirements are completed. A candidate who is ABS is required to enroll for a minimum of five units during the academic semester in which the degree requirements are completed. Charges for these units are the responsibility of the candidate.

Since an ABS candidate will not be certified by the University as a “student” for immigration purposes, students who are in the United States on a student visa and who become ABD should not choose to become ABS.

ABD - On Campus: Students who are self-supporting and are in ABD status may remain on campus to complete the thesis. They must register and pay for a minimum of five units each semester. However, students who receive a stipend predicated on their status as a graduate student and paid by or administered by the university will be required to register for a minimum of 36 research units. Nearly every ABD student in ISR falls into this latter category.

For other important information regarding ABD and ABS status, please see the [University Doctoral Student Status Policy](#).

10.4. Time to Degree Policy

Students who began in the PhD program after June 1, 2011 must complete all requirements for the PhD within a maximum of ten years from original matriculation as a doctoral student, unless terminated earlier by conferral of the degree or by academic or administrative action.

Students who began in the PhD program prior to June 1, 2011 must complete all requirements for the PhD within a maximum of seven full academic years after achieving ABD status, unless terminated earlier by conferral of the degree or by academic or administrative action.

Time spent in leaves of absence or in-absentia counts towards the limits above. Once this time-to-degree limit has lapsed, the person may resume work towards a doctoral degree only if newly admitted to a currently offered doctoral degree program under criteria determined by that program.

10.5. Thesis Committee

The student’s advisor chairs the thesis committee. All other committee members, including the external member, should be agreed upon before the thesis proposal presentation. Members of the student’s committee must accept the responsibility of meeting with the student regularly to ensure that the research

is progressing in the right direction. The Thesis Committee must consist of at least one Institute for Software Research faculty member, two other members of the SCS faculty and/or other faculty approved by the Institute Head, and an external committee member. All thesis committees are subject to departmental approval.

The list of other approved faculty currently consists of Anthony Tomasic and David Eckhardt.

10.6. Thesis

The thesis must describe a significant piece of original research work and must describe it well. It is on this basis that the Institute certifies the qualifications of the new Ph.D. Furthermore, it is the most important basis on which the scientific community judges the initial achievement and potential of that individual.

10.7. Thesis Defense

The student's thesis committee decides whether to accept the thesis based on its content and the outcome of the *thesis defense*, which is a public presentation describing the contributions of the thesis. At least one week in advance of the oral presentation, students must provide the SE Ph.D. Program Administrator with an electronic copy of the abstract and a list of all thesis committee members. The SE Ph.D. Program Administrator posts the public announcement of the thesis defense.

Before the thesis defense, the entire thesis committee is expected to have read the entire thesis, to have given comments to the candidate, and to have given approval for scheduling the public defense. This means that a copy of the complete thesis document should be provided to the whole thesis committee a minimum six weeks in advance of any proposed date for the defense. Significant deviations from this rule must be approved by the SE Ph.D. Program Director. Committee members should meet briefly before the thesis presentation to discuss any issues.

The presentation by the candidate is normally about 45 minutes, followed by a question-and-answer period which may be as long as needed.

As with the thesis proposal, at least three thesis committee members (including the Chair) must be physically present for the thesis defense, with the exceptions described above for Ph.D. programs joint with another university.

The thesis committee chair (advisor) determines who may ask questions and in what order and brings the discussion to a close at the appropriate time. The question-and-answer period is followed by a closed-door session attended by only the members of the thesis committee and any interested faculty members. The options of the committee are:

- To approve without corrections
- To approve subject to minor changes, to be approved later by the thesis chair only

- To require a resubmission after major changes and reapproval of the entire committee
- Not to approve the thesis

All members of the committee are required to sign a Final Oral Examination card, indicating that the student has passed the thesis oral examination. In addition, the thesis committee chair, the Institute Head, and the Dean sign a final certification sheet when the student submits the final version of the thesis.

10.8. Graduation Certification

The SE Ph.D. Program Administrator maintains a checklist of procedures for scheduling the thesis oral presentation and completing the other requirements for graduation. The SE Ph.D. Program Administrator certifies fulfillment of requirements for graduation only when the final version of the thesis has been approved by the thesis committee, the Institute Head, and the Dean. Students are not allowed to participate in commencement exercises unless final certification has been made, so the Ph.D. defense should be scheduled a few weeks in advance of graduation to allow time for possible revisions and certification.

If the final copy of the thesis is not submitted within one year of the thesis defense, the faculty may require a second defense before making a final certification.

11. Master's Degrees

Ph.D. students may wish to have their progress in the program recognized by receiving a Master of Science in Software Engineering degree upon completion of an appropriate number of Ph.D. program requirements. These requirements serve to characterize the student's preparedness to develop a doctoral thesis proposal in the program.

Upon completing the Master of Science in Software Engineering degree, students should be able to:

- Demonstrate breadth in knowledge across three foundational areas in software engineering.
- Demonstrate the ability to identify, read, and understand relevant research literature, and to design a research study using an established research method.

The above learning objectives can be realized by the following course plan:

- Complete the Software Engineering Research Course
- Participate in the Software Engineering Research Seminar (SSSG) each semester, unless excused by the Program Director due to a course conflict.
- Complete four additional courses, covering at least three of the four star areas

- Complete 96 units of supervised research
- Either complete an additional 24 units of research or coursework, or else serve as a teaching assistant for one semester
- Fulfill the writing requirement

The learning objectives and sample course plan are equivalent to a two-year master's program with no thesis option. All courses used to qualify for the master's degree must be taken at CMU, and no master's degree will be granted to a student who has previously received a master's degree from the CMU School of Computer Science. The degree is granted upon written request by the student to the SE Ph.D. Program Administrator once they have completed sufficient requirements to demonstrate the learning objectives.

12. Dual Degree Program with Portugal

The institute also offers a dual degree Ph.D. program in Software Engineering in cooperation with several Portuguese universities. The regulations are essentially the same as given in this document, except that some requirements can be fulfilled in an affiliated program in Portugal. For more information, see <http://www.cmuportugal.org/>.

13. Student Support and Employment

13.1. Academic Year Support

The Institute aims to allow students as much freedom as is possible in choosing research directions, subject to the interests and expertise of the faculty who are available to oversee the work. Thus, the Ph.D. program places the responsibility on the advisor to identify a source of funding to support his or her student. We also encourage students to seek their own external funding since often the award is prestigious (e.g., NSF or Hertz) or the source provides an opportunity to make professional connections (e.g., an industrial fellowship).

If a student receives an external fellowship/scholarship, they must notify the SE Ph.D. Program Administrator. The Institute supplements the stipends of students with an outside fellowship to meet the stipends of students with internal funding, plus a bonus: in a year when a student brings in a fellowship worth X , that student gets 1% of X added to their stipend each month, for a total of 12% of X if the student takes a stipend all per month, the Institute pays a dependency allowance that is 10% of the student's SCS monthly stipend per dependent.

¹Note that since roughly half of a student's costs are related to tuition, if X is a full-ride then 12% of X may increase the stipend by approximately 24%.

13.2. Summer Support and Internships

Advisors provide summer support for many students, particularly for those working on their dissertation. However, many students benefit from gaining experience in either a development or research position in industry for one or two summers during their career here at Carnegie Mellon. Practice-oriented summer internships are particularly important for students who have had little or no prior full-time experience in the software industry. Faculty can provide help in finding suitable summer employment.

Students who participate in relevant software engineering internships may remain an active student by taking the 17-998 Practicum Internship course, as described earlier in the section on Directed Research.

International students should consult with the Program Administrator and the Office of International Education before accepting an internship.

13.3. Employment While a Student

Working (i.e. doing anything for pay) either within or externally to the university, beyond your responsibilities as a teaching assistant or research assistant, is a privilege, not a right. We grant this privilege for one of two reasons:

- The employment is relevant to the student's thesis work or a Carnegie Mellon research project.
- The student has exceptional financial obligations.

Employment is normally limited to a maximum of one day per week.

A student who wishes to work must obtain prior permission from his or her advisor and the SE Ph.D. Program Director.

We may require that students limit employment in order to be in compliance with university and government rules, but the more important principle is maintaining adequate focus and creative energy for the research that is at the core of the Ph.D. degree.

14. Leave of Absence

Students who wish to leave the program temporarily may request a leave of absence by submitting a request to the SE Ph.D. Program Director, with cc to the Program Administrator.

Leaves are initially granted for a period of no more than one year, but an extension of up to one additional year may be granted under exceptional circumstances. When an extension is granted, the conditions for return must be negotiated with the advisor and the SE Ph.D. Program Director prior to returning to the program. Students must be in good standing in order to be granted a leave of absence.

Students on leave of absence should contact the SE Ph.D. Program Administrator two months prior to the end of the leave to indicate their plans. While

a leave can in principle start at any time, university regulations allow students to return only at the beginning of a semester (usually late August or January).

15. Evaluation of Students' Progress

Evaluation and feedback on a student's progress are important both to the student and to the faculty. Students need information on their overall progress to make long-range plans. The faculty need to make evaluations to advise students, to make support decisions, and to write recommendations to potential employers.

The faculty meet at the end of each semester to make a formal evaluation of each student in the Ph.D. program. For historical reasons this meeting is called "Black Friday." The purpose of having all the faculty meet together to discuss all the students is to ensure uniformity and consistency in evaluation across all the different areas, by all the different advisors, throughout the years of the SE Ph.D. program as it inevitably changes.

The faculty measure each student's progress against the goal of completing the Ph.D. program in a reasonable period of time. The evaluation considers all components of the program using indicators and information sources described below. Requirements need not be fulfilled in any particular order, but each student must show reasonable progress each semester toward satisfying the full set of requirements. Because the critical path to completing the Ph.D. is research, making early and regular research progress is the most important consideration. Through a Black Friday letter, the faculty inform students of the results of this evaluation, which may include specific recommendations for future work or requirements that must be met for continued participation in the program.

15.1. Components and Indicators

In their evaluation, the faculty consider the following components, though naturally only some of these components will be applicable in any given semester; they are not equally important at every stage of a student's career, and each student will progress through the requirements as suits his or her individual needs:

- *Directed research*: Evaluated by research supervisor and other collaborating faculty.
- *Courses taken*: Evaluated by the course instructor—brief prose evaluation/summary grade.
- *Teaching*: Evaluated by the course instructor and two different teaching evaluation forms (one filled out by the course instructor and the other filled out by students, where appropriate).
- *Skills*: Writing and speaking, by relevant faculty and forms.

- *Thesis*: Status summarized by the thesis advisor and comment by members of the thesis committee.
- *Other*: Lectures given, papers written, etc. Evaluated by cognizant faculty.

The faculty's primary sources of information about the student are the student's advisor and the student's statement. The advisor is responsible for assembling the above information and presenting it at the faculty meeting. The student should make sure the advisor is informed about participation in activities and research progress made during the semester. Each student is asked to submit a summary of this information to the advisor at the end of each semester—the *Student Statement for Black Friday* at <https://gsaudit.cs.cmu.edu>. This statement is used as student input to the evaluation process and as factual information on activities and becomes part of the internal student record. It is strongly recommended that the student and advisor meet prior to the faculty meeting to review the information provided in this statement.

15.2. Outcomes and Recommendations

Based on the above information, the faculty decide whether a student is making satisfactory progress in the Ph.D. program. If so, the faculty usually suggest goals for the student to achieve over the next semester. If not, the faculty make more rigid demands of the student; these may be long-term (e.g., finish your thesis within 1-1/2 years) or short-term (e.g., select and complete one or more specific courses next semester; prepare a thesis proposal by next Black Friday).

Ultimately, permission to continue in the Ph.D. program is contingent on whether or not the student continues to make satisfactory progress toward the degree. If a student is not making satisfactory progress, the faculty may choose to drop the student from the program.

The faculty also decide whether financial support (including tuition and stipend) should be continued for each student. Termination of support does not always mean termination from the program.

15.3. Grades

As described above, a student's progress in the Ph.D. program is measured along multiple dimensions. One of these dimensions is a student's performance in courses, and our expectation is that Ph.D. students earn a B- or better. Grades of C+ or below do not count towards program requirements.

As described above, grades are just one dimension of student performance, and in fact are largely irrelevant for students who complete the program. In order to encourage students to place their primary focus on research over coursework, our general program policy is to record letter grades in each student's internal program record, but to record grades as pass/fail in the student's official transcript. Note, however, that although C and D grades will be converted to a pass on the transcript per university registrar policy, the above policy that the

student earn the equivalent of a B- or better internal grade in order to fulfill a program requirement still applies.

SE Ph.D. students may register for graduate or undergraduate courses in other departments. However, where possible, they should register for these courses with pass/fail grading. A form to request pass/fail grading is available from the Graduate Programs Administrator. While we encourage all instructors to follow our general policy for SE Ph.D. students in their courses, instructors have the discretion to make their courses letter graded only, which overrides the general policy above for those specific courses.

Once the required coursework is completed, students register only for a blanket course (e.g., Reading and Research') covering all their program activities for that semester, for which they receive a Pass/No Pass grade.

16. Problems?

16.1. Points of Contact

Students and advisors enjoy a close working relationship in our program. If students have problems, whether related to their research or not, they should feel free to speak to their advisors. If doing so is awkward or if students simply want a second opinion, they should feel free to discuss their problems with either the SE Ph.D. Program Director (currently Jonathan Aldrich) or the SE Ph.D. Program Administrator (currently Connie Herold).

16.2. Faculty and Student Ombudspersons

If a student feels that none of the above avenues are appropriate for addressing his or her problem, the student can turn to the Ph.D. program's student or faculty *ombudspersons*.

Currently, the faculty ombudsperson is Jim Herbsleb. The faculty ombudsperson's roles and responsibilities are:

- To meet with students and listen to their problems
- To give advice, perhaps suggesting someone else to talk to or suggesting the next step to take
- To take action on any issues where the program director may be conflicted
- To keep conversations confidential

Currently, the student ombudsperson is Roykrong Sukkerd. The student ombudsperson's roles and responsibilities are:

- To meet with other students and listen to their problems
- At the student's request, to refer issues to the SE Ph.D. program director, or to the faculty ombudsperson in any case where the program director may be conflicted. If both are conflicted, the ombudsperson can assist the student with referring the issue to the Dean of Students.
- To keep conversations confidential

17. University Policies

This section provides an overview of a number of important University-level policies that apply to graduate students. It is the responsibility of each member of the Carnegie Mellon community to be familiar with university policies and guidelines. In addition to this departmental graduate student handbook the following resources are available to assist you in understanding community expectations:

- The Word/Student Handbook: <http://www.cmu.edu/student-affairs/theword/>
- Academic Integrity Website: <https://www.cmu.edu/student-affairs/ocsi/academic-integrity/index.html>
- University Policies Website: <http://www.cmu.edu/policies/>
- Graduate Education Website: <http://www.cmu.edu/graduate/policies/>

17.1. Carnegie Mellon University Statement of Assurance

Carnegie Mellon University does not discriminate in admission, employment, or administration of its programs or activities on the basis of race, color, national origin, sex, handicap or disability, age, sexual orientation, gender identity, religion, creed, ancestry, belief, veteran status, or genetic information. Furthermore, Carnegie Mellon University does not discriminate and is required not to discriminate in violation of federal, state, or local laws or executive orders.

Inquiries concerning the application of and compliance with this statement should be directed to the vice president for campus affairs, Carnegie Mellon University, 5000 Forbes Avenue, Pittsburgh, PA 15213, telephone 412-268-2056.

Obtain general information about Carnegie Mellon University by calling 412-268-2000.

The Statement of Assurance can also be found on-line at <https://www.cmu.edu/policies/administrative-and-governance/statement-of-assurance.html>

17.2. The Carnegie Mellon Code

Students at Carnegie Mellon, because they are members of an academic community dedicated to the achievement of excellence, are expected to meet the highest standards of personal, ethical and moral conduct possible.

These standards require personal integrity, a commitment to honesty without compromise, as well as truth without equivocation and a willingness to place the good of the community above the good of the self. Obligations once undertaken must be met, commitments kept.

As members of the Carnegie Mellon community, individuals are expected to uphold the standards of the community in addition to holding others accountable for said standards. It is rare that the life of a student in an academic community can be so private that it will not affect the community as a whole or that the above standards do not apply.

The discovery, advancement and communication of knowledge are not possible without a commitment to these standards. Creativity cannot exist without

acknowledgment of the creativity of others. New knowledge cannot be developed without credit for prior knowledge. Without the ability to trust that these principles will be observed, an academic community cannot exist.

The commitment of its faculty, staff and students to these standards contributes to the high respect in which the Carnegie Mellon degree is held. Students must not destroy that respect by their failure to meet these standards. Students who cannot meet them should voluntarily withdraw from the university.

The Carnegie Mellon Code can also be found on-line at <http://www.cmu.edu/student-affairs/theword/code.html>

17.3. Assistance for Individuals with Disabilities

The Office of Disability Resources at Carnegie Mellon University has a continued mission to provide physical and programmatic campus access to all events and information within the Carnegie Mellon community. We work to ensure that qualified individuals receive reasonable accommodations as guaranteed by the Americans with Disabilities Act (ADA) and Sections 503 and 504 of the Rehabilitation Act of 1973. Students who would like to receive accommodations can begin the process through [Disability Resources secure online portal](#) or email access@andrew.cmu.edu to begin the interactive accommodation process. For more information please see <http://www.cmu.edu/education-office/disability-resources/>. Students with disabilities are encouraged to self-identify with the Office of Disability Resources by contacting Catherine Getchel, 412-268-6121, getchell@cmu.edu to access the services available at the university and initiate a request for accommodations.

17.4. Maternity Accommodation Protocol

Pregnant students whose anticipated delivery date is during the course of the semester may consider taking time away from their coursework and/or research responsibilities. All female students who give birth to a child while engaged in coursework or research are eligible to take either a short-term absence or formal leave of absence. Students in course work should consider either working with their course instructor to receive incomplete grades, or elect to drop to part-time status or to take a semester leave of absence. Students engaged in research must work with their faculty to develop plans for the research for the time they are away.

Students are encouraged to consult with relevant university faculty and staff as soon as possible as they begin making plans regarding time away. Students must contact the Office of the Dean of Student Affairs to register for Maternity Accommodations. Students will complete an information form and meet with a member of the Dean's Office staff to determine resources and procedures appropriate for the individual student. Planning for the student's discussion with her academic contact(s) (advisor, associate dean, etc.) will be reviewed during this meeting.

17.5. Policy Against Sexual Harassment and Sexual Assault

Sexual harassment and sexual assault are prohibited by CMU, as is retaliation for having brought forward a concern or allegation in good faith. The policy can be viewed in its entirety at: http://www.cmu.edu/policies/documents/SA_SH.htm. If you believe you have been the victim of sexual harassment or sexual assault, you are encouraged to make contact with any of the following resources:

- Office of Title IX Initiatives, <http://www.cmu.edu/title-ix/>, 412-268-7125
- Sexual Harassment Advisors, found in appendix A of the Policy Against Sexual Harassment and Sexual Assault;
- Survivor Support Network, found in appendix B of the Policy Against Sexual Harassment and Sexual Assault;
- Sexual Harassment Process and Title IX Coordinators, found in section II of the Policy Against Sexual Harassment and Sexual Assault;
- University Police, 412-268-2323
- University Health Services, 412-268-2157
- Counseling & Psychological Services, 412-268-2922

17.6. Other University Policies and Procedures

Other important University-level policies and procedures include the following:

- The University Policy on Grades: <http://www.cmu.edu/policies/documents/Grades.html>
- Academic Integrity <http://www.cmu.edu/academic-integrity/>
- Graduate Student Appeal and Grievance Procedures
<http://www.cmu.edu/graduate/policies/appeal-grievance-procedures.html>

References

- [1] Mary Shaw (editor). *Software Engineering for the 21st Century: A Basis for Rethinking the Curriculum*. CMU-ISRI-05-108. Carnegie Mellon University. 2005.

A. Time Estimates

The following table indicates estimates for approximately when students should have finished each requirement. Overall, we expect students to complete the program within 5–6 years, depending on background and dissertation research.

These figures are meant to be suggestive, not prescriptive, and can be modified for any student by agreement with the student’s advisor. We present them so that all faculty and students can develop a shared image of a typical path through the program.

COMPONENT	INTENSITY	COMPLETION TIME
Practicum	1/4 time	by end of year 2
Writing Skills	variable	by end of year 2
Speaking Skills	SSSG	by end of year 3
Course Requirements	each 1/4 time	by end of year 4
Thesis Proposal	1/2 time	by end of year 4
Teaching	1/2 time	by end of year 5
Thesis	full time	by end of year 5 (or 6)

Students are expected to be working on research every semester with intensity at least 1/2 time throughout their time at CMU. In addition, it is expected that students volunteer within the department and school throughout their time at CMU.

B. Outcome to Requirement Mapping

The following table provides a correspondance between the program outcomes and the program requirements. In the table, a filled-in box indicates that the activity on the left is a principal contributor to the outcome above, whereas an outlined box indicates that the activity is an auxiliary contributor to the outcome. Naturally, for individual students, other activities might contribute as well.

Activity (Program Requirement)	Independent Research	Research Methods	Depth in Area	Broad SE Knowledge	Teaching SW	Comm Skills	Practical Development	Mature Perspective
Dir research	■	■	■	□		□	□	□
Thesis	■	■	■			□		
Course: Core				■	■			
Course: SYM		■	□	■	□			
Course: ENG		□	□	■	□		□	
Course: BEH		■	□	■	□			
Course: SOC			□	■				■
Electives			■	■	□			
SSSG		□		■		■		
TAing					■	□		
Comm skill	□				□	■		
Practicum							■	□

Appendix C: Key University Resources for Graduate Students and The WORD, Student Handbook

Key Offices for Graduate Student Support

Office of the Assistant Vice Provost for Graduate Education

www.cmu.edu/graduate; grad-ed@cmu.edu

The Office of the Assistant Vice Provost for Graduate Education, AVPGE, directed by Suzie Laurich-McIntyre, Ph.D., Assistant Vice Provost for Graduate Education, provides central support for graduate students in a number of roles. These include being an ombudsperson and resource person for graduate students as an informal advisor; resolving formal and informal graduate student appeals; informing and assisting in forming policy and procedures relevant to graduate students; and working with departments on issues related to graduate students and implementation of programs in support of graduate student development.

The Office of the AVPGE often collaborates with the division of Student Affairs to assist graduate students with their Carnegie Mellon experience. Senior members of the student affairs staff are assigned to each college (college liaisons) and are often consulted by the Assistant Vice Provost for Graduate Education and departments on an individual basis to respond to graduate student needs.

The Office of the Assistant Vice Provost for Graduate Education (AVPGE) offers a robust schedule of professional development opportunities. Some are geared towards a specific population (master's students, PhD students at the beginning of their program, graduate students seeking tenure track positions, etc.) and others are open to all graduate students (time management, balancing, staying healthy). A full schedule of programs is at <http://www.cmu.edu/graduate/>.

The Office of the AVPGE also coordinates several funding programs, and academically focused seminars and workshops that advise, empower and help retain all graduate students. The fundamental goals of our programs have been constant: first, to support, advise and guide individual graduate students as they work to complete their degrees; second, to contribute to the greatest degree possible to the diversification of the academy. Visit the Graduate Education website for information about:

- Conference Funding Grants
- Graduate Small Project Help (GuSH) Research Funding
- Graduate Student Professional Development: seminars, workshops and resources

Office of the Dean of Student Affairs

www.cmu.edu/student-affairs/index.html

The Office of the Dean provides central leadership of the metacurricular experience at Carnegie

Mellon. The offices that fall under the division of Student Affairs led by Vice President and Dean of Student Affairs Gina Casalegno, include (not an exhaustive list):

- Athletics
- Career and Professional Development Center
- Cohon University Center
- Counseling & Psychological Services (CaPS)
- Dining Services
- Housing Services
- Office of Community Standards and Integrity
- Office of Student Leadership, Involvement, and Civic Engagement
- University Health Services
- Wellness Initiatives

Graduate students will find the enrollment information for **Domestic Partner Registration** and **Maternity Accommodations** in the Office of the Dean of Student Affairs and on the website. The Office of the Dean of Student Affairs also manages the **Emergency Student Loan (ESLs)** process. The Emergency Student Loan service is available through generous gifts of alumni and friends of the university. The Emergency Student Loan is an interest-free, emergency-based loan repayable within 30 days. Loans are available to enrolled students for academic supplies, medication, food or other expenses not able to be met due to unforeseeable circumstances.

The Office of Integrity and Community Standards also provides consultation, support, resources and follow-up on questions and issues of Academic Integrity: www.cmu.edu/academic-integrity.

Center for Student Diversity & Inclusion

<https://www.cmu.edu/student-diversity/>

Diversity and inclusion have a singular place among the values of Carnegie Mellon University. The Center for Student Diversity & Inclusion actively cultivates a strong, diverse and inclusive community capable of living out these values and advancing research, creativity, learning and development that changes the world.

The Center offers resources to enhance an inclusive and transformative student experience in dimensions such as access, success, campus climate and intergroup dialogue. Additionally, the Center supports and connects historically underrepresented students and those who are first in their family to attend college in a setting where students' differences and talents are appreciated and reinforced, both at the graduate and undergraduate level. Initiatives coordinated by the Center include, but are not limited to:

- First generation/first in family to attend college programs
- LGBTQ+ Initiatives

- Race and ethnically-focused programs, including Inter-University Graduate Students of Color Series (SOC) and PhD SOC Network
- Women's empowerment programs, including Graduate Women's Gatherings (GWGs)
- Transgender and non-binary student programs

Assistance for Individuals with Disabilities

<http://www.cmu.edu/education-office/disability-resources/>

The Office of Disability Resources at Carnegie Mellon University has a continued mission to provide physical and programmatic campus access to all events and information within the Carnegie Mellon community. We work to ensure that qualified individuals receive reasonable accommodations as guaranteed by the Americans with Disabilities Act (ADA) and Sections 503 and 504 of the Rehabilitation Act of 1973. Students who would like to receive accommodations can begin the process through [Disability Resources secure online portal](#) or email access@andrew.cmu.edu to begin the interactive accommodation process.

Students with disabilities are encouraged to self-identify with the Office of Disability Resources by contacting Catherine Getchell, 412-268-6121, getchell@cmu.edu to access the services available at the university and initiate a request for accommodations.

Eberly Center for Teaching Excellence & Educational Innovation

www.cmu.edu/teaching

Support for graduate students who are or will be teaching is provided in many departments and centrally by the Eberly Center for Teaching Excellence & Educational Innovation. The Eberly Center offers activities for current and prospective teaching assistants as well as any graduate students who wish to prepare for the teaching component of an academic career. The Center also assists departments in creating and conducting programs to meet the specific needs of students in their programs. Specific information about Eberly Center support for graduate students is found at www.cmu.edu/teaching/graduatestudentsupport/index.html.

Carnegie Mellon Ethics Hotline

The health, safety and well-being of the university community are top priorities at Carnegie Mellon University. CMU provides a hotline that all members of the university community should use to confidentially report suspected unethical activity relating to financial matters, academic and student life, human relations, health and campus safety or research.

Students, faculty and staff can anonymously file a report by calling 877-700-7050 or visiting www.reportit.net (user name: tartans; password: plaid). All submissions are reported to appropriate university personnel.

The hotline is NOT an emergency service. For emergencies, call University Police at 412-268-2323.

Graduate Student Assembly

www.cmu.edu/stugov/gsa/index.html

The Carnegie Mellon Student Government consists of an Executive Branch and a Legislative Branch. This is the core of traditional student government, as governed by the Student Body Constitution. The Executive Branch serves the entire student body, graduate and undergraduate, and consists of one president and four vice-presidents. The Legislative Branch for graduate students, The Graduate Student Assembly (GSA) passes legislation, allocates student activities funding, advocates for legislative action locally and in Washington D.C. on behalf of graduate student issues and needs, and otherwise acts on behalf of all graduate student interests. GSA also contributes a significant amount of funding for conferences and research, available to graduate students through application processes managed by the Office of the Assistant Vice Provost for Graduate Education. GSA also plans various social opportunities for graduate students and maintains a website of graduate student resources on and off-campus, <http://www.cmu.edu/stugov/gsa/resources/index.html>. Each department has representation on GSA and receives funding directly from GSA's use of the student activities fee for departmental activities for graduate students. The department rep(s) is the main avenue of graduate student representation of and information back to the graduate students in the department.

Intercultural Communication Center (ICC)

www.cmu.edu/icc/

The Intercultural Communication Center (ICC) is a support service offering both credit and non-credit classes, workshops, and individual appointments designed to equip nonnative English speakers (international students as well as international students who attended high school and/or undergraduate programs in the U.S.) with the skills needed to succeed in academic programs at Carnegie Mellon. In addition to developing academic literacy skills such as speaking, reading and writing, students can learn more about the culture and customs of the U.S. classroom. The ICC also helps international teaching assistants (ITAs) who are non-native English speakers develop fluency and cultural understanding to teach successfully at Carnegie Mellon and provides ITA testing, required testing indicating a nonnative speaking student has a language proficiency required before being allowed to work with undergraduates in classes, labs or individual meetings.

Office of International Education (OIE)

<http://www.cmu.edu/oie/>

Carnegie Mellon hosts international graduate and undergraduate students who come from more than 90 countries. Office of International Education (OIE) is the liaison to the University for all non-immigrant students and scholars. OIE provides many services including: advising on personal, immigration, academic, social and acculturation issues; presenting programs of interest such as international career workshops, tax workshops, and cross-cultural and immigration workshops; maintaining a resource library that includes information on cultural

adjustment, international education and statistics on international students in the United States; posting pertinent information to students through email and the OIE website, and conducting orientation programs.

Veterans and Military Community

<http://www.cmu.edu/veterans/>

Military veterans are a vital part of the Carnegie Mellon University community. Graduate students can find information on applying veteran education benefits, campus services, veteran's groups at CMU, non-educational resources and international military service information through the Veterans and Military Community website. There are also links and connections to veteran resource in the Pittsburgh community. The ROTC and Veteran Affairs Coordinator can be reached at uro-vaedbenefts@andrew.cmu.edu or 412-268-8747.

Key Offices for Academic & Research Support

Computing and Information Resources

www.cmu.edu/computing

Computing Services provides a comprehensive computing environment at Carnegie Mellon. Graduate students should seek Computing Services for information and assistance with your Andrew account, network access, computing off-campus, campus licensed software, email, calendar, mobile devices, computer security, cluster services and printing. Computing Services can be reached at it-help@cmu.edu.

The Carnegie Mellon Computing Policy establishes guidelines and expectations for the use of computing, telephone and information resources on campus. The policy is supported by a number of guidelines graduate students should know. The policy and guidelines are available at: www.cmu.edu/computing/guideline/index.html.

Research at CMU

www.cmu.edu/research/index.shtml

The primary purpose of research at the university is the advancement of knowledge in all fields in which the university is active. Research is regarded as one of the university's major contributions to society and as an essential element in education, particularly at the graduate level and in faculty development. Research activities are governed by several university policies. Guidance and more general information is found by visiting the Research at Carnegie Mellon website.

Office of Research Integrity & Compliance

www.cmu.edu/research-compliance/index.html

The Office of Research Integrity & Compliance (ORIC) is designed to support research at Carnegie Mellon University. The staff work with researchers to ensure research is conducted with integrity and in accordance with federal and Pennsylvania regulation. ORIC assists researchers with human subject research, conflicts of interest, responsible conduct of research,

export controls, intellectual property rights and regulations, and institutional animal care & use. ORIC also consults on, advises about and handles allegations of research misconduct.

Key Offices for Health, Wellness & Safety

Counseling & Psychological Services

<https://www.cmu.edu/counseling/>

Counseling & Psychological Services (CaPS) affords the opportunity for students to talk privately about issues that are significant for them in a safe, confidential setting. Students sometimes feel confused about why they are feeling upset and perhaps confused about how to deal with it. An initial consultation with a CaPS therapist will clarify options and provide a recommendation to the appropriate mental health resource at Carnegie Mellon or the larger Pittsburgh community. CaPS services are provided at no cost. Appointments can be made in person or by telephone, 412-268-2922.

Health Services

www.cmu.edu/HealthServices/

University Health Services (UHS) is staffed by physicians, advanced practice clinicians and registered nurses who provide general medical care, allergy injections, first aid, gynecological care and contraception as well as on-site pharmaceuticals. The CMU student insurance plan covers most visit fees to see the physicians and advanced practice clinicians & nurse visits. Fees for prescription medications, laboratory tests, diagnostic procedures and referral to the emergency room or specialists are the student's responsibility and students should review the UHS website and their insurance plan for detailed information about the university health insurance requirement and fees.

UHS also has a registered dietician and health promotion specialists on staff to assist students in addressing nutrition, drug and alcohol and other healthy lifestyle issues. In addition to providing direct health care, UHS administers the Student Health Insurance Program. The Student Health Insurance plan offers a high level of coverage in a wide network of health care providers and hospitals. Graduate students should contact UHS to discuss options for health insurance for spouses, domestic partners and dependents. Appointments can be made by visiting UHS's website or by telephone, 412-268-2157.

Campus Wellness

<https://www.cmu.edu/wellness/>

At the university, we believe our individual and collective well-being is rooted in healthy connections to each other and to campus resources. The university provides a wide variety of wellness, mindfulness and connectedness initiatives and resources designed to help students thrive inside and outside the classroom. The BeWell@CMU e-newsletter seeks to be a comprehensive resource for CMU regarding all wellness-inspired events, announcements and professional and personal development opportunities. To sign up for the e-newsletter, text BEWELLATCMU to 22828 and share your preferred email address.

University Police

<http://www.cmu.edu/police/>

412-268-2323 (emergency only), 412-268-6232 (non-emergency)

The University Police Department is located at 300 South Craig Street, Room 199 (entrance is on Filmore Street). The department's services include police patrols and call response, criminal investigations, shuttle and escort services, fixed officer and foot officer patrols, event security, and crime prevention and education programming. Visit the department's website for additional information about the staff, escort and shuttle, emergency phone locations, crime prevention, lost and found, finger print services, and annual statistic reports.

Shuttle and Escort Services

University Police coordinates the Shuttle Service and Escort Service provided for CMU students, faculty, and community. University Police [Shuttle & Escort website](#) has full information about these services, stops, routes, tracking and schedules.

Carnegie Mellon University publishes an annual campus security and fire safety report describing the university's security, alcohol and drug, sexual assault, and fire safety policies and containing statistics about the number and type of crimes committed on the campus and the number and cause of fires in campus residence facilities during the preceding three years. Graduate students can obtain a copy by contacting the University Police Department at 412-268-6232. The annual security and fire safety report is also available online at <https://www.cmu.edu/police/Fire%20and%20Safety%20Reports.html>.

The WORD

<http://www.cmu.edu/student-affairs/theword//>

The WORD is Carnegie Mellon University's student on-line handbook and is considered a supplement to the department (and sometimes college) handbook. The WORD contains campus resources and opportunities, academic policy information and resources, community standards information and resources. It is designed to provide all students with the tools, guidance, and insights to help you achieve your full potential as a member of the Carnegie Mellon community. Information about the following is included in The WORD (not an exhaustive list) and graduate students are encouraged to bookmark this site and refer to it often. University policies can also be found in full text at: <http://www.cmu.edu/policies/>.

Carnegie Mellon Vision, Mission

Carnegie Code

Academic Standards, Policies and Procedures

 Educational Goals

 Academic and Individual Freedom

 Statement on Academic Integrity

 Standards for Academic & Creative Life

 Assistance for Individuals with Disabilities

- Master's Student Statute of Limitations
- Conduct of Classes
- Copyright Policy
- Cross-college & University Registration
- Doctoral Student Status Policy
- Evaluation & Certification of English Fluency for Instructors
- Final Exams for Graduate Courses
- Grading Policies
- Intellectual Property Policy
- Privacy Rights of Students
- Research
 - Human Subjects in Research
 - Office of Research Integrity & Compliance
 - Office of Sponsored Programs
 - Policy for Handling Alleged Misconduct of Research
 - Policy on Restricted Research
- Student's Rights
- Tax Status of Graduate Student Awards

Campus Resources & Opportunities

- Alumni Relations
- Assistance for Individuals with Disabilities
- Athletics, Physical Fitness & Recreation
- Carnegie Mellon ID Cards and Services
- Cohon University Center
- Copying, Printing & Mailing
- Division of Student Affairs
- Domestic Partner Registration
- Emergency Student Loan Program
- Gender Programs & Resources
- Health Services
- Dining Services
- The HUB Student Services Center
- ID Card Services
- Leonard Gelfand Center
- LGBTQ Resources
- Multicultural and Diversity Initiatives
- Opportunities for Involvement
- Parking and Transportation Services
- Shuttle and Escort Services
- Spiritual Development
- University Police

Student Activities
University Stores

Community Standards, Policies and Procedures

Alcohol and Drugs Policy
AIDS Policy
Bicycle/Wheeled Transportation Policy
Damage to Carnegie Mellon Property
Deadly Weapons
Discriminatory Harassment
Disorderly Conduct
Equal Opportunity/Affirmative Action Policy
Freedom of Expression Policy
Health Insurance Policy
Immunization Policy
Missing Student Protocol
Non-Discrimination Policy
On-Campus Emergencies
Pets
Political Activities
Recycling Policy
Riotous and Disorderly Behavior
Safety Hazards
Scheduling and Use of University Facilities
Sexual Harassment and Sexual Assault Policy
Smoking Policy
Student Accounts Receivable and Collection Policy and Procedures
Student Activities Fee
Student Enterprises
Workplace Threats and Violence Policy

Statement of Assurance

Last updated: May 31, 2018