The Computer Science graduate program prepares students for research and professional practice in computer science and related technologies. The program includes both fundamentals and advanced work in the areas of artificial intelligence and databases, programming languages and software engineering, systems and networks, theoretical computer science, and visual computing. Graduate classes are divided into basic classes, which have no graduate course prerequisite, and advanced classes, which have a graduate class as a prerequisite. Graduate classes are generally offered in the late afternoon and evening. Financial aid in the form of graduate assistantships may be available for full-time degree-seeking students.

Admissions & Policies

Admissions

In addition to fulfilling Mason's admission requirements for graduate study, applicants must meet the following requirements:

- Hold a baccalaureate degree that includes:
  - Data Structures and Algorithms (CS 310 Data Structures)
  - Automata Theory and Formal Languages (CS 330 Formal Methods and Models)
  - Computer Architecture including Assembly Language (CS 367 Computer Systems and Programming)
  - Calculus I and II
  - A substantial course in discrete mathematics such as MATH 125 Discrete Mathematics I (Mason Core) (http://catalog.gmu.edu/mason-core/)

- Earned a cumulative GPA of 3.00 or higher for the last two years of undergraduate work, preferably with a major in a technical field such as computer science, mathematics, physical sciences, engineering, or information systems.

- Submit transcripts of all post secondary education, complete the online application, including a goals statement, resume, and two letters of recommendation.

- A valid GRE score is required for those who have not earned a Bachelor's degree or higher from a US institution.

- English Proficiency Exam Score (https://www2.gmu.edu/admissions-aid/how-apply/graduate/standardized-test-information/), if applicable.

Requirements

(Banner code updated on July 12, 2021. Formerly: VS-MS-CS)

Degree Requirements

Total credits: 30

Required Courses and Plan of Study

In addition to general university requirements, completion of the MS in CS requires 30 credits of graduate courses.

To ensure that students have uniform preparation for the core courses, all students are required to take CS 530 Mathematical Foundations of Computer Science and CS 531 Computer Systems and Fundamentals of Systems Programming as their first two courses in the program. Students with a strong academic background in computer science may have CS 530 and CS 531 substituted for other elective courses at the discretion of the program director. Students enrolled in PhD CS or the Bachelor's/Accelerated Master's program cannot take these courses for credit. Students also have the opportunity to indicate that they have the requisite knowledge corresponding to CS 530 and CS 531 by passing an exam. The exams are given before classes begin in January and August, and can only be taken once. Students failing either one of the exams must take the equivalent course in their first semester. Students who successfully test out of CS 530 or CS 531 will be required to fulfill the credit requirement with other coursework chosen under advisement.

Courses are grouped in the following five broad areas: Artificial Intelligence and Databases, Programming Languages and Software Engineering, Systems and Networks, Theoretical Computer Science, and Visual Computing. The list of pre-approved courses with their areas follows.

All the following requirements should be satisfied for the MS in CS degree:

- CS 583 Analysis of Algorithms (from the Theoretical Computer Science area) and two additional core courses from two other areas must be successfully completed with a grade of B- or higher. Students receiving lower than a B- must retake the course or face termination.
- At least four courses (12 credits) must be chosen from the advanced courses in the list of pre-approved courses from at least two different areas.
- At least six courses, including two advanced courses, must be designated CS.
- At least eight courses must be taken from the list of pre-approved courses. Up to two computer science-related courses that are not on the list of pre-approved courses may be taken with prior approval of the program director.

Plan of Study

Before the end of the first semester, students must have a plan of study approved by their academic advisor. This plan should be kept up to date by regular consultation with the academic advisor.

Core Courses by Area

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<tr>
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<td>CS 580</td>
<td>Introduction to Artificial Intelligence</td>
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</tr>
<tr>
<td>CS 584</td>
<td>Theory and Applications of Data Mining</td>
<td></td>
</tr>
</tbody>
</table>
Programming Languages and Software Engineering
CS 540  Language Processors
SWE 619  Object-Oriented Software Specification and Construction
SWE 621  Software Design and Architecture

Systems and Networks
CS 555  Computer Communications and Networking
CS 571  Operating Systems
ISA 562  Information Security Theory and Practice

Theoretical Computer Science
CS 583  Analysis of Algorithms 1

Visual Computing
CS 551  Computer Graphics

1 Must be successfully completed with a grade of B- or better

Preapproved Basic and Advanced MS CS Courses by Area

Artificial Intelligence and Databases

Basic Courses:
CS 550  Database Systems
CS 580  Introduction to Artificial Intelligence
CS 584  Theory and Applications of Data Mining
INFS 623  Web Search Engines and Recommender Systems

Advanced Courses:
CS 595  Basic Topics in Computer Science
CS 650  Advanced Database Management
CS 657  Mining Massive Datasets with MapReduce
CS 667  Biometrics and Identity Management
CS 681  Instructable Cognitive Agents
CS 685  Autonomous Robotics
CS 687  Advanced Artificial Intelligence
CS 688  Machine Learning
CS 689  Planning Motions of Robots and Molecules
CS 747  Deep Learning
CS 782  Advanced Machine Learning
CS 787  Decision Guidance Systems
INFS 740  Database Programming for the World Wide Web
INFS 760  Advanced Database Management
INFS 772  Intelligent Agents and the Semantic Web
INFS 774  Enterprise Architecture

Programming Languages and Software Engineering

Basic Courses:
CS 540  Language Processors
SWE 619  Object-Oriented Software Specification and Construction
SWE 620  Software Requirements Analysis and Specification
SWE 621  Software Design and Architecture
SWE 622  Distributed Software Engineering

Advanced Courses:
CS 640  Advanced Compilers
ISA 681  Secure Software Design and Programming
SWE 631  Software Design Patterns
SWE 632  User Interface Design and Development
SWE 637  Software Testing
SWE 642  Software Engineering for the World Wide Web
SWE 645  Component-Based Software Development
SWE 721  Reusable Software Architectures
SWE 737  Advanced Software Testing
SWE 760  Software Analysis and Design of Real-Time Systems

Systems and Networks

Basic Courses:
CS 531  Computer Systems and Fundamentals of Systems Programming
CS 555  Computer Communications and Networking
CS 571  Operating Systems
CS 587  Introduction to Cryptography
ISA 562  Information Security Theory and Practice
ISA 564  Security Laboratory

Advanced Courses:
CS 635  Foundations of Parallel Computation
CS 655  Wireless and Mobile Computing
CS 658  Networked Virtual Environments
CS 672  Computer System Performance Evaluation
CS 673  Multimedia Computing and Systems
CS 675  Distributed Systems
CS 706  Concurrent Software Systems
CS 719  Scalable Internet Services
CS 756  Performance Analysis of Computer Networks
CS 773  Real-Time Systems Design and Development
CS 779  Topics in Resilient and Secure Computer Systems
CS 788  Autonomic Computing
ISA 656  Network Security
ISA 673  Operating Systems Security
ISA 674  Intrusion Detection
ISA 697  Topics in Information Security
ISA 763  Security Protocol Analysis
ISA 764  Security Experimentation
ISA 785  Research in Digital Forensics

Theoretical Computer Science

Basic Courses:
CS 530  Mathematical Foundations of Computer Science
Advanced Courses:

- CS 600 Theory of Computation
- CS 630 Advanced Algorithms
- CS 633 Computational Geometry
- CS 683 Parallel Algorithms
- CS 684 Graph Algorithms

Visual Computing

Basic Courses:

- CS 551 Computer Graphics

Advanced Courses:

- CS 662 Computer Graphics Game Technologies
- CS 663 Computational Design
- CS 667 Biometrics and Identity Management
- CS 682 Computer Vision
- CS 686 Image Processing and Applications
- CS 752 Interactive Graphics Software
- CS 774 Computational Vision
- CS 777 Human-Computer Intelligent Interaction

Project or Thesis

Three to six credit hours of the advanced classes may be replaced by a project or thesis with consent of a faculty sponsor and faculty advisor. The project or thesis must be guided and approved by a committee of three appropriate faculty members and presented at an appropriate forum. The thesis must meet relevant university requirements.

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>CS 798</td>
<td>Project Seminar (3 credits)</td>
<td></td>
</tr>
<tr>
<td>CS 799</td>
<td>Thesis (6 credits)</td>
<td></td>
</tr>
</tbody>
</table>

Additional Pre-approved CS Courses

These courses are not classified by area. Note that CS 695 Topics in Computer Science/CS 795 Advanced Topics in CS can be used to satisfy the breadth requirement if the area is listed in the syllabus for the course.

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>CS 595</td>
<td>Basic Topics in Computer Science</td>
<td>3</td>
</tr>
<tr>
<td>CS 695</td>
<td>Topics in Computer Science</td>
<td>3</td>
</tr>
<tr>
<td>CS 697</td>
<td>Independent Reading and Research</td>
<td>1-3</td>
</tr>
<tr>
<td>CS 795</td>
<td>Advanced Topics in CS</td>
<td>3</td>
</tr>
<tr>
<td>CS 798</td>
<td>Project Seminar</td>
<td>3</td>
</tr>
<tr>
<td>CS 799</td>
<td>Thesis</td>
<td>1-6</td>
</tr>
<tr>
<td>CS 895</td>
<td>Research Topics in CS</td>
<td>3</td>
</tr>
</tbody>
</table>

Concentration in Cyber Security (CYSC)

In addition to the existing program requirements, MS CS degree students must satisfy the following requirements.

Students must take 5 courses from the following categories:

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ISA 656</td>
<td>Network Security</td>
<td>3</td>
</tr>
<tr>
<td>ISA 562</td>
<td>Information Security Theory and Practice</td>
<td>3</td>
</tr>
</tbody>
</table>

Choose 2-3 elective courses:

- CS 587 Introduction to Cryptography
- ISA 564 Security Laboratory
- ISA 673 Operating Systems Security
- ISA 674 Intrusion Detection
- ISA 681 Secure Software Design and Programming
- ISA 763 Security Protocol Analysis
- ISA 764 Security Experimentation

Choose 0-1 related course:

- CS 540 Language Processors
- CS 555 Computer Communications and Networking
- CS 571 Operating Systems
- CS 600 Theory of Computation
- CS 655 Wireless and Mobile Computing

Thesis:

Students, with the consent of a faculty sponsor and faculty advisor, may also elect a 6-credit thesis (CS 799 Thesis). The thesis must be guided and approved by a committee of three appropriate faculty members and presented at an appropriate forum. If the faculty advisor and the program director agree that the thesis is appropriate for the concentration the students will need to complete the two courses from the category 1 and one course from the category 2 in addition to the thesis to complete the Concentration requirements.

Concentration in Machine Learning (ML)

In addition to the existing program requirements, MS CS degree students must satisfy the following requirements.

Students must take 5 courses from the following categories:

<table>
<thead>
<tr>
<th>Code</th>
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<tbody>
<tr>
<td>CS 584</td>
<td>Theory and Applications of Data Mining</td>
<td>3</td>
</tr>
<tr>
<td>CS 688</td>
<td>Machine Learning</td>
<td>3</td>
</tr>
</tbody>
</table>

Choose 2-3 elective courses:

- CS 657 Mining Massive Datasets with MapReduce
- CS 681 Instructable Cognitive Agents
- CS 747 Deep Learning
- CS 782 Advanced Machine Learning

Choose 0-1 related course:

- CS 580 Introduction to Artificial Intelligence
- CS 687 Advanced Artificial Intelligence
- CS 685 Autonomous Robotics
- CS 682 Computer Vision

Thesis (optional):

Students, with the consent of a faculty sponsor and faculty advisor, may also elect a 6-credit thesis (CS 799 Thesis). The thesis must be guided and approved by a committee of three faculty members and presented to the committee. If the faculty advisor and the program director agree that the thesis is appropriate for the concentration the student will need to complete the two courses from category 1 and one course from category 2 in addition to the thesis to complete the concentration requirements.
Accelerated Master's

Applied Computer Science, BS/Computer Science, Accelerated MS

Overview

Highly-qualified students in the Applied Computer Science, BS (http://catalog.gmu.edu/colleges-schools/engineering/computer-science/applied-computer-science-bs/) can complete both a BS-ACS and a Computer Science, MS in five years through the BS-CS accelerated (BAM) program.

General BAM policies are in the catalog under AP.6 Bachelor’s/Accelerated Master’s Degrees (http://catalog.gmu.edu/policies/academic/graduate-policies/#ap-6-7). Policies governing all graduate degrees are in the catalog under AP.6 Graduate Policies (http://catalog.gmu.edu/policies/academic/graduate-policies/).

Admission Requirements

Students in the Applied Computer Science, BS (http://catalog.gmu.edu/colleges-schools/engineering/computer-science/applied-computer-science-bs/) program are encouraged to apply to the BAM program after earning 60 undergraduate credits with an overall GPA of at least 3.30. Students must have successfully completed CS 310 Data Structures and CS 330 Formal Methods and Models.

Accelerated Option Requirements

Students accepted to the BAM program may earn up to 12 credits of graduate coursework that count towards both the BS and MS degrees. They may begin taking graduate courses after completing 75 undergraduate credits and successfully completing CS 367 Computer Systems and Programming.

The following graduate courses can replace the corresponding undergraduate courses.

<table>
<thead>
<tr>
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<td>Language Processors (to replace CS 440)</td>
<td>3</td>
</tr>
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<td>Database Systems (to replace CS 450)</td>
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<td>CS 551</td>
<td>Computer Graphics (to replace CS 451)</td>
<td>3</td>
</tr>
<tr>
<td>CS 555</td>
<td>Computer Communications and Networking (to replace CS 455)</td>
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</tr>
<tr>
<td>CS 571</td>
<td>Operating Systems (to replace CS 471)</td>
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</tr>
<tr>
<td>CS 580</td>
<td>Introduction to Artificial Intelligence (to replace CS 480)</td>
<td>3</td>
</tr>
<tr>
<td>CS 584</td>
<td>Theory and Applications of Data Mining (to replace CS 484)</td>
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<tr>
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<td>Analysis of Algorithms (to replace CS 483)</td>
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<td>Software Engineering for the World Wide Web (to replace SWE 432)</td>
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Notes:

- Students may not use both the graduate course and the undergraduate alternative for their BS degree.
- Students must satisfy all recommended and required prerequisites for the graduate courses they take.
- Students also have the option to take up to 6 additional credits of graduate coursework on reserve, which can be used for the MS degree only.

Degree Conferral

Students must apply for degree conferral the semester before they expect to complete their BS requirements. At the beginning of their final undergraduate semester, students must submit a completed Bachelor’s-Accelerated Master’s Transition form to the CS department office. The master’s degree will be conferred after the student completes the MS requirements.

Computer Science, BS/Computer Science, Accelerated MS

Overview

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