Data Science (DTSC)

*Department Chairperson: Sheikh Iqbal Ahamed, Ph.D.*

*Master of Science Program Director: Praveen Madiraju, Ph.D.*

*Certificate Program Director: Michael Zimmer, Ph.D.*

Department of Computer Science website (https://www.marquette.edu/computer-science/)

Data Science Master of Science website (https://www.marquette.edu/grad/programs-data-science-masters-degree.php)

Data Science Certificate website (https://www.marquette.edu/grad/programs-data-science-certificate.php)

**Department Affiliation**

The data science degrees are affiliated with the Department of Computer Science in the Klingler College of Arts and Sciences. The Department of Computer Science also offers a *master of science in computing* (https://bulletin.marquette.edu/grad/programs/computing/#text) and a *doctor of philosophy in computer science* (https://bulletin.marquette.edu/grad/programs/computer-science/#doctoralrequirements). A list of courses creating an online degree can be found here: https://bulletin.marquette.edu/grad/programs/computer-science/#doctoralrequirements.

**Degrees Offered**

Master of Science, Certificate

**Program Descriptions**

**Data Science Master of Science**

The data science master of science targets the growing demand for data science talent through a unique Marquette mission-oriented curriculum of theory-based and hands-on data analytics courses that prepare graduate students to tackle today’s problems in the ever-growing data-driven world.

Learning outcomes for students completing the master’s program:

1. Represent, manipulate, analyze and interpret big data using exploratory, inferential methods and use packages/tools in effective ways.
2. Recognize and analyze ethical and social issues in data science.
3. Apply and evaluate complex models to devise solutions for data science tasks.
4. Interpret data science analysis outcomes and draw conclusions using effective written, graphical, and verbal tools and techniques.

**Data Science Certificate**

The data science certificate curriculum is designed to connect data analytics and data science skills and knowledge with the needs evident in a host of fields. This program seeks to meet a significant need for data analytics experts, targeting a human-centered approach.

Learning outcomes for students completing the certificate program:

1. Identify and articulate problems, issues and decisions that can be informed by data analytics approaches and the ethical and social issues surrounding them.
2. Design and implement advanced strategies for analyzing big data.
3. Create and present actionable information.

**Prerequisites for Admission**

Applicants should have:

- An earned baccalaureate degree, for the master’s program, in a relevant field such as data science, computer science, statistics, information science, and mathematics with a GPA of at least 3.000. An earned baccalaureate degree, for the certificate program, in any field with a GPA of at least 3.000.
- Basic computational thinking competency as demonstrated by completion of an introductory course (e.g., COSC 1010 Introduction to Software Development or equivalent). Alternatively, proof of successful completion of a recommended introductory online Python programming course as recommended by the program director.
- A foundational statistics course (e.g., PSYC 2001 Psychological Measurements and Statistics, SOCI 2060 Social Statistics or equivalent) with familiarity in programs such as R, MATLAB, SAS, Stata, etc. Alternatively, proof of successful completion of a recommended introductory online foundational statistics course as recommended by the program director.

**Application Deadlines**

Applications are reviewed on a rolling basis, and admitted students may begin their program in fall or spring. Priority consideration is given to master’s applicants who apply by January 15th.
The deadlines for merit-based financial aid consideration for master’s applicants are January 15 for the following fall term and November 15 for the following spring term.

**Application Requirements**

Applicants must submit, directly to the Graduate School:

2. Copies of all college/university transcripts except Marquette.¹
3. A statement of purpose essay outlining relevant work experience or education, career goals, possible areas of interest and reasons for seeking admission to this program. Required for master’s applicants; optional for certificate applicants.
4. (For international applicants who have not attended an English-speaking university only) a TOEFL score or other acceptable proof ([https://www.marquette.edu/grad/english-proficiency.php](https://www.marquette.edu/grad/english-proficiency.php)) of English proficiency.
5. (For master’s students applying for merit-based financial aid) GRE scores (General Test only). Required for international applicants; recommended for domestic applicants.
6. Resume. Recommended for master’s applicants.
7. Three letters of reference from professors or professionals familiar with the applicant’s abilities, academic work and/or professional background. Recommended for master’s applicants; optional for certificate applicants.

¹ Upon admission, final official transcripts from all previously attended colleges/universities, with certified English translations if original language is not English, must be submitted to the Graduate School within the first five weeks of the term of admission or a hold preventing registration for future terms is placed on the student record.

**Data Science Master of Science**

Students are admitted to the master of science in data science program under the non-thesis option (Plan B). Students may apply for the thesis option (Plan A) on approval of a thesis outline by their adviser and the department’s data science program director.

**Required Courses**

All students must successfully complete the following six 3-credit core courses, for a total of 18 credits.

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>COSC 6510</td>
<td>Business Intelligence</td>
<td>3</td>
</tr>
<tr>
<td>COSC 6520</td>
<td>Business Analytics</td>
<td>3</td>
</tr>
<tr>
<td>COSC 5500</td>
<td>Visual Analytics</td>
<td>3</td>
</tr>
<tr>
<td>COSC 5820</td>
<td>Ethical and Social Implications of Data</td>
<td>3</td>
</tr>
<tr>
<td>COSC 6570</td>
<td>Data at Scale</td>
<td>3</td>
</tr>
<tr>
<td>COSC 5610</td>
<td>Data Mining</td>
<td>3</td>
</tr>
</tbody>
</table>

**Total Credit Hours:** 18

**Thesis (Plan A) Requirements**

Plan A master’s students must complete 18 credit hours of core courses, 6 credit hours of approved electives, and 6 thesis credit hours, for a total of 30 credit hours.

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Required core courses</td>
<td></td>
<td>18</td>
</tr>
<tr>
<td>Graduate electives as approved by adviser</td>
<td></td>
<td>6</td>
</tr>
<tr>
<td>COSC 6999</td>
<td>Master’s Thesis</td>
<td>6</td>
</tr>
</tbody>
</table>

**Total Credit Hours:** 30

**NON-THESIS (PLAN B) REQUIREMENTS**

Plan B master’s students must complete 18 credit hours of core courses and 15 credit hours of approved electives, for a total of 33 credit hours. Students have three options in Plan B and are outlined below.

**No specialization (Generalist Degree)**

If a student does not choose a specialization, they must complete the 18 credit hours of core courses along with 15 additional adviser-approved graduate elective credit hours, for a total of 33 credit hours.
<table>
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<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Required core courses</td>
<td>18</td>
</tr>
<tr>
<td></td>
<td>Graduate electives as approved by adviser</td>
<td>15</td>
</tr>
<tr>
<td><strong>Total Credit Hours:</strong></td>
<td></td>
<td><strong>33</strong></td>
</tr>
</tbody>
</table>

**Machine Learning SPECIALIZATION**

Students choosing the machine learning specialization must successfully complete the following courses for a total of 33 credit hours.

<table>
<thead>
<tr>
<th>Code</th>
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<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Required core courses</td>
<td>18</td>
</tr>
<tr>
<td>COSC 5800</td>
<td>Principles of Database Systems</td>
<td>3</td>
</tr>
<tr>
<td>COSC 5600</td>
<td>Fundamentals of Artificial Intelligence</td>
<td>3</td>
</tr>
<tr>
<td>COSC 6330</td>
<td>Advanced Machine Learning</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Graduate electives as approved by adviser</td>
<td>6</td>
</tr>
<tr>
<td><strong>Total Credit Hours:</strong></td>
<td></td>
<td><strong>33</strong></td>
</tr>
</tbody>
</table>

**Big Data SPECIALIZATION**

Students choosing the big data specialization must successfully complete the following courses for a total of 33 credit hours.

<table>
<thead>
<tr>
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<td>18</td>
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<tr>
<td>COSC 5800</td>
<td>Principles of Database Systems</td>
<td>3</td>
</tr>
<tr>
<td>COSC 6060</td>
<td>Parallel and Distributed Systems</td>
<td>3</td>
</tr>
<tr>
<td>COSC 6380</td>
<td>Advanced Database Systems</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Graduate electives as approved by adviser</td>
<td>6</td>
</tr>
<tr>
<td><strong>Total Credit Hours:</strong></td>
<td></td>
<td><strong>33</strong></td>
</tr>
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</table>

**Accelerated Bachelor’s–Master’s Degree Program (ADP)**

The Department of Computer Science also offers an accelerated degree program where eligible students may obtain both a bachelor’s degree and the master of science degree in data science in five years. Students are eligible to apply to this program as early as the final term of their sophomore year. Students wishing to participate in the five-year program must apply and be admitted to the program before their senior year. Minimal criteria for application to the ADP include a cumulative GPA of at least 3.000.

The summer term may be taken immediately after the senior year or the following summer. Within the undergraduate degree program, the student enrolls in the required programming and data structures courses and 12 graduate credits related to data science. After completing the undergraduate program, there are three terms of graduate study. In these three terms, the student receives an additional 18 or 21 graduate credits, resulting in a total of 30-33 graduate credits.

**Data Science Certificate**

All students admitted to the data science certificate program are required to complete at least 15 credit hours of course work.

This ethically-centered graduate certificate is in the emerging interdisciplinary field of data science, which seeks to extract and quantify knowledge from large and/or heterogeneous data sets. The certificate prepares students to integrate advanced technology with modern statistical and mathematical practices and use data in action to directly benefit society. Students learn how to turn data into knowledge, thereby guiding problem-solving and decision-making.

A student must complete a minimum of 15 credits of course work from the following courses:

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</thead>
<tbody>
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<td>COSC 5500</td>
<td>Visual Analytics</td>
<td>3</td>
</tr>
<tr>
<td>COSC 5820</td>
<td>Ethical and Social Implications of Data</td>
<td>3</td>
</tr>
<tr>
<td>COSC 6510</td>
<td>Business Intelligence</td>
<td>3</td>
</tr>
<tr>
<td>COSC 6520</td>
<td>Business Analytics $^1$</td>
<td>3</td>
</tr>
<tr>
<td>or COSC 6540</td>
<td>Data Analytics</td>
<td>3</td>
</tr>
<tr>
<td>COSC 6570</td>
<td>Data at Scale $^2$</td>
<td>3</td>
</tr>
<tr>
<td>or COSC 6060</td>
<td>Parallel and Distributed Systems</td>
<td>3</td>
</tr>
</tbody>
</table>
Data Science (DTSC)

or COSC 6380

Advanced Database Systems

Total Credit Hours: 15

1. COSC 6540 recommended for students with a programming background
2. COSC 6060 or COSC 6380 recommended for students with a computer science background