

COMPUTER SCIENCE
STUDENT HANDBOOK

Classes of 2016 and Later

Department of Computer Science
Clarkson University

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1 Introduction

This handbook has been prepared for advising purposes. It contains detailed requirements and advice for students majoring in Computer Science. A checklist of requirements, as well as this handbook, can be found on the Computer Science website at internal.clarkson.edu/cs.

Note that the Clarkson Catalog (as amended) and the Clarkson Regulations remain the official references.

The office of the Computer Science Department is located in the Science Center, Room 357. Additional contact information and a list of faculty members can be found on the Department's web site.

This handbook was typeset with small paper size and margins for easier reading on a computer screen. If printed, the handbook looks best when printed double-sided, at "actual size" (100%) and centered. If your favorite Web browser doesn't allow you to do that, download the notes and print them from a standalone PDF reader such as Adobe Acrobat.

2 What's New?

April 2019 Starting Fall 2019, at most one of CS142 and EE262 can be counted towards graduation requirements.

March 2019 It is now recommended that students take CS341 in the fall semester of their sophomore year. See the sample schedules in Section 9. Starting Fall 2019, IS314 can no longer be counted as a CS elective. It can count as a free elective as long as it's not taken after CS460.

October 2017 IS237 can be counted towards graduation requirements only if it was taken before the student became a CS major at Clarkson. See Section 7 for details.

3 The Four Options of the CS Major

The Computer Science major is organized into four options that are described below. The General Option corresponds to the basic requirements of the major and is the most flexible. The other three options prepare students for specific career paths.

1. The **General Option** allows students to tailor their program of study to a wide variety of professional and personal goals. With the General Option, students may explore a wide range of topics in computer science and related disciplines. They can also combine portions of some of the other options. The General Option is also the easiest for pursuing a second major in another discipline.
2. The **Software Design and Development Option** prepares students for careers in the field of software engineering. These are careers that involve the specification, design, implementation, testing and maintenance of computer software.
3. The **Information Technology Option** prepares students for careers in the planning and management of information technology infrastructure. Such careers include the administration of computer systems, computer networks and database systems, as well as the design and implementation of websites.

4. The **Research Option** prepares students for careers in research and development in either academia or industry. Such careers typically require a graduate degree and the Research Option is the best way to prepare for graduate studies in computer science.

Some of these options allow students to satisfy all or most of the requirements for certain minors. See Section 11 for details. In all cases, you still need to officially enroll in the minor by submitting an enrollment form to the appropriate department office. That form can be found on SAS's web site.

Here are answers to some frequently asked questions.

When do I need to choose an option? The sample schedules in this handbook all have the same first five semesters and start diverging in the sixth semester. So you should normally choose an option no later than the fall semester of your junior year, before selecting courses for the spring. You can, of course, choose earlier. You may also be able to choose later, depending on your choice of courses. Your advisor can help you plan.

Do I have to “declare” an option? Not if you decide to follow the General Option. But if you decide to follow any of the other three options, you should notify your advisor, fill out the *Option Declaration Form* and submit it to the Department office. The form can be downloaded from the Department's web site. (You can also submit a minor enrollment form at the same time. That form can be found on SAS's web site.)

Does my CS option appear on my transcript? No but if you fulfill the requirements of one of the last three options, you will receive a certificate from the Department, provided you submitted the *Option Declaration Form* before your graduation.

Should I put my CS option on my resume? Yes. It is a good idea to mention your CS option when applying for jobs or graduate school. For example, *Major: Computer Science, Software Design and Development Option.*

4 General Advice

As you plan your program of study, keep in mind the following special programs and general advice.

Co-ops Doing a co-op usually means working for a company during a summer and the following or preceding academic semester. This allows you to gain valuable experience and get a foot in the door of a company. You also see first-hand how your education relates to the real world. The best time to go on co-op is probably around the summer between your junior and senior years. You should start planning as early as your sophomore year. Visit the Career Center web pages or pass by their office for more information.

Study Abroad A semester of study abroad exposes you to another educational system and culture. It's an excellent way to gain important skills for an increasingly globalized world. Clarkson has agreements with universities in Australia, England, Mexico and several other countries in Europe and Asia. Visit the International Center web pages or pass by their office for more information.

Cross Registration The four local colleges have a cross registration program for transferring credit. For example, SUNY Potsdam offers courses in foreign languages, fine arts and education that are not available at Clarkson. Contact SAS for more information.

Computer Science Labs You are encouraged to get involved in one of the student-centered department labs or in our student chapter of the Association for Computing Machinery (ACM), one of the main computer science professional organizations. The labs are the Clarkson Open Source Institute and the Internet Teaching Lab. Brief descriptions of the labs and ACM student chapter are given in Section 12.

Free Electives The requirements of the Computer Science major typically leave enough room for students to take 10 or 11 courses as free electives. Students are strongly encouraged to use these electives in a meaningful way. Some free electives can be used to take additional courses in computer science. Most students use some of their free electives to earn either a minor or a second major in another discipline. You are encouraged to follow their example: the knowledge and perspective gained through the study of a second discipline is a valuable addition to your major.

This second discipline can be closely related to computer science or it can be a discipline in which you have a strong personal or professional interest. Some of the most common possibilities are discussed in Section 11.

When you earn an official minor or second major, this will be indicated on your transcript. But you can also build your own “unofficial” minor: pick two or three courses in another discipline and add any necessary prerequisites. Discuss your plans with your advisor.

One-Year M.B.A. Another good use of free electives is to prepare for a one-year Master of Business Administration. Visit the School of Business web pages or office for details.

5 University Requirements

The following requirements apply to all Clarkson students.

1. Students must complete at least 120 credit hours and achieve a cumulative GPA of at least 2.0.
2. Students must also achieve a cumulative GPA of at least 2.0 in their major. The list of courses that constitute the major is maintained by SAS. The current list for the CS major is MA211 and all CS courses excluding directed studies and undergraduate research (CS407, 408, 411, 412, 497 and 498).
3. Students must satisfy the requirements of the Clarkson Common Experience, as described in the Clarkson Catalog. Courses that fulfill the requirements of the Common Experience can be found on PeopleSoft and on the SAS website at intranet.clarkson.edu/student-life/sas/classes-schedules.
4. FY100 First-Year Seminar is required for all students entering as first-year students.

6 Requirements of the CS Major

This section describes the requirements of the CS major for students in the classes of 2016 and later. Certain restrictions and some possible substitutions are mentioned in the next section.

Every option of the CS major puts some limit on the number of directed studies and research experiences that can be counted towards the major. Students

can take additional directed studies and research experiences but they have to be counted as free electives.

All students must take the courses that are common to all the options as well as the courses specified by at least one of the four options.

Common to All Options

Computer Science (9 courses, 28 credits)

CS141 Introduction to Computer Science I
CS142 Introduction to Computer Science II
CS241 Computer Organization
CS242 Advanced Programming Concepts
CS341 Programming Languages
CS344 Algorithms and Data Structures
CS345 Automata Theory and Formal Languages
CS350 Software Design and Development
CS444 Operating Systems

Mathematics (5 courses, 15 credits)

MA131 Calculus I
MA132 Calculus II
MA211 Foundations
MA339 Applied Linear Algebra (or MA239)
STAT383 Applied Statistics I (or MA381 Probability)

Science (12 credits, 3 or 4 courses)

A two-course sequence in physics or chemistry (PH131–132, PH141–142 or CM131–132).

At least 4 additional credits of physics, biology or chemistry (PH, BY or CM).

Common Experience (typically 8 courses, 19 credits)

FY100 First-Year Seminar

UNIV190 The Clarkson Seminar

Five courses covering four Knowledge Areas. At least one of these courses must be a University Course that covers two areas.

Courses that carry a total of six communication points. At least two of these points must be earned in courses in the major at the 300 level or higher. (CS350 and MA211 are both required in the CS major and each carry two communication points.)

CS499 Professional Experience. (See Section 10 for details.)

(Note that a single course can fulfill more than one Common Experience requirement as well as a requirement of the major.)

General Option

Three 3-credit CS courses numbered 400 or higher (directed studies and research experiences excluded).

Two courses chosen from the following list: any 3-credit CS course numbered 400 or higher, EE368, EE466, COMM440, COMM442, COMM444.

Note: If IS314 was taken before Spring 2016, then it can be counted as a CS elective in the second category. If IS314 was taken starting Spring 2016 but before Fall 2019, then it can be counted as a CS elective but only if CS460 is not taken. Otherwise, IS314 only counts as a free elective. If IS314 is taken starting Fall 2019, then it cannot be counted as a CS elective. It can count as a free elective as long as it's not taken after CS460.

Software Design and Development Option

CS458 Formal Methods for Program Verification

CS459 Human-Computer Interaction

CS460 Database Systems

Two courses chosen from the following list: any 3-credit CS course numbered 400 or higher, EE368. At least one must be a CS course other than a directed study or research experience.

Information Technology Option

CS460 Database Systems (or IS314 Database Design & Management)

COMM341 Introduction to Web Design (IA, C2)

COMM442 Advanced World Wide Web Interface Design (or COMM440 PHP/My SQL Interactive Design)

CS455 Computer Networks

COMM444 Unix Web System Administration

Two 3-credit CS courses numbered 400 or higher (directed studies and research experiences excluded). Recommended: CS457 Computer and Network Security.

Note: CS460 can double-count towards to the first and last requirements of the option.

Research Option

CS447 Computer Algorithms

Four 3-credit CS courses numbered 400 or higher. At least two must be courses other than directed studies or research experiences. Recommended: CS445 Compiler Construction.

6 credits of thesis or undergraduate research, or two graduate courses numbered 600 or higher (directed studies excluded). (See below for details.)

Thesis Requirement To satisfy the requirements of the Research Option, students must engage in a research project worth at least 6 credit hours and normally spanning two academic semesters. A research proposal must be submitted and approved during the first semester. A thesis based on the research must be submitted and approved by the end of the second semester. Approvals are

required from the student's research supervisor and the Computer Science Undergraduate Committee.

It is the student's responsibility to find a research supervisor. Every effort will be made to accommodate all qualified students but the Department cannot guarantee that an interested research supervisor will be available.

Alternatively, students can fulfill the thesis requirement by earning grades of C or better in two CS graduate courses numbered 600 or higher (directed studies excluded). This requires a GPA of at least 3.5 and permission of the student's advisor and of the course instructor.

7 Restrictions and Substitutions

Restrictions

1. Air, Space & Cyberspace Studies (AS) and Military Science (MS) courses at the 100 and 200 levels cannot be counted towards graduation requirements. A maximum of 12 credits of AS and MS courses at the 300 and 400 levels can be counted as free electives.
2. The following courses can be counted towards graduation requirements only if they were taken before a student became a CS major at Clarkson: IS237 (starting Spring 2018), MA120, MA180, MA181, STAT282, SC131, SC141, SC142.
3. IS314 cannot be counted towards graduation requirements if it is taken after CS460 (starting Fall 2019).
4. The following courses cannot be counted towards graduation requirements: MA031, MA041 and MA042. At most one of CS141 and EE261

can be counted (starting Fall 2012). At most one of CS142 and EE262 can be counted (starting Fall 2019). At most one of CS142 and EE363 can be counted. At most one of CS242 and EE408 can be counted.

Substitutions The following substitutions are allowed as long as the courses were taken before the student became a CS major at Clarkson, or with permission of advisor: EE261 or IS237 for CS141, EE262 or EE363 for CS142, EE264 and either EE260 or EE360 for CS241, EE408 for CS242.

8 CS Electives

Here is a list of undergraduate CS courses that can be taken as electives in the various options.

- CS442 Computational Complexity
- CS443 Parallel Programming
- CS445 Compiler Construction
- CS447 Computer Algorithms
- CS449 Computational Learning
- CS451 Artificial Intelligence
- CS452 Computer Graphics
- CS455 Computer Networks
- CS456 Cryptography
- CS457 Computer and Network Security
- CS458 Formal Methods for Program Verification
- CS459 Human-Computer Interaction
- CS460 Database Systems

CS461 Mixed Reality
CS465 Mobile Robotics and Human-Machine Interaction
CS466 Blockchain Technologies
CS469 Quantum Information and Computation
CS470 Deep Learning (pending approval)
CS471 System Administration and Network Operations

Undergraduate students can also take graduate courses. Courses at the 500 level require a GPA of at least 3.0 and courses at the 600 level require a GPA of at least 3.5. In both cases, you also need approval of your advisor and of the course instructor.

Courses at the 500 level are normally cross-listed with 400-level courses. Courses at the 600 level are research-oriented. Here is a list of the current 600-level courses:

CS644 Current Issues in Operating Systems Research
CS647 Advanced Topics in Algorithms
CS649 Current Issues in Machine Learning Research
CS652 Computer Vision
CS653 Automated Reasoning
CS654 Current Issues in Computer Networks Research
CS656 Advanced Topics in Cryptography
CS657 Advanced Topics in Computer Security
CS665 Advanced Topics in Mobile Robotics and Human-Machine Interaction
CS667 Cloud Systems and Networks
CS668 Natural Language Processing

Students interested in research can enroll in CS497 and CS498. This requires permission of a research supervisor.

It is also possible to study topics not covered in regular courses by arranging a directed study (CS407, 408, 411, 412). This requires permission of a faculty supervisor.

Students can also receive credit for projects carried out in the Open Source Institute (COSI) and the Internet Teaching Lab (ITL) through the courses MP*51 and MP*52, respectively. This requires permission of a faculty advisor.

9 Sample Schedules

The following are sample schedules for all the options of the CS major. These schedules are set up so that the first five semesters are identical for all options. This allows students to delay the choice of an option until the fall semester of their junior year.

These are only sample schedules. Many variations are possible. In these schedules, KA means *Knowledge Area course*, CS means *CS elective*, and free means *free elective*.

Common to All Options

First Year	
CS141 MA131 Science UNIV190 FY100	CS142 MA132 Science KA Free
Sophomore Year	
CS242 CS341 MA211 Science KA	CS241 CS344 Math KA Science/Free
Junior Year	
CS345 CS350 KA Free Free	

General Option

Junior Year	
	CS444 CS Math KA Free
Senior Year	
CS CS Free Free Free CS499	CS CS Free Free Free

Software Design and Development Option

Junior Year	
	CS444 CS460 Math KA Free
Senior Year	
CS459 CS Free Free Free CS499	CS458 CS Free Free Free

Information Technology Option

Junior Year	
	CS444 COMM341 COMM440 Math Free
Senior Year	
CS455 CS Free Free Free CS499	CS460 COMM444 Free Free Free

Research Option

Junior Year	
	CS444 CS Math KA Free
Senior Year	
CS447 CS Research Free Free CS499	CS CS Research Free Free

10 Professional Experience

This section describes guidelines and procedures that CS students should follow to fulfill the Professional Experience requirement, which is one element of the Clarkson Common Experience. All students in the classes of 2010 and later must participate in a project-based professional experience following their first year. The project must be clearly related to the student's professional goals. For students majoring in CS, typical professional experiences include internships and co-ops, directed research, and suitable semester-long class projects.

Step 1: Decide what type of professional experience you want to get. For most students, the ideal professional experience is a summer internship or a co-

op. A directed research project is equally good for students who are considering a career in research. This can take many forms such as a project done for credit on campus (e.g., CS497, Honors Thesis), or a summer project done on campus, at another university or at a research lab.

Another option is a semester-long class project. To qualify, the project must be of sufficient scope and quality to truly represent a professional experience. In addition, the project should help you meet certain learning objectives of the Common Experience related to lifelong and independent learning, teamwork, leadership and service. Projects done as part of CS350 may qualify but the instructor will have to certify your particular project once it is completed. A minimum grade of C in the project is normally required.

Step 2: Obtain preliminary approval for your professional experience.

This is done by filling out an online form on the KnightLink system. This form asks you for basic information on your professional experience. The form is normally filled out before your experience but it can also be filled out after.

Step 3: Complete your professional experience.

Your professional experience is meant to help you achieve certain learning objectives related to lifelong and independent learning, teamwork, leadership and service. During your professional experience, look for and record the following (perhaps in a journal):

- Instances where more experienced colleagues update their skills and knowledge.
- Instances where you have to learn new knowledge or skills on your own.
- Instances where you have to use leadership skills such as goal setting, change management, ethical behavior, and providing actionable feedback.

- Instances where you have to use teamwork skills such as building effective relationships with peers, being a collaborative team member, and identifying and managing team conflicts.
- Instances where you or your colleagues provide service to the University, to the community, or to the profession.

You will have to report on these when you ask for final approval for your professional experience.

Step 4: Obtain final approval for your professional experience. Once you return to campus, enroll in CS499 *Professional Experience*. This is how your professional experience will be recorded on your transcript. (One special case is if you're doing your professional experience during your last semester at Clarkson. In that case, you should enroll in CS499 at the beginning of that semester.)

After the semester has begun, you will receive instructions on how to fill out a second form on KnightLink, the completion worksheet. On this form, you will be asked to reflect on your experience. This is where you should report your observations from Step 3.

11 Minors and Second Majors

Most CS students use some of their free electives to earn either a minor or a second major in another discipline. In all cases, an enrollment form must be submitted to the department offering the minor or second major.

Students in the General Option can earn a minor in Mathematics by simply taking one additional eligible math or CS course. The courses CS442, CS447, CS449 and CS456 are recommended because they also count as CS electives.

Students in the General Option can earn a minor in Information Technology by taking four courses: IS314, CS455, COMM444 and either COMM440 or COMM442. Three of these courses can be counted towards the General Option.

Students in the Research Option automatically satisfy the requirements for a minor in Mathematics. (The enrollment form must still be submitted.)

Students in the Information Technology Option satisfy the requirements for a minor in Information Technology if they take IS314.

Note that the enrollment form for the Information Technology minor can be submitted to Computer Science Department office (SC 357).

The complete requirements for these and other minors are listed in the Clarkson Catalog, which is available on the University web pages. You should consult with the department offering the minor to verify what the current requirements are. Discuss your plans with your advisor.

Many CS students also major in a second discipline. Common choices are Mathematics, Computer Engineering, Information Systems and Business Processes, Psychology, and Physics. Double majoring is possible in all options but easier in the General Option. Double majoring with an engineering major usually requires overloading. Discuss your plans with your advisor and the department of your second major.

12 Labs and Other Groups

Clarkson Open Source Institute Laboratory (SC 336) The mission of the Clarkson Open Source Institute (COSI) is to explore and develop the areas in which Open Source Software (OSS) and academia can strengthen each other — in both research and education. The COSI Laboratory serves as a development environment and meeting space for students involved in OSS projects. Students

are responsible for administering a variety of server machines running open source software as well as the desktop lab machines, thus gaining real-world experience in administering a Linux facility. COSI students deploy, learn from and develop cutting-edge open source software. COSI students have brought home numerous awards in international open source computing competitions such as the IBM Linux challenge and the Unisys Tuxmaster competition. The lab also provides a Linux-based facility for teaching Computer Science and related courses, and is open for public use during much of the work week. COSI meets each week to review projects and offers tutorials/workshops. The COSI web page is at cosi.clarkson.edu.

Internet Teaching Laboratory (SC 334) The Clarkson Internet Teaching Laboratory (ITL) is dedicated to providing students hands-on experience with cutting edge networking hardware and software. Students develop, deploy and improve novel solutions to modern network challenges such as Internet security or network management. Students are responsible for administering a lab of 30 desktop computers that dual-boot Windows and Linux as well as a number of server machines. The lab contains a wide variety of networking equipment for experimentation including four high-end Cisco 7000 routers, five Cisco 2500 router as well as an assortment of switches, hubs and wireless access points. ITL students have brought home numerous awards in international competitions including the Unisys Tuxmaster competition and the VMware Ultimate Appliance Challenge. The ITL meets each week to review projects and offers tutorials/workshops. The ITL's web page is at www.clarkson.edu/projects/itl.

ACM Student Chapter The Clarkson University chapter of the Association for Computing Machinery, founded in 1982, is a student chapter that promotes the

free interchange of information among specialists, students, and the public. It does this through various activities such as programming contests, help sessions on various topics like Linux, UNIX, viruses, and programming languages, as well as information tables and demonstrations of advanced software and graphics on advanced computer systems. The chapter also sponsors invited talks on a variety of topics of interest. Recent talks include the following: IBM representatives gave a presentation on Grid Computing, Clarkson alumni Mike deMare spoke about his experiences as a software engineer in the electronic design automation industry, Clarkson alumni Eric Hutchins talked about legal issues in enforcing the GNU general public license. The chapter is currently organizing an IBM mainframe contest.

The Clarkson ACM is, in general, here for students or other members of the Clarkson community to get help from other knowledgeable students on just about any subject which is related to computers, information processing, data exchange, and so on. Our primary focus is to learn something about computers, then extend that knowledge to practical applications, and educate the community about the subject. The chapter's web page is at people.clarkson.edu/clubs/acm/index.php.