Computing (COMP)

Chairperson: Rebecca L. Sanders, Ph.D.
Program Director: Thomas Kaczmarek, Ph.D.

Computing website (http://www.marquette.edu/mscs/grad-computing.shtml)

Degree Offered

Master of Science, students are admitted under Plan B (non-thesis option) but may request Plan A (thesis option). Students are not required to select a specialization. There are two specializations that focus study on cyber security and data analytics (predictive analytics). A third specialization is offered for students wishing to do a career change into computing.

Program Description

Computing is a broad-based family of disciplines that includes computer science, computer engineering, software engineering, information systems and information technology. By design, the computing program allows the student to pursue studies in any combination of these disciplines.

This program strives to meet the educational needs of present and future computing professionals interested in starting a career or updating their skills. Careers are in areas such as cyber security, data analytics, business and systems analysis, software engineering, project management, enterprise architecture, business process modeling and management, database design and administration, technology management and service management.

Students may select courses from a large number of approved courses offered by the Department of Mathematics, Statistics and Computer Science, the Department of Electrical and Computer Engineering, the Graduate School of Management and other units on campus. Students selecting a specialization have required coursework which constitutes about one-half of the credit requirements for the degree.

Students may pursue the degree on a full-time or part-time basis. Most courses are offered in the evenings and distance learning classes are available. Distance learning options for most courses offered in the department add flexibility to the program.

Prerequisites for Admission

Applicants must have completed or be in the process of completing a bachelor's degree from an accredited college or university. Applicants who are not in the career change specialization must have studied computer programming in a modern computer programming language with have knowledge of algorithms and data structures (or have equivalent work experience). Applicants entering the career change specialization do not need the prerequisites in programming and data structures and algorithms. However, they must enroll in a Foundations of Computing course, which is a summer-long boot camp-like experience, designed to satisfy the prerequisites and provide the proper introduction to a career in computing. Applicants for the integrated practicum curriculum typically have a major in computer science or computer engineering or a related discipline and work experience.

Application Requirements

Applicants must submit, directly to the Graduate School:

1. A completed application form and fee online (http://marquette.edu/grad/future_apply.shtml).
2. Copies of all college/university transcripts except Marquette.*
3. An essay outlining relevant work experience or education, career goals, possible areas of interest and reasons for seeking admission to this program.
4. Three letters of reference from professors or professionals familiar with the applicant's abilities, academic work and/or professional background.
5. (For students applying for merit-based financial aid) GRE scores (General Test only).
6. (For international applicants who have not attended an English-speaking university only) a minimum TOEFL score of 80 on the Internet-based version or other acceptable proof of English proficiency.

* 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.

Application Deadline

The master of science program in computing follows the Graduate School deadlines for the submission of applications: August 1 for fall admission June 1 for international applicants), December 15 for spring admission (October 15 for international applicants), and May 1 for summer admission. However,
to be considered for financial aid, applications for fall must be submitted by January 15. Decisions about acceptance into the program are made when all required documents for the application are received. Admission decisions are made independently of decisions to offer financial aid.

**General Information**

Students interested in applying to the program should consult the program website (http://www.marquette.edu/mscs/grad.shtml) for additional information, including a description of specializations and a list of currently suggested courses for the degree.

A complete list and short description of the courses offered by the Mathematics, Statistics and Computer Science Department (MSCS) is available on the MSCS Department page of the bulletin (http://bulletin.marquette.edu/grad/programs/mathstatsandcomputerscience).

**Computing Master's Requirements**

Students are admitted to the 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 computing program's graduate committee.

The course of study is very flexible. Students complete a breadth requirement and additional courses suited to their backgrounds and career goals. The program director and faculty advisers work very closely with students to ensure that they achieve their educational goals through appropriate course selection.

Computing students gain both breadth and an in-depth knowledge of their field.

**Breadth Requirement**

Computing students experience the breadth of the field by completing (or having completed before entering the program) at least three credits in four of the following five areas, for a total of 12 credits:

1. Information Management
2. Hardware and Software Architecture and Organization
3. Operating Systems
4. Programming Concepts and Skills
5. Software Engineering.

Classes at the 5000 level and the 6000 level have been designated by the program in each area, but satisfaction of the breadth requirement does not rely on any specific course selection. An individual plan is developed by the student and approved by the computing program's director of graduate studies.

**Career Focus**

Students choose a primary career focus and a secondary career focus. The career focus aids in selecting courses that provide in-depth knowledge aligned with career objectives. The courses chosen in the primary career focus area and the secondary career focus area are driven by students' interests working with an adviser. Each student must have at least 12 credit hours related to their primary career focus, and at least six credit hours in a different secondary career focus for a total of 18 credit hours.

Courses taken to satisfy the breadth requirement also count toward career focus requirements. No course may be counted toward satisfying both a primary and a secondary focus. The breadth requirements and the career focus requirements may be satisfied with any combination of approved 5000- and 6000-level classes.

Examples of a career focus include, but are not limited to, the following:

- Business Intelligence and Analytics
- Database Analysis/Administration/Architecture
- Information Security
- Mobile Computing
- System/Enterprise Architecture
- Software Development/Software Engineering.

Specific courses related to a career focus are designated by the computing program. The final course selections are determined on an individual basis with approval by an adviser. Consult the program website (http://www.marquette.edu/mscs/grad-computing.shtml) for a list of the currently approved courses.
Additional Course Work

Courses beyond the breadth and career focus requirements are taken from a list of computer science, information technology and computer engineering courses approved by the computing program. Six out-of-program elective credits may be selected from other Marquette graduate courses germane to computing or its applications.

Plan B Option (36 or 42 Credits)

Students admitted to the computing career change specialization must complete a total of 42 credit hours, which must include MSCS 6500 Foundations of Computing and 35 additional credit hours. The program of study includes individualized combinations of 12 credit hours for a primary career focus and 6 credit hours for a secondary career focus. At least 25 credit hours must be taken at the 6000 level.

All other students in Plan B must complete a total of 36 credit hours of course work. The program of study includes individualized combinations of 12 credit hours for a primary career focus and 6 credit hours for a secondary career focus. At least 18 credit hours must be taken at the 6000 level.

For all students, courses beyond the career focus and breadth requirements are taken from a list of computer science, information technology and computer engineering courses approved by the computing program.

Integrated Practicum

Within Plan B, the integrated practicum provides a unique opportunity for professional development. Students must indicate a desire to participate in the integrated practicum on their application to the program. Students must satisfy the requirements for a primary career focus as well as the breadth requirement. The primary career focus must be related to their work assignments. The practicum can serve as the 6 credit secondary career focus.

In the integrated practicum, practical assignments in a working enterprise enhance the “learn from doing” opportunity beyond the typical assigned exercises, case studies, and student projects. The student adviser works with a participating employer and the student to ensure a tight integration between course work and work assignments. Together they pair work assignments and courses to provide the simultaneous acquisition of foundational knowledge, professional skills, and professional experience. The integration of course work and experience begins in the first semester of the program and must continue through graduation.

The integrated practicum curriculum path meets the 36 credit requirement of Plan B through a minimum of 24 credits of course work (of which at least 12 credits must be at the 6000-level), students may choose 6 credits in the MSCS 6390 Professional Seminar in Computing, and 6 credits in MSCS 6965 Curriculum Integrated Practicum in Computing. Each 300-350 hours of integrated work experience earn one practicum credit. During the final practicum session, students will earn an additional practicum credit for a comprehensive paper demonstrating their competency in their primary career focus through accomplishments in their work assignments.

Additional considerations include:

- The student must maintain full-time graduate student status every term with the exception of the final term.
- Participation in this option is subject to the availability of open positions and the qualifications of the student.
- The student must apply to the master of science program in computing and inform the director of the program or their adviser of the intention to participate in the integrated practicum.
- The student must apply to the participating employer and meet all of the requirements for an academically qualified position.
- If for any reason continuing work assignments are not available, the student can complete the degree program under Plan B’s non-thesis course work option.

Plan A Option (30 credits)

Students must supply an approved thesis outline to enter Plan A, the thesis option, which requires a total of 30 credits.

In Plan A, students must complete 24 credit hours of course work, of which at least 12 hours must be earned in graduate-level courses (6000-level and above). Students must also complete a master's thesis (MSCS 6999 Master’s Thesis) for 6 credit hours and pass the oral examination concentrated on the thesis. The student must select a primary career focus, which is typically related to their thesis topic and meets the breadth requirement of the program. The six thesis credits are considered the secondary career focus.

Courses beyond the career focus, thesis and breadth requirements are taken from a list of computer science, information technology and computer engineering courses approved by the computing program. Six out-of-program elective credits may be selected from other Marquette graduate courses germane to computing or its applications.

Specializations

The master of science program in computing offers three specializations: information assurance and cyber defense, big data and data analytics and the computing career change opportunity. The 18 credit hours in the first two of these specializations fulfill the requirements for both the primary and the secondary career focus. In the computing career change opportunity specialization, students must work with their adviser to select a primary and secondary career focus.
Information Assurance and Cyber Defense

In addition to required course work, this specialization requires practical experience. The practicum options in the master of science program in computing provide 6 credit hours for the practical application of course work. With permission from the director of the graduate studies for the program, the student may substitute a professional project.

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<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credit Hours</th>
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<tbody>
<tr>
<td>MSCS 6550</td>
<td>Introduction to Cybersecurity</td>
<td>3</td>
</tr>
<tr>
<td>MSCS 6560</td>
<td>Principles of Service Management and System Administration</td>
<td>3</td>
</tr>
<tr>
<td>MSCS 5300</td>
<td>Networks and Internets</td>
<td>3</td>
</tr>
<tr>
<td>MSCS 6964</td>
<td>Practicum for Research and Development in Computing (With consent, MSCS 6998 Professional Project may be substituted.)</td>
<td>6</td>
</tr>
<tr>
<td>or MSCS 6965</td>
<td>Curriculum Integrated Practicum in Computing</td>
<td></td>
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<tr>
<td>Elective (Choose one)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MSCS 5360</td>
<td>Computer Security</td>
<td>3</td>
</tr>
<tr>
<td>MSCS 5800</td>
<td>Principles of Database Systems</td>
<td></td>
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<tr>
<td>MSCS 6355</td>
<td>Mobile Computing</td>
<td></td>
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<tr>
<td>MSCS 6380</td>
<td>Advanced Database Systems</td>
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<tr>
<td><strong>Total Credit Hours</strong></td>
<td><strong>18</strong></td>
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Big Data and Data Analytics

This specialization features course work related to trends in data management, parallelism, and data analysis techniques used for business applications.

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<th>Credit Hours</th>
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<tbody>
<tr>
<td>MSCS 6510</td>
<td>Business Intelligence</td>
<td>3</td>
</tr>
<tr>
<td>MSCS 6520</td>
<td>Data Analytics</td>
<td>3</td>
</tr>
<tr>
<td>MSCS 6060</td>
<td>Parallel and Distributed Systems</td>
<td>3</td>
</tr>
<tr>
<td>MSCS 6380</td>
<td>Advanced Database Systems (or 6000-level class with a focus on databases or data warehouses such as MSCS 6530)</td>
<td>3</td>
</tr>
<tr>
<td>Elective-Graduate course emphasizing the application of data collection and analysis in a discipline outside of computing (requires consent of adviser)</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>MSCS 5610</td>
<td>Data Mining (or 6000-level graduate statistics course)</td>
<td>3</td>
</tr>
<tr>
<td><strong>Total Credit Hours</strong></td>
<td><strong>18</strong></td>
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Computing Career Change Opportunity

The computing career change opportunity specialization is a workforce development initiative designed to move students from an underemployed status into a STEM career in computing. It supports a career change for students who do not have the prerequisite knowledge and skills in programming, data structures and algorithms. The specialization requires successful completion of foundations course MSCS 6500 Foundations of Computing, supplying the computing program prerequisites in a 40 hour/week boot-camp-like environment. Students must then work with their adviser to select a primary and secondary career focus. Courses beyond the career focus, thesis and breadth requirements are taken from a list of computer science, information technology and computer engineering courses approved by the computing program.

Accelerated Bachelor’s–Master’s Degree Program

The Department of Mathematics, Statistics and Computer Science offers an accelerated degree program where eligible students may obtain both a bachelor’s degree and the professional master of science degree in computing 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 GPA of at least 3.000 and the following course work: two terms of courses in programming; one course on data structures and algorithms.

Upon completion of the undergraduate degree, the ADP student must satisfy all of the requirements for the master of science degree in computing and complete additional required graduate courses. 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 a computing career. After completing the undergraduate program, there are three terms of graduate study. In these three terms, the student receives an additional 24 graduate credits, resulting in a total of 36 graduate credits.