KLINGLER
College of Arts & Sciences

MARQUETTE UNIVERSITY

Handbook for Computer Science Majors

2025-2026

MARQUETTE
UNIVERSITY
COMPUTER SCIENCE

rev Nov 30, 2025

INTRODUCTION

The Department seeks to provide each of its majors with a broad understanding of computer science. This broad understanding serves as a coherent framework in which the student can place his or her developing knowledge and technical skill. Moreover, the Department seeks to provide each student with a solid foundation in the central ideas and methods of modern computer science. It seeks to produce computer scientists who know, understand, and can apply these central ideas and methods to real problems.

Computer science is dynamic. It grows constantly. It evolves continuously. It regularly experiences revolutionary transformation. The Department seeks, therefore, to produce computer scientists who can adapt and grow along with their chosen profession.

The Department does not seek to train its majors in any particular hardware device, software product or conceptual methodology. Rather, the goal is to provide its majors with the power to succeed in today's computer environment as well as tomorrow's. Students will, however, acquire ample specific knowledge during their education.

PROGRAM EDUCATIONAL OBJECTIVES

Within a few years of graduation, we expect alumni of our program to be applying the skills, knowledge and values they have learned at Marquette University to solve problems and to effect positive changes in a complex world. Specifically, our graduates are:

1. Demonstrate peer-recognized expertise to solve meaningful problems in computing, technology, and other fields, as employees in industry or government, students seeking advanced degrees, or merely as engaged citizens;
2. Demonstrate commitment to teamwork, communicating and collaborating effectively with colleagues, clients and those in other fields;
3. Demonstrate engagement in professional, legal, ethical, and leadership responsibilities in their profession and in their community; and
4. Demonstrate adaptability to evolving technology and workforce needs through continued learning to become a lifelong endeavor, especially in the computing realm.

ADVISING and PRE-REGISTRATION

A student planning to complete a major in computer science should enroll in COSC 1010[1] and MATH 1450[2] in the first semester of their first year and in COSC 1020[3] and MATH 1455[4] in the second semester. As soon as they have decided to major in the Department, the student should declare their major online through CheckMarq and to be assigned a departmental advisor.
From this time on, the student meets with the advisor to discuss course selections for the next semester and general academic progress.

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[1] Upon request, 4 credits for COSC 1010 will be awarded to those students who scored a 4 or 5 on their Advanced Placement (AP) Computer Science Principles test.

[2] Upon request, 4 credits for MATH 1450 will be awarded to those students who scored a 4 or 5 on their Advanced Placement (AP) Calculus AB test or who scored a 3, 4, or 5 on their AP Calculus BC test.

[3] Upon request, 4 credits for COSC 1020 will be awarded to those students who scored a 4 or 5 on their Advanced Placement A test.

[4] Upon request, 4 credits for MATH 1451 (equivalent to MATH 1455) will be awarded to those students who scored a 4 or 5 on their AP Calculus BC test.

STUDENT LEARNING OUTCOMES

Upon completion of all required coursework, Computer Science majors will be able to:

1. Analyze a complex computing problem and apply principles of computing and other relevant disciplines to identify solutions
2. Design, implement, and evaluate a computing-based solution to meet a given set of computing requirements in the context of the program's discipline
3. Communicate effectively in a variety of professional contexts
4. Recognize professional responsibilities and make informed judgments in computing practice based on legal and ethical principles
5. Function effectively as a member or leader of a team engaged in activities appropriate to the program's discipline
6. Apply computer science theory and software development fundamentals to produce computing-based solutions

REQUIREMENTS FOR THE COMPUTER SCIENCE MAJOR

REQUIRED COURSES

All students must take the following ten courses:

COSC 1010	Introduction to Software Development	4 sem. hrs.
COSC 1020	Object-Oriented Software Design	4 sem. hrs.
COSC 2100	Data Structures	3 sem. hrs.
COSC 2200	Hardware Systems	4 sem. hrs.
COSC 3100	Algorithms	3 sem. hrs.
COSC 3250	Operating Systems	4 sem. hrs.
COSC 3410	Programming Languages	3 sem. hrs.
Or COSC 4400	Compiler Construction	
COSC 3820	Professional Ethics in Computer & Data Science	3 sem. hrs.
COSC 4920	Principles of Design	3 sem. hrs.
COSC 4998	Senior Design Project	3 sem. hrs.

COGNATE REQUIREMENTS

MATH 1450	Calculus 1	4 sem. hrs.
MATH 1451	Integral Calculus	4 sem. hrs.
or MATH 1455	Calculus 2	
MATH 2100	Discrete Mathematics	3 sem. hrs.
MATH 3100	Linear Algebra and Matrix Theory	3 sem. hrs.
MATH 4720	Statistical Methods	3 sem. hrs.

ELECTIVES

To complete the major, 6 additional semester hours of Science cognate electives are required, including at least:

- one Natural Science elective with **Laboratory** component
  (BIOL, CHEM or PHYS) 3-4 sem. hrs.

Courses that satisfy the Laboratory Science requirement are normally 4 credit-hours, and include CHEM 1001, 1002, 1013, and 1014; PHYS 1001, 1002, 1003 and 1004. These departments may also offer laboratory-only sections for students that have completed Advanced Placement Chemistry or Physics in high school. Many 3-credit BIOL courses also satisfy the Laboratory Science requirement, but these generally require prerequisite courses in Biology or Chemistry.

To complete the major, 12 additional semester hours of upper-division (3000- or 4000-level) COSC courses are required. A partial list of available choices is given below:

COSC 3090	Bioinformatics Algorithms	3 sem. hrs.
COSC 3550	Programming Computer Games	3 sem. hrs.
COSC 3570	Introduction to Data Science	3 sem. hrs.
COSC 3810	Software Design and Analysis	3 sem. hrs.
COSC 3840	Ethical Hacking	3 sem. hrs.
COSC 3870	Pedagogy of Computer Science	1 sem. hrs.
COSC 3977	Problem Solving - Programming	1 sem. hrs.
COSC 4290	Real-Time and Embedded Systems	3 sem. hrs.
COSC 4300	Network Design and Security	3 sem. hrs.
COSC 4360	Software and System Security	3 sem. hrs.

COSC 4370	Internet of Things	3 sem. hrs.
COSC 4380	Web Development	3 sem. hrs.
COSC 4400	Compiler Construction	3 sem. hrs.
COSC 4500	Visual Analytics	3 sem. hrs.
COSC 4510	User-Interface Design and Evaluation	3 sem. hrs.
COSC 4550	Social and Collaborative Computing	3 sem. hrs.
COSC 4600	Fundamentals of Artificial Intelligence	3 sem. hrs.
COSC 4610	Data Mining and Machine Learning	3 sem. hrs.
COSC 4800	Principles of Database Systems	3 sem. hrs.
COSC 4860	Component-Based Software Construction	3 sem. hrs.

Special topics courses (COSC 4931 Topics in Computer Science, 1-3 sem. hrs.) are also routinely offered by the faculty.

In addition, Marquette's Computer Engineering (COEN) major offers upper division electives in computer architecture, graphics, intelligent systems, and other topics. Students are normally permitted to substitute up to six credits of COEN electives toward the COSC elective requirement, but must apply for a waiver from the CS Director of Undergraduate Studies on a course by course basis.

Special 1-credit electives COSC 3870 and 3977 may be taken for credit more than once in subsequent semesters, and can accumulate towards the COSC elective total. COSC 3870 (Pedagogy of Computer Science) is a service learning course in which students collaborate with area schools to plan and deliver computer science lessons in their classrooms or after school programs. COSC 3977 (Problem Solving-Programming) prepares student teams to compete in the ACM International Collegiate Programming Contest (ICPC) regional competition each fall. Special 1-credit courses 01 (Python Programming for Data Analysis) and COSC 1002 (Introductory Programming in R) are regularly offered by the faculty.

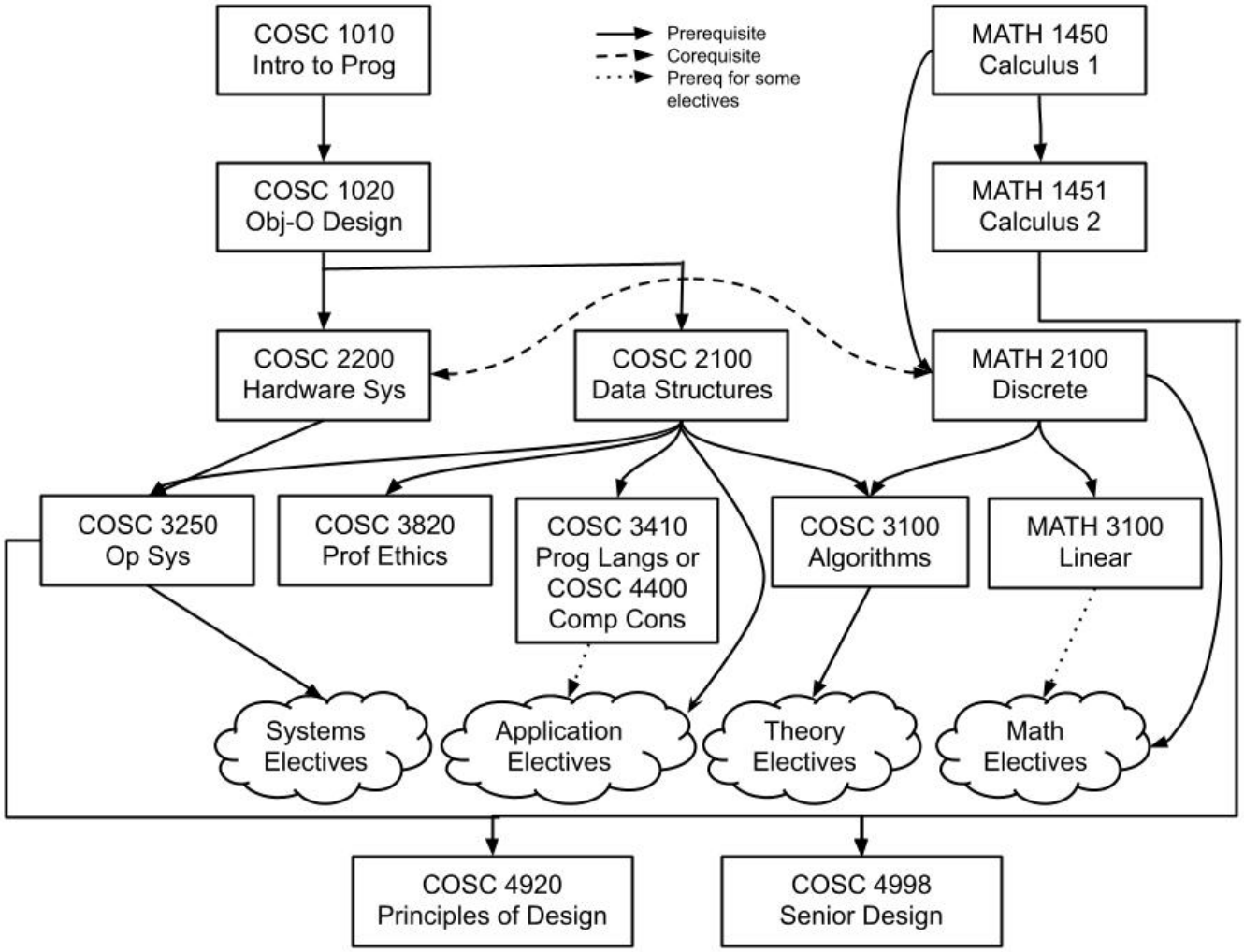
Students who plan to work full time (internship) during a semester should apply for COSC 4987 (Co-op Work Period) during the semester in which they are employed full-time. In the following semester, they should register for COSC 4988 (Co-op Grading Period) and submit a written report. If the work performed is proprietary in nature and limits the student’s ability to submit the required report, an agreement must be established between the student and the faculty advisor prior to the start of the Co-op experience.

The department also offers several general education courses in computing:

COSC 1000	Introduction to Computer Science	3 sem. hrs.
COSC 1360	Introduction to Cybersecurity	3 sem. hrs.
COSC 1820	Computers, Ethics and Society	3 sem. hrs.

While these general education courses do not currently count towards the COSC major, these courses and COSC 1010 may count towards specific requirements in the Marquette Core Curriculum Discovery Tier required of all students. See the bulletin for additional details.

The dependency tree of COSC prerequisites and cognates is shown below:



COURSE SELECTION

A computer science major must satisfy the requirements for the major as well as the graduation requirements of the College of Arts and Sciences and the Marquette Core Curriculum (MCC) as described in the University Undergraduate Bulletin in effect in the year in which they enter Marquette. Both the requirements for the major and the general requirements of the College are flexible enough to allow each student to select a variety of courses. The following comments are intended to aid students in making these selections.

Most elective COSC courses are offered either every semester, every other semester, or every fourth semester (once every two years) in a standard rotation. Consult your advisor for a predicted schedule of offerings. In addition, the Department occasionally offers special courses not yet part of the regular curriculum. These will be listed in the Timetable of Classes as COSC 4931 (Topics in Computer Science).

Students interested in transforming data into insights and making predictions about the world through machine learning, artificial intelligence, and data analytics are encouraged to pursue a major or minor in Data Science. Students interested in the safety, privacy, and security of computers, networks, and data are encouraged to complete the requirements for the minor in Cybersecurity.

A student interested in the mathematical aspects of Computer Science, including both mathematical modeling and numerical analysis, should seriously consider a major or minor in Mathematics to go with his or her major in Computer Science, or perhaps a major in Computational Mathematics or Data Science. The requirements for combined programs are described later in this document. The MSSC department offers electives in a wide range of areas in applied mathematics, statistics, and theoretical mathematics, as well as graduate-level courses in computational sciences.

A student interested in applications of computing in media or entertainment may consider completing the requirements for the Minor in Digital Media or Minor in Fine Arts – Graphic Design. A student interested in applications of computing in business may consider completing the requirements for the Minor in Business Administration or the Minor in Innovation and Entrepreneurship. A student interested in electronics and computer hardware may consider completing the requirements for a Minor in Computer Engineering. These are described in the University Undergraduate Bulletin.

Both the College of Engineering and the College of Business Administration offer a number of computer-related courses. Computer science majors may find some of these useful as electives. Courses from other colleges can sometimes be used to satisfy the elective requirements for a major in computer science, but students must apply for a waiver from the CS Director of Undergraduate Studies. Consult your advisor before attempting any such cross-college substitutions.

For electives outside the Department, courses that enhance communication and reasoning skills are the most beneficial to the computer science professional. There are a number of such courses to be found in the offerings of the Departments of English and Philosophy.

COMBINED MAJORS AND MINORS IN COMPUTER SCIENCE AND OTHER AREAS

MAJOR IN COMPUTER SCIENCE AND MINOR IN MATHEMATICS

A student with a major in computer science needs to complete the math requirements for the minor in mathematics. There are seven additional credit hours of MATH courses including: MATH 2450, MATH 2350 (in place of MATH 2100), and one more upper division MATH elective (in addition to the MATH cognates required for the COSC major). If a COSC major decides to embark on a MATH minor after completing MATH 2100, substitutions for the MATH 2350 requirement may be allowed, but students must apply for a waiver from the CS Director of Undergraduate Studies.

MAJOR IN COMPUTER SCIENCE AND IN MATHEMATICS

A student majoring in both Computer Science and Mathematics must complete eighty credit hours of COSC and MATH courses. This total includes twenty-two additional credit hours of MATH course in addition to the 58 credit hour required of the computer science major. The required courses include: COSC 1010, 1020, 2100, 2200, 3100, 3250, 3410 (or 4400), 3820, 4920, 4998, and twelve additional hours of upper division COSC courses; MATH 1450, 1451, 2350 (in place of MATH 2100), 2450, 3100, and 21 additional hours of upper division MATH courses as outlined in the Mathematics major handbook. MATH 4550 (Numerical Analysis) may be double-counted as satisfying both a COSC elective and a MATH elective.

MAJOR IN COMPUTER SCIENCE AND OTHER MINOR.

A student majoring in Computer Science may choose to pursue an interdisciplinary minor in Data Science or the Minor in Cybersecurity. Other common minors with a major in computer science include the Minor in Business Administration or the Minor in Innovation and Entrepreneurship from the College of Business Administration, or the Minor in Digital Media from the College of Communication. A student seeking one of these minors should follow the course requirements listed in the Undergraduate Bulletin.

MAJOR IN DATA SCIENCE.

Data Science is an emerging field that seeks to extract and quantify knowledge from data. The interdisciplinary Data Science major (INDS) integrates statistics and mathematics with computer science, allowing students to develop the knowledge and skills necessary to discover and quantify new knowledge from data. INDS majors begin with the same sequence of MATH and COSC courses for the first two terms, and begins to diverge from Computer Science in the second year.

MINORS IN COMPUTER SCIENCE, CYBERSECURITY, AND DATA SCIENCE.

The Department of Computer Science offers a Minor in Computer Science, an interdisciplinary Minor in Cybersecurity, and an interdisciplinary Minor in Data Science. A student pursuing the Minor in Computer Science must complete 20 credit hours of coursework, including three required COSC courses (11 credit hours) and 9 credit hours of COSC electives, with at least 6 of those credits at the upper-division level. The interdisciplinary Minor in Cybersecurity introduces students to essential cybersecurity principles applicable across disciplines. Students pursuing this minor must complete four required COSC courses and two electives, for a total of 18–21 credit hours, depending on the courses selected. The interdisciplinary Minor in Data Science consists of 19 credit hours, including five required courses in computer science and mathematics (16 credit hours) and one 3-credit advanced elective.

STUDENT COMPUTING FACILITIES

Katherine Reed Cudahy Hall houses CS Department computing facilities. The University's Information Technology Services (ITS) can be found on the first floor of Raynor Library.

Marquette students, faculty and staff are granted accounts on the Emarq and CheckMarq systems maintained by ITS. Authentication credentials can be obtained from the ITS Help Desk, located on the first floor of Raynor Library, and are maintained throughout a student's enrollment at Marquette. Additional information regarding University computing facilities can be obtained by calling the ITS Help Desk at 288-7799.

The CS Department maintains its own independent computing facilities for both teaching and research purposes. Students enrolled in CS courses or as department majors are granted access to general purpose laboratories in CU 101 and CU 310. In addition, students enrolled in particular courses or involved in research projects may be granted access to special-purpose laboratories in CU 240A, CU 240B, CU 240K, CU 240M, CU 240U, CU 310, CU 410, CU 417 or CU 419.

The CS network features Gigabit internal connectivity between seven subnets with a wide variety of computing hardware and operating systems. Linux and Windows servers provide centralized file, mail, web and print services to Linux, Mac and Windows clients. Computer configurations range from an in-desk PC classroom to laboratories of dual-head workstations for collaborative project work.

Although students may have their own computer equipment, the CS Department provides sufficient facilities for all CS coursework. Students are encouraged to make use of department facilities; experience with heterogeneous computing environments provides a rich educational opportunity, and CS maintains a large body of software tailored to the needs and interests of department majors.

To promote research and scholarship, the university has made high performance computing (HPC) support part of its information technology offerings. Faculty and students at Marquette are eligible to use Marquette's HPC infrastructure for their courses or research projects without cost. "Raj" is Marquette's centrally managed HPC cluster, featuring 7,808 compute cores and 48 GPUs, including three nodes built for training and running programs related to artificial intelligence and machine learning.

Additional information about CS department computing facilities can be obtained from the CS system administrator at 288-1580, or online at https://www.cs.mu.edu/.

Computer Science Major
SAMPLE CURRICULUM

Freshman

First Term	*Sem. Hrs.*	*Second Term*	*Sem. Hrs.*
COSC 1010	4	COSC 1020	4
MATH 1450	4	MATH 1451	4
ENGL 1001 or ESSV1 (MCC)	3	ENGL 1001 or ESSV1 (MCC)	3
Natural Science with Laboratory[5]	4	THEO 1001 or PHIL 1001 (MCC)	3
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	15		14

Sophomore

First Term	*Sem. Hrs.*	*Second Term*	*Sem. Hrs.*
COSC 2100	3	COSC 3250	4
COSC 2200	4	COSC 3xxx/4xxx	3
MATH 2100	3	MATH 3100	3
CORE 1929 (MCC) or Elective	3	CORE 1929 (MCC) or Elective	3
PHIL 1001 or THEO 1001 (MCC)	3	DSCV (MCC)[6,7]	3
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	16		16

Junior

First Term	*Sem. Hrs.*	*Second Term*	*Sem. Hrs.*
COSC 3410 or 4400	3	COSC 3100	3
COSC 3xxx/4xxx	3	COSC 3820	3
MATH 4720	3	Science elective[6]	3
DSCV (MCC)[7,8]	3	DSCV (MCC)[6,7]	3
DSCV (MCC)[7,8]	3	Elective	3
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	15		15

Senior

First Term	*Sem. Hrs.*	*Second Term*	*Sem. Hrs.*
COSC 4920	3	COSC 4998	3
COSC 3xxx/4xxx	3	COSC 3xxx/4xxx	3
CORE 4929 (MCC) or Elective	3	CORE 4929 (MCC) or Elective	3
Science elective[6]	3	Electives	6
Electives	3		
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	15		15

[5] Must complete 6 credit hours of Science electives, including at least one course with Laboratory component (BIOL, CHEM or PHYS).

[6] The four courses in the Discovery Tier (DSCV) must be completed in the same theme and include the following content areas: Humanities (HUM), Social Science (SSC), Natural Science and Mathematics (NSM) and one elective (ELE), which is an additional course from any of the three content areas. A maximum of two courses in the Discovery Tier can apply towards a primary major.

[7] Students must also complete the Writing Intensive (WRIT) and Engaging Social System and Values 2 (ESSV2) requirements. These requirements can be fulfilled through designated courses in the Discovery Tier or other degree requirements.

Computer Science and Mathematics Double Major[8]

SAMPLE CURRICULUM

Freshman

First Term	*Sem. Hrs.*	*Second Term*	*Sem. Hrs.*
COSC 1010	4	COSC 1020	4
MATH 1450	4	MATH 1451	4
ENGL 1001 or ESSV1 (MCC)	3	ENGL 1001 or ESSV1 (MCC)	3
Natural Science with Laboratory[9]	4	THEO 1001 or PHIL 1001 (MCC)	3
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	15		14

Sophomore

First Term	*Sem. Hrs.*	*Second Term*	*Sem. Hrs.*
COSC 2100	3	COSC 3250	4
COSC 2200	4	COSC 3xxx/4xxx	3
MATH 2350	3	MATH 3100	3
MATH 2450	4	DSCV (MCC)	3
CORE 1929 (MCC)	3	PHIL 1001 or THEO 1001 (MCC)	3
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	17		16

Junior

First Term	*Sem. Hrs.*	*Second Term*	*Sem. Hrs.*
COSC 3410 or 4400	3	COSC 3100	3
COSC 3xxx/4xxx	3	COSC 3820	3
MATH Sequence (part 1)	3	MATH Group 3 (statistics)	3
Science elective[10]	3	MATH Sequence (part 2)	3
DSCV (MCC)	3	MATH 4720	3
		DSCV (MCC)	3
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	15		18

Senior

First Term	*Sem. Hrs.*	*Second Term*	*Sem. Hrs.*
COSC 4920	3	COSC 4998	3
COSC 3xxx/4xxx	3	COSC 3xxx/4xxx[10]	3
MATH Group 1 (pure)	3	MATH Group 2 (applied)[10]	3
MATH 3xxx/4xxx[10]	3	MATH 3xxx/4xxx[10]	3
DSCV (MCC)	3	CORE 4929 (MCC)	3
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	15		15

[8] For a single major programs that combines aspects of both Computer Science and Mathematics with fewer course requirements, please see the Computational Mathematics major and Data Science major handbooks.

[9] Must complete 6 additional credit hours of Math/Science electives, including at least one 3-4 credit hour science course with a laboratory component (BIOL, CHEM or PHYS).

[10] MATH 4550 (Numerical Analysis) may be double-counted as satisfying both a Computer Science elective and a Mathematics elective for double majors.

Computer Science Major with Innovation and Entrepreneurship Minor

SAMPLE CURRICULUM

Freshman

First Term	*Sem. Hrs.*	*Second Term*	*Sem. Hrs.*
COSC 1010	4	COSC 1020	4
MATH 1450	4	MATH 1451	4
ENGL 1001 or ESSV1 (MCC)	3	ENGL 1001 or ESSV1 (MCC)	3
Natural Science with Laboratory[11]	4	THEO 1001 or PHIL 1001 (MCC)	3
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	15		14

Sophomore

First Term	*Sem. Hrs.*	*Second Term*	*Sem. Hrs.*
COSC 2100	3	COSC 3250	4
COSC 2200	4	COSC 3xxx/4xxx	3
MATH 2100	3	DSCV (MCC)	3
CORE 1929 (MCC)	3	PHIL 1001 or THEO 1001 (MCC)	3
ECON 1001 or ECON 1103	3	BUAD 2100 or ACCO 1030	3
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	16		16

Junior

First Term	*Sem. Hrs.*	*Second Term*	*Sem. Hrs.*
COSC 3410 or 4400	3	COSC 3100	3
COSC 3xxx/4xxx	3	COSC 3820	3
MATH 3100	3	MATH 4720[12]	3
DSCV (MCC)	3	Science elective[12]	3
ENTP 3001	3	DSCV (MCC)	3
		ENTP 4010	3
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	15		15

Senior

First Term	*Sem. Hrs.*	*Second Term*	*Sem. Hrs.*
COSC 4920	3	COSC 4998[13]	3
COSC 3xxx/4xxx	3	COSC 3xxx/4xxx	3
Science elective[12]	3	Science elective[12]	3
DSCV (MCC)	3	CORE 4929	3
Entrepreneurship Elective[14]	3	Elective	3
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	15		15

[11] Must complete 6 additional credit hours of Natural Science cognate electives (BIOL, CHEM or PHYS), including at least one Laboratory course.

[12] MATH 4720 satisfies both a COSC major Math requirement, and the Innovation and Entrepreneurship minor statistics requirement.

[13] COSC 4998 can be used to satisfy Applied Experiential Course requirement for Innovation and Entrepreneurship Minor.

[14] ENTP 4020, ENTP 4041, ENTP 4931, MANA 3034, MANA 4010, INSY 3001, OSCM 3001 or MARK 3001.