

Software Engineering, Minor

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s3d.cmu.edu/education/undergrad (<http://s3d.cmu.edu/education/undergrad>)

Software Engineering Minor

available to non-SCS undergraduate students in **any major** at Carnegie Mellon University

Effectively building modern software systems at scale requires not just programming skills, but also engineering skills. These skills include the ability to interact effectively with customers to gather the requirements for a system in a precise way; to develop a design that resolves competing quality attributes; to make tradeoffs among schedule, cost, features, and quality to maximize value to stakeholders; to work effectively with other engineers; and to assure the quality of the delivered software system. We hear regularly from industry that these skills are crucial to them, and that they are interested in students with a strong software engineering background.

The software engineering minor is designed to teach the fundamental tools, techniques, and processes of software engineering. Through internships and a mentored project experience, students gain an understanding of the issues of scale and complexity that motivate software engineering tools and techniques. The core curriculum includes material both on engineering the software product and on the process, teamwork, and management skills that are essential to successful engineering. Graduates of the program should have the technical, process, and teamwork skills to be immediately productive in a mature engineering organization.

Admission

The Software Engineering Minor is open to non-SCS undergraduate students in any major in the university. We encourage students to submit applications no later than 3 days before the beginning of Spring and Fall course registration, so that subsequent decisions can help students plan their subsequent course schedule effectively. However, students may petition the Director for admission outside this general schedule.

To apply, send the director an email. Include in your email:

- Full name
- Andrew ID
- Preferred email address (if different)
- Semester you intend to graduate
- QPA
- All (currently) declared majors and minors, or home college if no major declared
- Statement of purpose (maximum 1 page) - Describes why you want to take this minor and how it fits into your career goals
- Proposed schedule of required courses and internship (this is your plan, NOT a commitment)

Curriculum

Prerequisite

17-214	Principles of Software Construction: Objects, Design, and Concurrency	Units 12
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Core Course Requirements

Complete both of the following courses.		Units
17-313	Foundations of Software Engineering	12
17-413	Software Engineering Practicum	12
or 15-413	Advanced Foundations of Programming Languages	

Electives

The minor requires three elective courses, one selected from each of the following categories:

1. One domain-independent course focused on technical software engineering material (min. 9 units):

Must complete at least 9 units, may comprise one 9-12 unit course or multiple minis

15-414	Bug Catching: Automated Program Verification	9
17-355	Program Analysis	12
17-356	Software Engineering for Startups	12
17-480	API Design and Implementation	12
17-653	Managing Software Development (Prerequisite 17-413 or internship)	6
17-614	Formal Methods ** Mini pair with 17-624	6
17-612	Business and Marketing Strategy **Mini: pair with either 17-626 or 17-627	6
17-622	Agile Methods ** Mini pair with another min-course of your choice from this list	6
17-623	Quality Assurance ** Mini pair with 17-443/17-643	6
17-731	Foundations of Privacy	12
17-423	Software System Design	12

Crosslisted courses allowed.

Other courses may be allowed, with prior approval from the Director of the Software Engineering Program.

2. One engineering-focused course with a significant software component (min. 9 units):

At least 9 units of the following:

15-410	Operating System Design and Implementation	15
15-412	Operating System Practicum	9
17-437	Web Application Development	12
15-440	Distributed Systems	12
17-422	Human-AI Interaction using Sensing Systems	12
15-441	Networking and the Internet	12
15-445	Database Systems	12
18-749	Building Reliable Distributed Systems	12
67-443	Mobile Application Design and Development	12

Crosslisted courses allowed

Other courses may be allowed, with prior approval from the Director of the Software Engineering Program.

3. One course that explores computer science problems in society and industry, related to existing and emerging technologies and their associated social, political, legal, business, and organizational contexts (min. 9 units):

At least 9 units of the following:		Units
15-390	Entrepreneurship for Computer Science	12
17-200	Ethics and Policy Issues in Computing	9
70-311	Organizational Behavior	9
17-331	Information Security, Privacy and Policy in the Age of AI	12
17-733	Privacy Policy, Law, and Technology	12
17-334	Usable Privacy and Security	9
19-403	Policies of Wireless Systems	12
70-471	Supply Chain Management	9
17-562	Computer and AI Law	9
17-781	Mobile and IoT Computing Services	12
17-801	AI Enabled Network Science	12
17-821	Computer Simulation of Complex Socio-Technical Systems	12
88-341	Team Dynamics and Leadership	9

Crosslisted courses allowed.

Required Internship and Reflection Course

A software engineering internship of a minimum of 8 full-time weeks in an industrial setting is required. The student must be integrated into a team and exposed to industry pressures. The intern may work in development,

management, quality assurance, or other relevant positions. The director of the SE minor program has sole discretion in approving an internship experience based on these criteria. Students should confirm that an internship position is appropriate before accepting it, but internships that fulfill the criteria will also be accepted after the fact.

- 17-415 *Software Engineering Reflection* (required 6 unit course, number to be determined, to be offered Fall semester): Each student will conduct an analysis of some personal software engineering experience, typically (but not always) based on the engineering internship above. The student will then write and edit a short paper presenting this analysis. Initial course meetings will cover the reflective, writing, and speaking process. In later meetings, each student will present his or her experience through a 30-45 minute talk, which will be evaluated for communication skills and critical reflective content. This course is limited to enrollment of 16, and students who are admitted to the minor program are given first priority.

Double Counting

At most 2 of the courses used to fulfill the minor requirements may be counted towards any other major or minor program. This rule does not apply to 17-214 (a prerequisite for the minor) or courses counted for general education requirements, nor does it apply to double-counting with the SCS General Education requirements.