



MARQUETTE
UNIVERSITY

HELEN WAY KLINGLER
COLLEGE OF ARTS AND SCIENCES

Handbook

for

Data Science
Majors

2017-2018

Department of Mathematics, Statistics and Computer Science

College of Arts and Sciences

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. Working 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. Communicating and collaborating effectively with colleagues, clients and those in other fields;
3. Pursuing excellence and continued learning as a lifelong endeavor, especially in the computing realm; and
4. Growing into ethical and informed leaders and role-models in their profession and in their community.

ADVISING and PRE-REGISTRATION

A student planning to complete a major in data science 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.

STUDENT LEARNING OUTCOMES

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

1. Represent and manipulate data in effective ways.
2. Manipulate data using package/tools and by “ad hoc” data handling.
3. Use mathematical, computational and statistical tools to detect patterns and model performance.
4. Use computational principles and tools to tackle issues addressable by data science.
5. Use a solid foundation in data science to independently learn new methodologies and technologies in the emerging field of data science.

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 DATA SCIENCE MAJOR

REQUIRED COURSES

All students must take the following sixteen 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 4610	Data Mining	3 sem. hrs.
COSC 4800	Principles of Database Systems	3 sem. hrs.
COSC 4920	Principles of Design	3 sem. hrs.
COSC 4998	Senior Design Project	3 sem. hrs.
MATH 1450	Calculus 1	4 sem. hrs.
MATH 1451	Calculus 2	4 sem. hrs.
MATH 2100/2350	Discrete Mathematics/ Foundations of Mathematics	3 sem. hrs.
MATH 2450	Calculus 3	4 sem. hrs.
MATH 3100	Linear Algebra and Matrix Theory	3 sem. hrs.
MATH 3XXX	Data Science and Data Visualization	3 sem. hrs.
MATH 4700	Theory of Probability	3 sem. hrs.
MATH 4720	Statistical Methods	3 sem. hrs.
MATH 4780	Regression Analysis	3 sem. hrs.

ELECTIVES

To complete the major, 6 additional semester hours of upper-division (3000- or 4000-level) COSC or MATH courses are required. A partial list of available choices is given below:

COSC 4600	Fundamentals of Artificial Intelligence	3 sem. hrs.
COSC 4931	Topics in Computer Science: Bioinformatics	3 sem. hrs.
MATH 4630	Mathematical Modeling and Analysis	3 sem. hrs.
MATH 4710	Mathematical Statistics	3 sem. hrs.
MATH 4760	Time Series Analysis	3 sem. hrs.

Special topics courses (COSC 4931) are also routinely offered by the faculty.

In addition, Marquette's Computer Engineering (COEN) major offers upper division electives in computer architecture, graphics, security, 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 MSCS Undergraduate Committee on a course by course basis.

Data Science Major SAMPLE CURRICULUM

<u>First Term</u>		<i>Freshman</i>	<u>Second Term</u>	
	<u>Sem. Hrs.</u>			<u>Sem. Hrs.</u>
COSC 1010	4		COSC 1020	4
MATH 1450	4		MATH 1451	4
ENGL 1001	3		ENGL 1002	3
UCCS- Science & Nature	4		UCCS – Histories of Cult./Soc.	3
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	15			14

<u>First Term</u>		<i>Sophomore</i>	<u>Second Term</u>	
	<u>Sem. Hrs.</u>			<u>Sem. Hrs.</u>
COSC 2100	3		MATH 3100	3
MATH 2350	3		MATH 3***	3
MATH 2450	4		MATH 4720	3
UCCS – Literature / Performing Arts	3		UCCS – Ind. & Social Behavior	3
Elective	3		Elective	3
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	16			15

<u>First Term</u>		<i>Junior</i>	<u>Second Term</u>	
	<u>Sem. Hrs.</u>			<u>Sem. Hrs.</u>
COSC 4800	3		COSC 4610	3
MATH 4700	3		Data Science Elective	3
PHIL 1001	3		THEO 1001	3
Electives	6		PHIL 2310	3
	-----		Elective	3
	15			-----
				15

<u>First Term</u>		<i>Senior</i>	<u>Second Term</u>	
	<u>Sem. Hrs.</u>			<u>Sem. Hrs.</u>
COSC 4920	3		COSC 4998	3
Data Science Elective	3		COSC 4780	3
UCCS – Theology	3		UCCS - Diverse Cultures	3
Electives	6		Electives	6
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	15			15

Data Science Major with Minor in Business Administration

SAMPLE CURRICULUM

<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
MATH 1450	4	MATH 1451	4
ENGL 1001	3	ENGL 1002	3
ECON 1103	3	ECON 1104	3
		BUAD 1060	1
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	14		15

<i>Sophomore</i>			
<u>First Term</u>	<u>Sem. Hrs.</u>	<u>Second Term</u>	<u>Sem. Hrs.</u>
COSC 2100	3	MATH 3100	3
MATH 2350	3	MATH 3***	3
MATH 2450	4	MATH 4720	3
UCCS – Literature / Performing Arts	3	UCCS – Science & Nature	3
ACCO 1030	3	ACCO 1031	3
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	16		15

<i>Junior</i>			
<u>First Term</u>	<u>Sem. Hrs.</u>	<u>Second Term</u>	<u>Sem. Hrs.</u>
COSC 4800	3	COSC 4610	3
MATH 4700	3	Data Science Elective	3
PHIL 1001	3	PHIL 2310	3
FINA 3001	3	THEO 1001	3
UCCS – Histories Cult./Soc.		MANA 3001	3
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	16-17		15

<i>Senior</i>			
<u>First Term</u>	<u>Sem. Hrs.</u>	<u>Second Term</u>	<u>Sem. Hrs.</u>
COSC 4920	3	COSC 4998	3
Data Science Elective	3	MATH 4780	3
UCCS-Theology	3	UCCS - Diverse Cultures	3
MARK 3001	3	Electives	6
Elective	3		
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	15		15

STEM-MBA program Data Science BS/MBA SAMPLE CURRICULUM

<u>Fall 1</u>	<u>Sem. Hrs.</u>	<u>Spring 1</u>	<u>Sem. Hrs.</u>
COSC 1010	4	COSC 1020	4
MATH 1450	4	MATH 1451	4
ENGL 1001	3	ENGL 1002	3
UCCS-Histories of Cult./Soc.	3	UCCS-Science & Nature	3
THEO 1001	3	BUAD 1060	1
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	17		15
<u>Fall 2</u>	<u>Sem. Hrs.</u>	<u>Spring 2</u>	<u>Sem. Hrs.</u>
COSC 2100	3	MATH 3100	3
MATH 2350	3	MATH 3***	3
MATH 2450	4	MATH 4720	3
UCCS-Literature/Perform. Arts	3	UCCS-Diverse Cultures	3
PHIL 1001	3	ECON 1103	3
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	16		15
<u>Fall 3</u>	<u>Sem. Hrs.</u>	<u>Spring 3</u>	<u>Sem. Hrs.</u>
COSC 4800	3	COSC 4610	3
MATH 4700	3	Data Science Elective	3
PHIL 2310	3	UCCS-Theology	3
Elective	3	Elective	3
ECON 1104	3	ACCO 1030	3
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	15		15
<u>Fall 4</u>	<u>Sem. Hrs.</u>	<u>Spring 4</u>	<u>Sem. Hrs.</u>
COSC 4920	3	COSC 4998	3
Data Science Elective	3	MATH 4780	3
PHIL 4330	3	ACCO 6100	3
ACCO 1031	3	Electives	6
ECON 6100	3		
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	15		15
<u>Summer Session 1</u>	<u>Sem. Hrs.</u>	<u>Summer Session 2</u>	<u>Sem. Hrs.</u>
INTE 6000	2	MBA Elective	3
FINA 6100	3	MBA Elective	3
Skills Course	1		
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	6		6
<u>Fall 5</u>	<u>Sem. Hrs.</u>	<u>Spring 5</u>	<u>Sem. Hrs.</u>
MANA 6100	3	OSCM 6100	3
MARK 6100	3	MANA 6240	3
MBA Elective Core	3	MBA Elective Core	3
MSCS or MBA Elective	3	MSCS or MBA Elective	3
COOP	0	COOP	0
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	12		12

BS/MS Program in Data Science and Computing with Big Data & Data Analytics Specialization SAMPLE CURRICULUM

<u>Fall 1</u>	<u>Sem. Hrs.</u>	<u>Spring 1</u>	<u>Sem. Hrs.</u>
COSC 1010	4	COSC 1020	4
MATH 1450	4	MATH 1451	4
ENGL 1001	3	ENGL 1002	3
UCCS-Science & Nature	4	UCCS-Histories of Cult./Soc.	3
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	15		14
<u>Fall 2</u>	<u>Sem. Hrs.</u>	<u>Spring 2</u>	<u>Sem. Hrs.</u>
COSC 2100	3	MATH 3100	3
MATH 2350	3	MATH 3***	3
MATH 2450	4	MATH 4720	3
UCCS-Literature/Perform. Arts	3	UCCS-Ind. & Social Behavior	3
Elective	3	Elective	3
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	16		15
<u>Fall 3</u>	<u>Sem. Hrs.</u>	<u>Spring 3</u>	<u>Sem. Hrs.</u>
MSCS 5800*	3	MSCS 5610	3
MSCS 5700*	3	Data Science Elective	3
PHIL 1001	3	THIO 1001	3
Electives	6	PHIL 2310	3
	-----	Elective	3
	15		15
<u>Fall 4</u>	<u>Sem. Hrs.</u>	<u>Spring 4</u>	<u>Sem. Hrs.</u>
COSC 4920	3	COSC 4998	3
Data Science Elective	3	MSCS 5780	3
UCCS-Theology	3	UCCS-Diverse Cultures	3
Electives	6	Electives	6
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	15		15
<u>Summer Session 1</u>	<u>Sem. Hrs.</u>	<u>Summer Session 2</u>	<u>Sem. Hrs.</u>
GSM Elective (e.g. INTE 6000)	3	MSCS Computing elective	3
MSCS 6390 Professional seminar	1	MSCS 6390, Professional seminar	1
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	4		4
<u>Fall 5</u>	<u>Sem. Hrs.</u>	<u>Spring 5</u>	<u>Sem. Hrs.</u>
MSCS 6931 Topics: Data Warehousing	3	MSCS 6060 Parallel & Distributed Computing	3
MSCS 6931 Topics: Business Intelligence	3	MSCS 6931 Topics: Business Analytics	3
MSCS Computing Elective	3	MSCS 6390 Professional seminar	1
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	9		7

STUDENT COMPUTING FACILITIES

Katherine Reed Cudahy Hall houses the University's Information Technology Service (ITS) central computing facilities on the second floor, and MSCS 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 MSCS Department maintains its own independent computing facilities for both teaching and research purposes. Students enrolled in MSCS 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 MSCS 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 MSCS department provides sufficient facilities for all MSCS coursework. Students are encouraged to make use of department facilities; experience with heterogeneous computing environments provides a rich educational opportunity, and MSCS maintains a large body of software tailored to the needs and interests of department majors.

Additional information about MSCS department computing facilities can be obtained from the MSCS system administrator at 288-1580, or online at <http://www.mscs.mu.edu/>.