

# APPLIED COMPUTER SCIENCE, BS

**Banner Code:** VS-BS-ACS

## Academic Advising

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This program presents an innovative approach to the integration of computer science with other disciplines that require expertise in computing techniques. These disciplines do not merely use computing but create new and interesting problems for computer scientists.

## Admissions & Policies

### Policies

#### Advanced Placement, Credit by Exam

A score of 4 on the Advanced Placement (AP) computer science exam qualifies students for credit in CS 112 Introduction to Computer Programming (Mason Core). A score of 4 on the International Baccalaureate (IB) computer science exam qualifies students for credits in CS 112 Introduction to Computer Programming (Mason Core), and a score of 5 or more qualifies students for credit in CS 211 Object-Oriented Programming.

#### Change of Major

Students requesting a change of major to Applied Computer Science must meet with the Volgenau School of Engineering Coordinator of Undergraduate Advising, 2500 Nguyen Engineering Building. Students requesting a change of major to Applied Computer Science must have a GPA of at least 2.75 in computer science and math courses and successfully completed one of CS 112 or CS 211, and one of MATH 113,

MATH 114, or MATH 125, with a grade of B or better at Mason. See Change of Major for more information.

#### Grades

Students must earn a C or better in any course intended to satisfy a prerequisite for a computer science course. Applied Computer Science majors may not use more than one course with a grade of C- or D toward department requirements.

#### Program Requirements

For the BS ACS degree, students must complete 120 credits, including the Mason Core requirements. The program requires foundation, core, and concentration courses. These course requirements provide expertise in programming, computer systems, software requirements and modeling, formal methods, and analysis of algorithms.

#### Repeating Courses

Students may attempt an undergraduate course taught by the Volgenau School of Engineering twice. A third attempt requires approval of the department offering the course. This policy does not apply to STAT 250 Introductory Statistics I (Mason Core), which follows the normal university policy for repeating undergraduate courses.

The CS Department may not allow students to retake certain high-demand CS courses in which they have already earned a grade of C or better simply to improve their GPA.

#### Termination from the Major

No math, science, or Volgenau School of Engineering course that is required for the major may be attempted more than three times. Those students who do not successfully complete such a course within three attempts will be terminated from the major. Undeclared students in the Volgenau School who do not successfully complete a course required for a Volgenau School major within three attempts will also be terminated. For more information, see AP.5.2.4 Termination from the Major.

Once a student has attempted one of these courses twice unsuccessfully, the third attempt must be no later than the next semester of enrollment, excluding summers. Failure to take the course at that time will result in termination from the major. If the student is unable to take the course when required, the student may request an extension to a future semester; extensions require approval of the student's advisor, their department, and the Associate Dean for Undergraduate Programs. The deadline for extension requests is the add deadline for the semester in which the course is required.

Students who have been terminated from a Volgenau School of Engineering major may not register for a Volgenau School course without permission of the department offering the course. This applies to all undergraduate courses offered by the Volgenau School except IT 104 Introduction to Computing (Mason Core) and STAT 250 Introductory Statistics I (Mason Core).

A student may not declare any major in the Volgenau School of Engineering if the student has previously met the termination criteria for that major at any time, regardless of what the student's major was at the time the courses were taken.

#### Writing-Intensive Requirement

Computer science majors complete the writing-intensive requirement through a sequence of projects and reports in CS 306 Synthesis of Ethics and Law for the Computing Professional (Mason Core) and CS 321 Software Engineering. Faculty members provide feedback on students' expository writing.

## Requirements

### Degree Requirements

Total credits: 120

Students must complete all foundation, core, elective, and communication requirements, and the requirements from one selected concentration.

#### Foundation

CS 110	Essentials of Computer Science <sup>1</sup>	3
CS 112	Introduction to Computer Programming (Mason Core)	4
CS 211	Object-Oriented Programming	3
MATH 113	Analytic Geometry and Calculus I (Mason Core)	4

MATH 114	Analytic Geometry and Calculus II	4
MATH 125	Discrete Mathematics I (Mason Core)	3
MATH 203	Linear Algebra	3
Total Credits		24

<sup>1</sup> Must be taken within a student's first year at the university.

### Note:

MATH 104 Trigonometry and Transcendental Functions, MATH 105 Precalculus Mathematics, MATH 108 Introductory Calculus with Business Applications (Mason Core), and courses with an IT designation (and any associated cross-listed courses) cannot be counted toward this degree.

### Core

CS 262	Introduction to Low-Level Programming	3
CS 310	Data Structures	3
CS 321	Software Engineering	3
CS 330	Formal Methods and Models	3
CS 367	Computer Systems and Programming	4
CS 471	Operating Systems	3
CS 483	Analysis of Algorithms	3
Total Credits		22

### Elective

Select one CS course numbered above 400, except CS 498	3
Total Credits	3

### Communication

COMM 100	Public Speaking (Mason Core)	3
Total Credits		3

### Concentration in Bioinformatics (BNF)

#### Foundation

PHYS 160	University Physics I (Mason Core)	3
PHYS 161	University Physics I Laboratory (Mason Core)	1
CHEM 201	Introductory Chemistry I (Mason Core)	3
BIOL 213	Cell Structure and Function (Mason Core)	4
CS 306	Synthesis of Ethics and Law for the Computing Professional (Mason Core) <sup>1</sup>	3
STAT 344	Probability and Statistics for Engineers and Scientists I	3
Total Credits		17

<sup>1</sup> Requires a grade of C or better to satisfy the Mason Core synthesis requirement.

#### Core

BINF 450	Bioinformatics for Life Sciences	4
BIOL 482	Introduction to Molecular Genetics	3
BIOL 580	Computer Applications for the Life Sciences	3
CS 450	Database Concepts	3
BINF 401	Bioinformatics and Computational Biology I	3

or CS 444	Introduction to Computational Biology	
BINF 402	Bioinformatics and Computational Biology II	3
or CS 445	Computational Methods for Genomics	

Total Credits 19

### Two Approved Electives Related to Bioinformatics

Select two approved electives (6 credits) related to bioinformatics with the student's advisor and approved by the CS department

Total Credits 6

### Additional Mason Core

Written Communication <sup>1</sup>	6
Literature	3
Arts	3
Western Civilization/World History	3
Social and Behavioral Sciences	3
Global Understanding	3
Total Credits	21

<sup>1</sup> Applied Computer Science majors must take the Natural Sciences section of ENGH 302 Advanced Composition (Mason Core).

### Electives

Select 5 credits of electives	5
Total Credits	5

### Concentration in Computer Game Design (CGDS)

#### Foundation

GAME 230	History of Computer Game Design	3
CS 306	Synthesis of Ethics and Law for the Computing Professional (Mason Core) <sup>1</sup>	3
CS 325	Introduction to Game Design	3
CS 351	Visual Computing	3
AVT 104	Two-Dimensional Design and Color (Mason Core)	4
STAT 344	Probability and Statistics for Engineers and Scientists I	3
Total Credits		19

<sup>1</sup> Requires a grade of C or better to satisfy the Mason Core synthesis requirement.

#### Core

CS 425	Game Programming I	3
CS 426	Game Programming II	3
CS 451	Computer Graphics	3
AVT 382	2D Experimental Animation	3
AVT 383	3D Experimental Animation	3
Total Credits		15

### Approved Elective Related to Game Design

Select one course from the following: 3

CS 332	Object-Oriented Software Design and Implementation	
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CS 455	Computer Communications and Networking	
CS 475	Concurrent and Distributed Systems	
CS 480	Introduction to Artificial Intelligence	
CS 485	Autonomous Robotics	
SWE 432	Design and Implementation of Software for the Web	
GAME 332	RS: Story Design for Computer Games	
AVT 370	Entrepreneurship in the Arts	
AVT 374	Sound Art I	
AVT 487	Advanced Topics: New Media Art	
Total Credits		3

### Natural Science

PHYS 160	University Physics I (Mason Core)	3
PHYS 161	University Physics I Laboratory (Mason Core)	1
Select one additional lab science		4
Total Credits		8

### Additional Mason Core

Written Communication <sup>1</sup>		6
Literature		3
Western Civilization/World History		3
Social and Behavioral Sciences		3
Global Understanding		3
Total Credits		18

<sup>1</sup> Applied Computer Science majors must take the Natural Sciences section of ENGH 302 Advanced Composition (Mason Core).

### Electives

Select 5 credits of electives		5
Total Credits		5

### Concentration in Geography (GEOG)

#### Foundation

CS 306	Synthesis of Ethics and Law for the Computing Professional (Mason Core) <sup>1</sup>	3
GGG 101	Major World Regions (Mason Core)	3
GGG 102	Physical Geography (Mason Core)	3
GGG 103	Human Geography (Mason Core)	3
GGG 110	Introduction to Geoinformation Technologies	3
GGG 300	Quantitative Methods for Geographical Analysis	3
STAT 344	Probability and Statistics for Engineers and Scientists I	3
Total Credits		21

<sup>1</sup> Requires a grade of C or better to satisfy the Mason Core synthesis requirement.

### Core

GGG 310	Introduction to Digital Cartography	4
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GGG 311	Introduction to Geographic Information Systems	3
GGG 411	Advanced Digital Cartography	3
GGG 412	Air Photography Interpretation	3
GGG 416	Satellite Image Analysis	3
GGG 463	Applied Geographic Information Systems	3
One GGS course numbered above 300		3
Total Credits		22

### Additional Mason Core

Written Communication <sup>1</sup>		6
Literature		3
Arts		3
Western Civilization/World History		3
Lab Science		4
Total Credits		19

<sup>1</sup> Applied Computer Science majors must take the Natural Sciences section of ENGH 302 Advanced Composition (Mason Core).

### Electives

Select 6 credits of electives		6
Total Credits		6

### Concentration in Software Engineering (SWE)

#### Foundation

STAT 344	Probability and Statistics for Engineers and Scientists I	3
CS 306	Synthesis of Ethics and Law for the Computing Professional (Mason Core) <sup>1</sup>	3
Total Credits		6

<sup>1</sup> Requires a grade of C or better to satisfy the Mason Core synthesis requirement.

### Core

SWE 205	Software Usability Analysis and Design	3
SWE 301	Internship Preparation	0
SWE 401	Internship Reflection	1
CS 332	Object-Oriented Software Design and Implementation	3
SWE 437	Software Testing and Maintenance	3
Total Credits		10

### SWE Related

Select 15 credits from the following:		15
CS 450	Database Concepts	
CS 455	Computer Communications and Networking	
CS 463	Comparative Programming Languages	
CS 465	Computer Systems Architecture	
CS 468	Secure Programming and Systems	
CS 475	Concurrent and Distributed Systems	
CS 491	Industry-Sponsored Senior Design Project	
SWE 432	Design and Implementation of Software for the Web	

SWE 443	Software Architectures	
Total Credits		15

**Cross-Disciplinary**

ENGH 388	Professional and Technical Writing	3
Select one from the following:		3
PSYC 333	Industrial and Organizational Psychology	
COMM 320	Business and Professional Communication	
COMM 335	Organizational Communication	
Total Credits		6

**Additional Mason Core**

Written Communication <sup>1</sup>		6
Literature		3
Arts		3
Western Civilization/World History		3
Social and Behavioral Sciences		3
Global Understanding		3
Natural Science		7
Total Credits		28

<sup>1</sup> Applied Computer Science majors must take the Natural Sciences section of ENGH 302 Advanced Composition (Mason Core).

**Electives**

Select 3 credits of electives		3
Total Credits		3

**Honors****CS Honors Program**

The Department of Computer Science offers a CS Honors Program for students with strong computational foundations and the drive to delve deeper into computing. The program is based on the bachelor of science in computer science and applied computer science curriculum and is distinct from the University Honors College curriculum.

**Entry Requirements**

Students must be seeking a Bachelor of Science in Computer Science or a Bachelor of Science in Applied Computer Science and must apply for entry into the CS Honors Program after completing 12 credits of CS courses. Applicants must meet the GPA requirements outlined below to enter into the CS Honors Program.

**Honors Requirements**

CS Honors Program students must fulfill all standard courses required by the Bachelor of Science in Computer Science or Applied Computer Science degree as well as the following additional requirements:

- GPA Requirement: Students must maintain an overall GPA of at least 3.50 and a GPA of at least 3.50 for courses which count towards the BS/CS or BS/ACS major including math, natural sciences, and all CS/SWE courses.
- Research Project Requirement: Students must complete a significant research project prior to graduation. Students should seek out a CS faculty member willing to serve as their research advisor for the

project. The project should comprise original work by the student and be demonstrated via two channels:

- a written project report that is approved by the student's research advisor and submitted to the department;
- a presentation of the project to an audience of students and/or faculty.

- Advanced Course Requirement: At least two Advanced Courses must be completed. A complete list of acceptable advanced courses is maintained by the CS department and is available on the department web site.

**Accelerated Master's****Applied Computer Science, BS/Computer Science, Accelerated MS****Overview**

Highly-qualified students in the Applied Computer Science, BS have the option of obtaining an accelerated Computer Science, MS.

For more detailed information, see AP.6.7 Bachelor's/Accelerated Master's Degrees. For policies governing all graduate degrees, see AP.6 Graduate Policies.

**Admission Requirements**

Students in the Applied Computer Science, BS program may apply to this option if they have earned 90 undergraduate credits with an overall GPA of at least 3.30. Students must have successfully completed:

Code	Title	Credits
CS 310	Data Structures	3
CS 330	Formal Methods and Models	3
CS 367	Computer Systems and Programming	4
Total Credits		10

**Accelerated Option Requirements**

Students must complete all requirements for the BS and MS programs, with 6 credits overlap.

Students register for 6 credits of CS 500-level basic courses in place of the corresponding CS 400-level courses required for the undergraduate degree requirements. Specifically, students must register for CS 583 Analysis of Algorithms and one of the following courses in place of the corresponding 400-level course:

Code	Title	Credits
CS 540	Language Processors	3
CS 550	Database Systems	3
CS 551	Computer Graphics	3
CS 555	Computer Communications and Networking	3
CS 571	Operating Systems	3
CS 580	Introduction to Artificial Intelligence	3
CS 584	Theory and Applications of Data Mining	3

Note:

Students are permitted to take additional graduate basic courses in their undergraduate programs. In such cases, those classes cannot be counted toward requirements for the MS.

## Degree Conferral

Students must apply the semester before they expect to complete the BS requirements to have the BS degree conferred. In addition, at the beginning of the student's final undergraduate semester, students must complete a Bachelor's/Accelerated Master's Transition form that is submitted to the Office of the University Registrar and the VSE Graduate Admissions Office. At the completion of MS requirements, a master's degree is conferred.

## Applied Computer Science, BS/Data Analytics Engineering, Accelerated MS

### Overview

Highly-qualified students in the Applied Computer Science, BS have the option of obtaining an accelerated Data Analytics Engineering, MS.

For more detailed information, see AP.6.7 Bachelor's/Accelerated Master's Degrees. For policies governing all graduate degrees, see AP.6 Graduate Policies.

### Admission Requirements

Students in the Applied Computer Science, BS program may apply to this option if they have earned 90 undergraduate credits with an overall GPA of at least 3.30. Students must have successfully completed:

Code	Title	Credits
CS 310	Data Structures	3
CS 330	Formal Methods and Models	3
CS 367	Computer Systems and Programming	4
Total Credits		10

### Accelerated Option Requirements

Students must complete all requirements for the BS and MS programs, with 6 credits overlap.

Students must register for 6 credits of CS 500-level basic courses in place of the corresponding CS 400-level courses required for the undergraduate degree requirements. Specifically, students in all concentrations of the Applied Computer Science, BS program must register for:

Code	Title	Credits
CS 584	Theory and Applications of Data Mining	3
Total Credits		3

Students in the Software Engineering and Bioinformatics concentrations of the Applied Computer Science, BS program must also register for:

Code	Title	Credits
CS 550	Database Systems	3
Total Credits		3

Students in the Computer Game Design and Geography concentrations of the Applied Computer Science, BS program must also register for one of the following courses:

Code	Title	Credits
CS 550	Database Systems	3
CS 580	Introduction to Artificial Intelligence	3

Note:

For students in the Computer Game Design and Geography concentrations of the Applied Computer Science, BS program, one of the 500 level courses will count as an elective towards their undergraduate degree.

Students are permitted to take additional graduate basic courses in their undergraduate programs. In such cases, those classes cannot be counted toward requirements for the MS.

## Degree Conferral

Students must apply the semester before they expect to complete the BS requirements to have the BS degree conferred. In addition, at the beginning of the student's final undergraduate semester, students must complete a Bachelor's/Accelerated Master's Transition form that is submitted to the Office of the University Registrar and the VSE Graduate Admissions Office. At the completion of MS requirements, a master's degree is conferred.

## Applied Computer Science, BS/Information Security and Assurance, Accelerated MS

### Overview

Highly-qualified students in the Applied Computer Science, BS program have the option of obtaining an accelerated Information Security and Assurance, MS program.

For more detailed information, see AP.6.7 Bachelor's/Accelerated Master's Degrees. For policies governing all graduate degrees, see AP.6 Graduate Policies.

### Admission Requirements

Students in the Applied Computer Science, BS program can apply for this option if they have earned 90 undergraduate credits with an overall GPA of at least 3.30. Students must have successfully completed:

Code	Title	Credits
CS 310	Data Structures	3
CS 330	Formal Methods and Models	3
CS 367	Computer Systems and Programming	4
Total Credits		10

### Accelerated Option Requirements

Students must complete all requirements for the BS and MS programs, with 6 credits overlapping.

Students register for two 500-level computer science core courses (6 credits) in place of the corresponding 400-level computer science courses, as part of the undergraduate degree requirements. Specifically, students must take

Code	Title	Credits
CS 583	Analysis of Algorithms	3
Select one of the following:		3

CS 540	Language Processors	
CS 550	Database Systems	
CS 551	Computer Graphics	
CS 555	Computer Communications and Networking	
CS 571	Operating Systems	
CS 580	Introduction to Artificial Intelligence	
CS 584	Theory and Applications of Data Mining	
Total Credits		6

Note:

Students complete all MS in Information Security and Assurance core courses and apply the two courses from the above list toward the degree requirements.

### Degree Conferral

Students must apply the semester before they expect to complete the BS requirements to have the BS degree conferred. In addition, at the beginning of the student's final undergraduate semester, students must complete a Bachelor's/Accelerated Master's Transition form that is submitted to the Office of the University Registrar and the VSE Graduate Admissions Office. At the completion of MS requirements, a master's degree is conferred.

## Applied Computer Science, BS/ Information Systems, Accelerated MS Overview

Highly-qualified students in the Applied Computer Science, BS program have the option of obtaining an accelerated Information Systems, MS. See AP.6.7 Bachelor's/Accelerated Master's Degrees.

Students in an accelerated degree program must fulfill all university requirements for the master's degree. For policies governing all graduate degrees, see AP.6 Graduate Policies.

### Admission Requirements

Students in the Applied Computer Science, BS program can apply to this option if they have earned 90 undergraduate credits with an overall GPA of at least 3.30. Students must have successfully completed:

Code	Title	Credits
CS 310	Data Structures	3
CS 330	Formal Methods and Models	3
CS 367	Computer Systems and Programming	4
Total Credits		10

### Accelerated Option Requirements

Students must complete all credits that satisfy requirements for the BS and MS programs, with 6 credits overlap.

Students register for two 500-level computer science core courses (6 credits) in place of the corresponding 400-level computer science courses, as part of the undergraduate degree requirements. Specifically, students must take

Code	Title	Credits
CS 583	Analysis of Algorithms	3

Select one of the following:		3
CS 540	Language Processors	
CS 550	Database Systems	
CS 551	Computer Graphics	
CS 555	Computer Communications and Networking	
CS 571	Operating Systems	
CS 580	Introduction to Artificial Intelligence	
CS 584	Theory and Applications of Data Mining	
Total Credits		6

Note:

Students complete all MS in Information Systems core courses and apply the two courses from above toward the elective requirements.

### Degree Conferral

Students must apply the semester before they expect to complete the BS requirements to have the BS degree conferred. In addition, at the beginning of the student's final undergraduate semester, students must complete a Bachelor's/Accelerated Master's Transition form that is submitted to the Office of the University Registrar and the VSE Graduate Admissions Office. At the completion of MS requirements, a master's degree is conferred.

## Applied Computer Science, BS/Software Engineering, Accelerated MS Overview

Highly-qualified students in the Applied Computer Science, BS have the option of obtaining an accelerated Software Engineering, MS. See AP.6.7 Bachelor's/Accelerated Master's Degrees.

Students in an accelerated degree program must fulfill all university requirements for the master's degree. For policies governing all graduate degrees, see AP.6 Graduate Policies.

### Admission Requirements

Students in the Applied Computer Science, BS program may apply to this option if they have earned 90 undergraduate credits with an overall GPA of at least 3.30. Students must have successfully completed:

Code	Title	Credits
CS 310	Data Structures	3
CS 330	Formal Methods and Models	3
CS 367	Computer Systems and Programming	4
Total Credits		10

### Accelerated Option Requirements

Students must complete all credits that satisfy requirements for the BS and MS programs, with 6 credits overlap.

Students register for two 500-level computer science core courses (6 credits) in place of the corresponding 400-level computer science courses, as part of the undergraduate degree requirements. Specifically, students must take:

Code	Title	Credits
CS 583	Analysis of Algorithms	3

Select one of the following:	3
CS 540	Language Processors
CS 550	Database Systems
CS 551	Computer Graphics
CS 555	Computer Communications and Networking
CS 571	Operating Systems
CS 580	Introduction to Artificial Intelligence
CS 584	Theory and Applications of Data Mining
Total Credits	6

**Note:**

Students complete all Software Engineering, MS core courses and apply the two courses from the above list toward the elective requirements.

**Degree Conferral**

Students must apply the semester before they expect to complete the BS requirements to have the BS degree conferred. In addition, at the beginning of the student's final undergraduate semester, students must complete a Bachelor's/Accelerated Master's Transition form that is submitted to the Office of the University Registrar and the VSE Graduate Admissions Office. At the completion of MS requirements, a master's degree is conferred.