

Computer Science Major's Capstone Requirements

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1 Outline of Requirements

This document outlines the requirements for a Computer Science Capstone Experience in the Department of Computer Science at SUNY Potsdam. This document is intended only as general guidance, and is **not** a substitute for careful consultation with a Computer Science faculty advisor/sponsor.

As described below, the Computer Science Capstone Experience requirement may be met in several ways. Regardless of the type of capstone, **all** students must complete the following tasks in addition to the work of the capstone itself:

1. Attend at least one Computer Science Capstone training session (Section 5).
2. Secure a faculty advisor/sponsor from among the Computer Science faculty (Section 6).
3. Register for the appropriate course credit for a minimum of 3 hours (CIS 480 Senior Project, CIS 490 Internship). **Please note that this includes paying tuition for the course credit.**
4. Write a capstone proposal for the Computer Science department (Section 6).
5. Complete at least one practice presentation of the capstone presentation with the faculty advisor in advance of the formal presentation (Section 8.2).
6. Present the capstone in a public presentation in the semester the capstone is completed, most often with Computer Science Board of Advisors in attendance (Section 8.2).
7. Write a final report on the capstone (Section 8.1).

2 Rationale

Computer science is a body of both knowledge and practice. Finishing any undergraduate degree in computer science at SUNY Potsdam requires completion of a capstone course that demonstrates a mastery of, in particular, the practice of the discipline; it is expected that in practicing, the student will exercise the requisite knowledge as well. The capstone course is variable credit with no fewer than 3 and no more than 6 credit hours counting in the student's CS major.

The capstone project can be fulfilled with either an internship working in a computer science related position or by a senior project where the student, primarily independently, completes a project of some moderate scale. This document spells out the required steps to propose, register for, and report a capstone course. Much of the work required is the same for internships and projects; attention will be called to those places where the two paths differ.

3 Alternative ways to meet the CS Capstone Requirement

The purpose of the requirement is for the senior student to synthesize everything they have learned, to use and extend their accumulated knowledge, and to document that they have, in fact, accomplished both of those things. Should a student be a **double major** (only work in a major will be considered) *and* participate

in a **capstone** (senior project or internship) in their other major for credit comparable to a CS capstone, the Computer Science department, through the student's Computer Science advisor, will consider waiving the CS capstone requirement. The CS department will waive the requirement on a case-by-case basis, attempting to defer to the other major's determination of what constitutes a capstone in that discipline. A course labeled "Senior Seminar" or "Graduate Seminar" is *not* considered to be a capstone for purposes of meeting this requirement.

To be considered for having the capstone waived in recognition of an alternative capstone, a student must propose such a waiver *in writing*. A short (200-500 word) justification of why the alternative experience should fulfill the CS capstone should be submitted to the student's CS advisor. The advisor will bring the proposal to the department and inform the student of the outcome as expeditiously as possible.

As described below, an oral report is part of fulfilling the CS capstone. Regardless of the department where a CS major fulfills the capstone, a presentation to the CS department and its Board of Advisors is expected, covering similar points of what was learned, what academic preparation was used, and what was produced as part of the capstone.

4 Before the CS Capstone

Part of the capstone project is to report on how the chosen activity extends the student's computer science education, how their academic preparation served them in their capstone activity, and what they accomplished during their capstone activity. The report is in the form of a paper and a presentation, both detailed below. To whom are the students reporting?

Capstone reports serve to inform and inspire students who have not yet done one. They inform up-coming students about the kinds of opportunities that can be found, both what companies might have internships, but also what kinds of work interns (or seniors doing projects) might be called upon to perform. The report on what was learned in the capstone along with the products of the hard work can inspire students when they embark on their own capstone experience.

This means that the other students in the CS department benefit greatly by attending the student capstone presentations. The presentations are part of the Fall and Spring semester Board of Advisors meetings. Students should make every effort to attend the presentation portion of the meeting whenever they can, both to be informed and inspired, and to support their fellow majors.

5 CS Capstone Training

The CS department holds a Capstone Training session each fall and spring semester, in collaboration with the *Center for Applied Learning*. The date/time/place of these meetings are widely publicized to students in advance of the meeting. At this meeting, requirements for both internships and senior projects are discussed. Mr. Toby White from the *Center for Applied Learning* addresses many details of the internship registration process and shows students some of the tools that are available to help in finding potential internships. At the same meeting, Computer Science faculty discuss the overall Capstone Experience requirements and address specifics of senior projects. Students are **required** to attend at least one of these trainings in advance of registering for a capstone course.

6 Proposing a CS Capstone

The first step in fulfilling the CS capstone experience within the department is contacting a CS faculty member to see if they can be your advisor on the project. In order to provide appropriate supervision (and support for the later stages of the process), faculty members are limited in the number of capstones they can oversee at any given time. Further, because faculty have different areas of expertise, a faculty member might guide a student to another, better suited, faculty sponsor for any given project.

6.1 Internship

For an internship, you find somewhere to work as an intern. **How** you find such a position is one reason to come to hear other students report their capstone experiences. *Career Planning and Placement*, the Board of Advisors, and on-line job postings are all common ways student find such opportunities. You should have some idea of where, when, and for how long you will be interning before proposing an internship.

You will complete two proposals for an internship. One proposal is made to the *Center for Applied Learning*. They are the central location in charge of translating internship hours into credit hours and administering the SUNY Potsdam side of any internship on campus. Their forms include space for the where, when, and duration information mentioned above. There are also questions about the academic goals of the internship: what are the learning objectives; what additional readings does your sponsor expect of you; and how will you be reporting your internship back to the campus community. The required paper and presentation cover the last set of questions.

The Computer Science department proposal is essentially the online proposal put into narrative form, with the addition of technical details you may know before leaving for your internship. For example, you may know some of the tools you will be learning (a programming language, a development platform, an IDE, *etc*), or you may know the application domain in which you will be working (*e.g.*, e-commerce, manufacturing, national security). You are responsible for filling out the paperwork and for **registering** for the internship. College credit for the capstone is required to complete it. This means paying tuition, attending the internship, and receiving a grade.

IMPORTANT NOTE: Beginning September 2019, the Computer Science department will no longer accept internship capstones retroactively. What that means is that students will **not** be allowed to propose and register for an internship after having completed the work. You **must** register for CIS 490 in the semester that you actually do the internship work, you **must** follow the internship application and registration process as outlined by the *Center for Applied Learning*, and you **must** submit your internal Computer Science department proposal in advance of leaving for your internship.

An internship proposal for the Computer Science department is a 500 - 1000 word essay addressing the following:

1. Introduction — What is the proposed internship? What organization will you work with? What will you do for the internship work?
2. Preparation — How is the student prepared to undertake this project? This may include specific Computer Science courses that you have completed and/or other experiences that prepare you for the internship.
3. Practice — How does completing the project bring together *and* go beyond the student's standard academic learning? Are there specific professional practice skills (beyond technical ones) that you will learn through the internship?
4. Work and Work Products — What work will you do with the organization and what will actually be produced? Are there privacy, property, or security issues involved in the internship work (see below)?
5. Administration — How many credit hours is the internship to be for? In what semester does the student expect to enroll for the credits?

Because the majority of internships are completed with companies, there may be issues of intellectual property, privacy, or security involved in the work that you will do. As much as is possible in advance of the internship, you must communicate with your on-site supervisor or mentor about these issues and include the information in your proposal.

6.2 Senior Project

A senior project is, to a large extent, an enhanced independent study course. The keyword in the previous sentence is **independent**: the student, working with their sponsor, needs to find a project (often but not

exclusively a software project). The sponsor is responsible for helping *scale* the project according to the number of credit hours the capstone will be for; the student is responsible for finding the *content* of the project. One hint: you will be living, closely, with the material for a semester or more; make sure it is something you are genuinely interested in.

A senior project proposal is a 500 -1000 word essay addressing the following:

1. Introduction — What is the proposed project: What will be produced?
2. Preparation — How is the student prepared to undertake this project?
3. Practice — How does completing the project bring together *and* go beyond the student's standard academic learning?
4. Deliverables — What artifacts (systems, objects, *etc.*) will actually be produced?
5. Administration — How many credit hours is the project expected to be for? In what semester does the student expect to enroll for the credits?
6. Appendices

Appendix A Grading rubric — Defining *done* for each grade level from 2.0 to 4.0. This sets the scope for the project and serves as agreement between sponsor and student as to what will actually be done.

Appendix B Tentative schedule — How will work proceed? It is important that this be realistic in light of the scope defined in the previous appendix. Included will be the schedule of meeting times with the sponsor.

The proposal may go through more than one draft. Note that it is normal for the student's first project idea to be too small or, more often, much too grand. The sponsor helps shape the project so the scope is adequate for the credits and something the student can successfully undertake. Once the proposal is accepted, the sponsor can help get the student registered for the credits; a senior project is always registered by the permission of the instructor.

6.3 Timing the Proposal

Either type of proposal should be completed around the registration period for the semester when the student expects to receive credit. That is, if doing an internship for the summer, the proposal and registration should take place in the spring term. The same timing is best for a fall semester senior project.

7 Doing a CS Capstone

Doing the capstone means working at the internship or meeting with the sponsor while making progress on the senior project. An internship has a job supervisor who communicates progress to the on-campus sponsor at intervals.

The student's proposal serves as a blueprint for the time allocation during the capstone experience. It is *extremely* important that a student communicate with their sponsor as soon as they detect a problem meeting the time (or other) commitments in the capstone. Proactive communication makes it much easier to fix problems.

8 Reporting a CS Capstone

When the capstone experience is done, the student's work is only *almost* done. Credit for the experience is granted after the student reports on their experience in both a paper and a presentation. Note that these are important for *documenting* the completion of the capstone experience as well as *demonstrating* the student's ability to communicate in both writing and speaking.

8.1 Writing up the Capstone

The student will write an essay about their capstone experience. This essay is in addition to any design, code, or documentation turned in as the deliverables of a senior project.

The summary report should be between 2000 and 3000 words, turned in electronically in a common word-processed format (PDF, MS Word/Libre Office). While code must be turned in in plain text, the report should be formatted in a professional manner. It must begin with a title, the author's name, the date of submission, the semester when the capstone was completed, and the name of the sponsor. As in:

Building Robot Spider Monkeys
Jimmie Q. Student
20 October 2019
To Fulfill the CS Senior Project Requirement
Summer 2018, Advisor Dr. Laura Grabowski

Horizontal margins should be 1", vertical margins 0.75" and the font should be proportional, professional, and 10-12pt.

The report must have an introduction that describes the capstone experience at a general level and includes a *thesis*, a statement that the remainder of the document will support. It should end with a conclusion that ties the internal portion of the report back to the thesis established in the introduction.

The body of the report should cover (in an order decided by the author) how the department's academics prepared the student for the capstone, how the capstone took the student's learning past their course work, and what the student actually did for the capstone. An internship report should include how the student found and then secured the internship, what a "day in the life" was like, and, if possible, an example of the artifacts produced as part of the internship. A senior project report should describe the project, the study (reading, programming) that was needed to pick the project and get started, and examples of challenges and how they were overcome.

8.2 Presenting the Capstone

The capstone experience is also presented to the Computer Science Department Board of Advisors, typically in the semester after the project is completed. Some senior projects will be presented during the semester they are being completed if the advisor and student agree that it is ready.

8.2.1 Presentation Format

The presentation is part of the Saturday activities of the BoA meeting during the Fall or Spring semester. Students present in an auditorium with a computer projector and without a microphone. Students are expected to prepare a professional set of slides for the presentation, including examples that can be presented in the limited time frame. Students will have between 12 and 20 minutes, including questions from the audience.

8.2.2 Presentation Content

The presentation should have an introduction that gives an overview of the capstone project: what, where, when. It provides the broad outlines of the project or internship. As with the report, a more compelling "story" can be told if the introduction includes a thesis, a statement of outcome that the rest of the presentation can support.

Possible theses to consider: The most important new thing I learned in my capstone was ...; My capstone reinforced my interest in ...; My capstone used more of what I learned in CIS ... than I expected. The point is to tie the thesis to what you learned and or practiced and how that makes you ready to graduate with a computer science degree.

The body of the presentation supports the thesis with examples and should focus on your work. Show off code or problem solving techniques. Be aware of the limitations of projecting a wall of code on the screen and the limited time you will have. The time limit probably means fewer, deeper examples rather than rushing multiple shallow samples.

The slides should use large, clear fonts that can be read from the back of the auditorium. The presentation should only use music, video, or animation if the student can make a strong argument that the material enhances the content. If such material is used, it is incumbent on the student to test their presentation *in the space that will be used* to make sure they understand how to get the technology in the room to work with their specialized material.

Images in the slides should also be checked to make sure they serve a rhetorical purpose in supporting the presentation content. Additionally, images should be professional (not sexist, racist, nationalist, *etc.*) and included at an appropriate resolution so that they are clear to follow when projected in the auditorium.

8.2.3 Practice

The capstone presentation is an important step in finishing an undergraduate degree in computer science. Because of this, the faculty of the department **requires** every student presenting for the Board of Advisors to make their presentation to their project advisor before they are allowed to present to the BoA. This requires the student to complete their slides and practice on their own, schedule time to make the presentation to the advisor, and to run through the presentation from beginning to end for their advisor.

Given that sponsors may well have multiple capstone presentations for any given BoA meeting and are teaching during the various semesters, students are urged to schedule the practice presentations as early as possible. The earlier the presentation is evaluated, the easier it will be to incorporate the sponsor's feedback into it.

The practice requirement pertains to **all** student presentations, including those by students no longer resident at SUNY Potsdam. A student who has not practiced the semester of the BoA meeting where they plan to present will **not** be permitted to present. Scheduling the rehearsal is the responsibility of the student.

8.2.4 Presentation

The slides should start with a title slide including the author's name, the date of submission, the semester when the capstone was completed, and the name of the sponsor. As in:

Building Robot Spider Monkeys
Jimmie Q. Student
20 October 2019
To Fulfill the CS Senior Project Requirement
Summer 2018, Advisor Dr. Laura Grabowski

During the presentation the student will receive an indication of the time remaining. Due to the number of presentations that the Board hears during a meeting, the cutoff time (which will be confirmed during the practice presentation) will be rigidly enforced. This means that a faculty member will be tasked with **interrupting** the ongoing presentation at the end of the allotted time.

The department will attempt to record all presentations and make the video available on the Web. The videos will be used to recruit potential students (by showing the range of capstone experiences available) and to give future capstone presenters access to a library of presentations they can study.

9 Conclusion

The Computer Science department includes a capstone experience in every one of its majors so that senior students get a chance to bring together what they learn across the curriculum and use it in a way that transcends the classroom. This guide tries to not over-specify how students fulfill the requirement because part of the learning is in finding a suitable internship or project. The faculty feels spelling out some parts of the process support the success of our students in completing the capstone.