



MARQUETTE
UNIVERSITY

HELEN WAY KLINGLER
COLLEGE OF ARTS AND SCIENCES

Handbook

for

Computational Mathematics Majors

2020-2021

Department of Mathematical and Statistical Sciences

INTRODUCTION

The computational mathematics curriculum is a program of study offered by the Department of Mathematical and Statistical Sciences that blends the subjects of computer science and applied mathematics. The program is designed to provide a balance between mathematics and computer science that would otherwise require a double major to achieve. It includes those courses in the mathematics curriculum that emphasize applied mathematics as well as those from the computer science curriculum that develop the computing skills required by many of today's applications.

CAREER OPPORTUNITIES

The curriculum in computational mathematics produces graduates who are uniquely positioned for careers in today's technical environment. Such careers vary greatly in one's day-to-day projects but tend to involve the development of mathematical models by which scientists and engineers can test theories and predict future actions in the real world. For example, a graduate working with a medical research team may develop models based on theories of diseases and immunizations and use these models to predict the long term effects of a particular immunization program. Other graduates might find themselves involved in the development of automated control systems for use in automobiles, airplanes or industrial machinery. Still others find careers developing scientifically oriented computer software. Indeed, the list seems endless, with opportunities in both large and small corporations, which can, in fact, lead to the creation of a graduate's own consulting business.

Perhaps of most importance in the long run is that the curriculum in computational mathematics, being encased in the liberal arts tradition of Marquette University, not only teaches the skills required to launch a successful career, but also enhances the creative skills that allow a graduate to grow and learn in a changing world.

ADVISING and PRE-REGISTRATION

A student planning to complete a major in computational mathematics should enroll in COSC 1010¹ and MATH 1450² in the first semester of his or her freshman year and in COSC 1020 and MATH 1451³ in the second semester. As soon as he or she has decided to major in the Department, the student should report to the Department office (room #340 of Cudahy Hall) to declare a major 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.

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 A 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 MATH 1451 will be awarded to those students who scored a 4 or 5 on their AP Calculus BC test.

REQUIREMENTS FOR THE COMPUTATIONAL MATHEMATICS MAJOR

REQUIRED COURSES

All students must take the following eight mathematics courses:

MATH 1450	Calculus 1	4 sem. hrs.
MATH 1451	Calculus 2	4 sem. hrs.
MATH 2350	Foundations of Mathematics	3 sem. hrs.
MATH 2450	Calculus 3	4 sem. hrs.
MATH 2451	Differential Equations	4 sem. hrs.
MATH 3100	Linear Algebra & Matrix Theory	3 sem. hrs.
MATH 4540	Numerical Analysis	3 sem. hrs.
MATH 4630	Mathematical Modeling and Analysis	3 sem. hrs.
MATH 4720	Statistical Methods	3 sem. hrs.
or MATH 4740.	Biostatistical Methods and Models	3 sem. hrs.

and the following four COSC courses:

COSC 1010	Introduction to Computer Programming	4 sem. hrs.
COSC 1020	Object-Oriented Software Design	4 sem. hrs.
COSC 2100	Data Structures & Algorithms 1	3 sem. hrs.
COSC 3100	Algorithms	3 sem. hrs.

In addition, all students must take two of the following MATH courses:

MATH 3570	Introduction to Data Science	3 sem. hrs.
MATH 4200	Intermediate Analysis 1	3 sem. hrs.
MATH 4210	Complex Variables	3 sem. hrs.
MATH 4500	Theory of Differential Equations	3 sem. hrs.
MATH 4510	Elementary Partial Differential Equations	3 sem. hrs.
MATH 4650	Theory of Optimization	3 sem. hrs.
MATH 4670	Applied Combinatorial Mathematics	3 sem. hrs.
MATH 4700	Theory of Probability	3 sem. hrs.
MATH 4710	Mathematical Statistics	3 sem. hrs.
MATH 4760	Time Series	3 sem. hrs.
MATH 4780	Regression Analysis	3 sem. hrs.

and one of the following COSC courses:

COSC 3090	Bioinformatics Algorithms	3 sem. hrs.
COSC 3250	Operating Systems	3 sem. hrs.
COSC 3410	Programming Languages	3 sem. hrs.
COSC 3570	Introduction to Data Science	3 sem. hrs.
COSC 3810	Software Design and Analysis	3 sem. hrs.
COSC 4600	Fundamentals of Artificial Intelligence	3 sem. hrs.
COSC 4610	Data Mining	3 sem. hrs.

Computational Mathematics Major SAMPLE CURRICULUM⁴

<i>Freshman</i>			
<u>First Term</u>	<u>Sem. Hrs.</u>	<u>Second Term</u>	<u>Sem. Hrs.</u>
COSC 1010	4	COSC 1020	4
ENGL 1001 or ESSV1 (MCC)	3	ENGL 1001 or ESSV1 (MCC)	3
PHIL 1001 or THEO 1001 (MCC)	3	PHIL 1001 or THEO 1001 (MCC)	3
MATH 1450	4	MATH 1451	4
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	14		14
<i>Sophomore</i>			
<u>First Term</u>	<u>Sem. Hrs.</u>	<u>Second Term</u>	<u>Sem. Hrs.</u>
COSC 2100	3	MATH 2451	4
CORE 1929 (MCC) or elective	3	MATH 3100	3
MATH 2350	3	CORE 1929 (MCC) or elective	3
MATH 2450	4	DSCV (MCC) ^{5 6}	3
Elective	3	Electives	3
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	16		16
<i>Junior</i>			
<u>First Term</u>	<u>Sem. Hrs.</u>	<u>Second Term</u>	<u>Sem. Hrs.</u>
MATH 4540	3	COSC 3100	3
MATH 4720 or 4740	3	Mathematics elective	3
DSCV (MCC) ^{2 3}	3	DSCV (MCC) ^{2 3}	3
DSCV (MCC) ^{2 3}	3	DSCV (MCC) ^{2 3}	3
Elective	3	Elective	3
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	15		15
<i>Senior</i>			
<u>First Term</u>	<u>Sem. Hrs.</u>	<u>Second Term</u>	<u>Sem. Hrs.</u>
MATH 4630	3	Mathematics elective	3
Computer Science elective	3-4	CORE 4929 (MCC) or elective	3
CORE 4929 (MCC) or elective	3	Electives	9
Electives	6		
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	15-16		15

⁴Taking the minimum number of hours each semester will not accumulate sufficient hours for graduation in four years.

⁵ The four courses in the Discovery Tier (DSCV) of the MCC 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.

⁶ Students must also complete the Writing Intensive (WRIT) and Engaging Social System and Values 2 (ESSV2) requirements of the MCC. These requirements can be fulfilled through designated courses in the Discovery Tier or other degree requirements.

STUDENT COMPUTING FACILITIES

Katherine Reed Cudahy Hall houses the University's Information Technology Service (ITS) central computing facilities on the second floor, and MSSC department computing facilities on the first, third and fourth floors.

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 (room CU 293) 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 MSSC Department maintains its own independent computing facilities for both teaching and research purposes. Students enrolled in MSSC courses or as department majors are granted access to general purpose laboratories in CU 101, CU 310, and CU 412. In addition, students enrolled in particular courses or involved in research projects may be granted access to special-purpose laboratories in CU 145, CU 301, CU 310, CU 368, CU 392, or CU 410.

The MSSC network features Gigabit internal connectivity between seven subnets with a wide variety of computing hardware and operating systems. Solaris and Linux servers provide centralized file, mail, web and print services to Windows, Linux, Solaris and Mac 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 MSSC department provides sufficient facilities for all MSSC coursework. Students are encouraged to make use of department facilities; experience with heterogeneous computing environments provides a rich educational opportunity, and MSSC maintains a large body of software tailored to the needs and interests of department majors.

Additional information about MSSC department computing facilities can be obtained from the MSSC system administrator at 288-1580, or online at <https://www.marquette.edu/mathematical-and-statistical-sciences/>.