

# COMPUTATIONAL AND DATA SCIENCES, BS

Banner Code: SC-BS-CDS

## Academic Programs Administrator

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Website: [science.gmu.edu/academics/departments-units/computational-data-sciences/computational-and-data-science-bs](http://science.gmu.edu/academics/departments-units/computational-data-sciences/computational-and-data-science-bs)

The aim of this degree is to provide students with technical skills and knowledge for rigorously investigating physical and social phenomena. The BS is a transformative approach that integrates science at George Mason University based on the combination of real-world computer science skills, data acquisition and analysis, scientific modeling, applied mathematics, and simulation. As an interdisciplinary STEM-designated program, this degree addresses the current central role of computation in the areas of "big data," modeling, and simulation. Graduates of the program will possess the computational, scientific, and mathematical skills necessary for participating effectively as members of the scientific simulation and data analysis groups that are of increasing importance in the federal and public sectors, and in high technology firms. Additionally, graduates of the program will be well prepared to pursue graduate studies.

## Admissions & Policies

### Admissions

University-wide admissions policies can be found in the Undergraduate Admissions Policies (<http://catalog.gmu.edu/admissions/undergraduate-policies/>) section of this catalog.

To apply for this program, please complete the George Mason University Admissions Application (<https://www2.gmu.edu/admissions-aid/apply-now/>).

### Policies

Students must fulfill all Requirements for Bachelor's Degrees (<http://catalog.gmu.edu/policies/academic/undergraduate-policies/#ap-5-3-2>), including the Mason Core (<http://catalog.gmu.edu/mason-core/>).

The university's writing intensive requirement for the major will be met upon successful completion of CDS 302 Scientific Data and Databases.

For policies governing all undergraduate programs, see AP5 Undergraduate Policies (<http://catalog.gmu.edu/policies/academic/undergraduate-policies/>).

## Requirements

### Degree Requirements

Total credits: minimum 120

Students should refer to the Admissions & Policies tab for specific policies related to this program.

### Core Required Courses

Code	Title	Credits
CDS 130	Computing for Scientists (Mason Core) ( <a href="http://catalog.gmu.edu/mason-core/">http://catalog.gmu.edu/mason-core/</a> )	3
CDS 151	Data Ethics in an Information Society (Mason Core) ( <a href="http://catalog.gmu.edu/mason-core/">http://catalog.gmu.edu/mason-core/</a> )	1
CDS 230	Modeling and Simulation I	3
CDS 301	Scientific Information and Data Visualization	3
CDS 302	Scientific Data and Databases <sup>1</sup>	3
CDS 303	Scientific Data Mining	3
Total Credits		16

<sup>1</sup>

Fulfills the writing intensive requirement.

### Extended Core Courses

Code	Title	Credits
Select 18 credits from the following:		18
CDS 101 & CDS 102	Introduction to Computational and Data Sciences (Mason Core) ( <a href="http://catalog.gmu.edu/mason-core/">http://catalog.gmu.edu/mason-core/</a> ) and Introduction to Computational and Data Sciences Lab (Mason Core) ( <a href="http://catalog.gmu.edu/mason-core/">http://catalog.gmu.edu/mason-core/</a> )	
CDS 201	Introduction to Computational Social Science	
CDS 205	Introduction to Agent-based Modeling and Simulation	
CDS 251	Introduction to Scientific Programming	
CDS 292	Introduction to Social Network Analysis (Mason Core) ( <a href="http://catalog.gmu.edu/mason-core/">http://catalog.gmu.edu/mason-core/</a> )	
CDS 403	Machine Learning Applications in Science	
CDS 411	Modeling and Simulation II	
CDS 421	Computational Data Science	
CDS 461	Molecular Dynamics and Monte Carlo Simulations	
CDS 468	Image Operators and Processing	
CSI 500	Computational Science Tools	
CSI 501	Introduction to Scientific Programming	
Total Credits		18

### Extended Multidisciplinary Core Courses

Code	Title	Credits
Mathematics		
Select 10-11 credits from the following:		10-11
MATH 113	Analytic Geometry and Calculus I (Mason Core) ( <a href="http://catalog.gmu.edu/mason-core/">http://catalog.gmu.edu/mason-core/</a> )	
MATH 114	Analytic Geometry and Calculus II	

MATH 125	Discrete Mathematics I (Mason Core) ( <a href="http://catalog.gmu.edu/mason-core/">http://catalog.gmu.edu/mason-core/</a> )	
MATH 203	Linear Algebra	
MATH 446	Numerical Analysis I	
<b>Statistics</b>		
Select 6 credits from the following:		6
STAT 250	Introductory Statistics I (Mason Core) ( <a href="http://catalog.gmu.edu/mason-core/">http://catalog.gmu.edu/mason-core/</a> )	
STAT 350	Introductory Statistics II	
STAT 344	Probability and Statistics for Engineers and Scientists I	
STAT 346	Probability for Engineers	
<b>Science or Engineering</b>		
Select 6 credits from the following options:		6
Additional Mason Core: Natural Science or Mason Core: Information Technology courses. ( <a href="http://catalog.gmu.edu/mason-core/#information-technology">http://catalog.gmu.edu/mason-core/#information-technology</a> )		
Any STEM course offered by the College of Science or the College of Engineering and Computing.		
Total Credits		22-23

## Mason Core and Elective Credits

In order to meet a minimum of 120 credits, this degree requires an additional 63-64 credits, which may be applied toward any remaining Mason Core (<http://catalog.gmu.edu/mason-core/>) requirements (outlined below), Requirements for Bachelor's Degrees (<http://catalog.gmu.edu/policies/academic/undergraduate-policies/#ap-5-3-2>), and elective courses. Students are strongly encouraged to consult with their advisors to ensure that they fulfill all requirements.

## Elective Course Suggestions

Code	Title	Credits
Credits of any course listed in the Extended Core that were not applied toward the Extended Core 18-credit requirement.		
CDS 290	Topics in Computational and Data Sciences	1-3
CDS 410 or MATH 447	Numerical Analysis II	3
CDS 486	Advanced Topics in Computational and Data Sciences	3
CDS 490	Directed Study and Research	1-3
CDS 491	Internship	1-3
CDS 492	Capstone in Data Science (Mason Core) ( <a href="http://catalog.gmu.edu/mason-core/">http://catalog.gmu.edu/mason-core/</a> )	3

## Mason Core

Some Mason Core (<http://catalog.gmu.edu/mason-core/>) requirements may already be fulfilled by the major requirements listed above. Students are strongly encouraged to consult their advisors to ensure they fulfill all remaining Mason Core (<http://catalog.gmu.edu/mason-core/>) requirements.

Students who have completed the following credentials are eligible for a waiver of the Foundation and Exploration (lower level) requirement categories. The Integration category (upper level) is not waived under this policy. See Admissions (<http://catalog.gmu.edu/admissions/undergraduate-policies/#transfertext>) for more information.

- VCCS Uniform Certificate of General Studies
- VCCS or Richard Bland Associate of Science (A.S.), Associate of Arts (A.A.), Associate of Arts and Sciences (A.A.&S.), or Associate of Fine Arts (A.F.A.)

Code	Title	Credits
<b>Foundation Requirements</b>		
	Written Communication (ENGH 101) ( <a href="http://catalog.gmu.edu/mason-core/#written">http://catalog.gmu.edu/mason-core/#written</a> )	3
	Oral Communication ( <a href="http://catalog.gmu.edu/mason-core/#oral">http://catalog.gmu.edu/mason-core/#oral</a> )	3
	Quantitative Reasoning ( <a href="http://catalog.gmu.edu/mason-core/#quantitative">http://catalog.gmu.edu/mason-core/#quantitative</a> )	3
	Information Technology and Computing ( <a href="http://catalog.gmu.edu/mason-core/#information-technology">http://catalog.gmu.edu/mason-core/#information-technology</a> )	3
<b>Exploration Requirements</b>		
	Arts ( <a href="http://catalog.gmu.edu/mason-core/#arts">http://catalog.gmu.edu/mason-core/#arts</a> )	3
	Global History ( <a href="http://catalog.gmu.edu/mason-core/#global-history">http://catalog.gmu.edu/mason-core/#global-history</a> )	3
	Global Understanding ( <a href="http://catalog.gmu.edu/mason-core/#global">http://catalog.gmu.edu/mason-core/#global</a> )	3
	Literature ( <a href="http://catalog.gmu.edu/mason-core/#literature">http://catalog.gmu.edu/mason-core/#literature</a> )	3
	Natural Science ( <a href="http://catalog.gmu.edu/mason-core/#natural-science">http://catalog.gmu.edu/mason-core/#natural-science</a> )	7
	Social and Behavioral Sciences ( <a href="http://catalog.gmu.edu/mason-core/#social-behavioral-science">http://catalog.gmu.edu/mason-core/#social-behavioral-science</a> )	3
<b>Integration Requirements</b>		
	Written Communications (ENGH 302) ( <a href="http://catalog.gmu.edu/mason-core/#written">http://catalog.gmu.edu/mason-core/#written</a> )	3
	Writing-Intensive ( <a href="http://catalog.gmu.edu/mason-core/#wi">http://catalog.gmu.edu/mason-core/#wi</a> ) <sup>1</sup>	3
	Synthesis/Capstone ( <a href="http://catalog.gmu.edu/mason-core/#synthesis-capstone">http://catalog.gmu.edu/mason-core/#synthesis-capstone</a> ) <sup>2</sup>	3
Total Credits		40

<sup>1</sup>

Most programs include the writing-intensive course designated for the major as part of the major requirements; this course is therefore not counted towards the total required for Mason Core.

<sup>2</sup>

Minimum 3 credits required.

## Accelerated Master's

## Computational and Data Sciences, BS/ Computational Science, Accelerated MS Overview

This bachelor's/accelerated master's degree program allows academically strong undergraduates with a commitment to advance their education to obtain both the Computational and Data Sciences, BS and the Computational Science, MS (<http://catalog.gmu.edu/colleges-schools/science/computational-data-sciences/computational-sciences-ms/>) degrees within an accelerated timeframe. Upon completion of this 138 credit accelerated program, students will be exceptionally well prepared for entry into their careers or into a doctoral program in the field or in a related discipline.

Students are eligible to apply for this accelerated program once they have earned at least 60 undergraduate credits and can enroll in up to 18 credits of graduate coursework after successfully completing 75 undergraduate credits. This flexibility makes it possible for students to complete a bachelor's and a master's in five years.

For more detailed information, see AP.6.7 Bachelor's/Accelerated Master's Degrees (<http://catalog.gmu.edu/policies/academic/graduate-policies/#ap-6-7>). For policies governing all graduate degrees, see AP.6 Graduate Policies (<http://catalog.gmu.edu/policies/academic/graduate-policies/>). For more information on undergraduates enrolling in graduate courses, see AP.1.4.4 Graduate Course Enrollment by Undergraduates (<https://catalog.gmu.edu/policies/academic/registration-attendance/#text>).

## Application Requirements

Applicants to all graduate programs at George Mason University must meet the admission standards and application requirements for graduate study as specified in the Graduate Admission Policies (<http://catalog.gmu.edu/admissions/graduate-policies/>) section of this catalog.

Important application information and processes for this accelerated master's program can be found here (<https://www2.gmu.edu/admissions-aid/how-apply/accelerated-masters/>).

Students should seek out the graduate program's advisor who will aid in choosing the appropriate graduate courses and help prepare the student for graduate studies.

GRE-general scores are waived for graduates of BS degrees from any program in the College of Science or in the Volgenau School of Engineering at George Mason University.

Applicants must have an overall undergraduate GPA of at least 3.00. Additionally, applicants will have completed the following courses with a GPA of 3.00 or better.

Code	Title	Credits
CDS 205	Introduction to Agent-based Modeling and Simulation	3
or CDS 251	Introduction to Scientific Programming	
CDS 230	Modeling and Simulation I	3
CDS 301	Scientific Information and Data Visualization	3
CDS 302	Scientific Data and Databases	3
CDS 303	Scientific Data Mining	3
CDS 411	Modeling and Simulation II	3
Select one from the following:		3
CDS 461	Molecular Dynamics and Monte Carlo Simulations	
CDS 490	Directed Study and Research	
CSI 500	Computational Science Tools	
Total Credits		21

## Accelerated Option Requirements

After the completion of 75 undergraduate credits, students may complete 3 to 12 credits of graduate coursework that can apply to both the undergraduate and graduate degrees.

In addition to applying to graduate from the undergraduate program, students in the accelerated program must submit a bachelor's/

accelerated master's transition form (available from the Office of the University Registrar (<https://registrar.gmu.edu/forms/>)) to the College of Science's Office of Academic and Student Affairs (<https://cos.gmu.edu/about/contact-us/>) by the last day to add classes of their final undergraduate semester. Students should enroll for courses in the master's program in the fall or spring semester immediately following conferral of the bachelor's degree, but should contact an advisor if they would like to defer up to one semester.

Students must maintain an overall GPA of 3.00 or higher in all graduate coursework and should consult with their faculty advisor to coordinate their academic goals.

## Reserve Graduate Credit

Accelerated master's students may also take up to 6 graduate credits as reserve graduate credits. These credits do not apply to the undergraduate degree, but will reduce the master's degree by up to 6 credits. With 12 graduate credits counted toward the undergraduate and graduate degrees plus the maximum 6 reserve graduate credits, the credits necessary for the graduate degree can be reduced by up to 18.

## Graduate Course Suggestions

The following list of suggested courses is provided for general reference. To ensure an efficient route to graduation and post-graduation readiness, students are strongly encouraged to meet with an advisor before registering for graduate-level courses. Undergraduate students may not register for courses at the 700-level or higher.

Code	Title	Credits
For students focusing on Data Science, the following courses are suggested:		
CSI 501	Introduction to Scientific Programming	3
CSI 672	Statistical Inference	3
CSI 695	Scientific Databases	3
STAT 544	Applied Probability	3
For students focusing on Modeling, the following courses are suggested:		
CSI 500	Computational Science Tools	3
CSI 501	Introduction to Scientific Programming	3
CSI 600	Quantitative Foundations for Computational Sciences	3
CSI 690	Numerical Methods	3

## Bachelor's Degree (selected), Bioinformatics Management, Accelerated PSM Overview

This bachelor's/accelerated master's degree program allows academically strong undergraduates with a commitment to advance their education to obtain both the Biology, BS (<https://catalog.gmu.edu/colleges-schools/science/biology/biology-bs/>), or the Chemistry, BS (<http://catalog.gmu.edu/colleges-schools/science/chemistry-biochemistry/chemistry-bs/>), or the Computational and Data Sciences, BS (<https://catalog.gmu.edu/colleges-schools/science/computational-data-sciences/computational-data-sciences-bs/>), or the Physics, BS (<https://catalog.gmu.edu/colleges-schools/science/physics-astronomy/physics-bs/>), or the Neuroscience, BS (<https://catalog.gmu.edu/colleges->

schools/science/neuroscience-program/neuroscience-bs/) and the Bioinformatics Management, PSM (<https://catalog.gmu.edu/colleges-schools/science/systems-biology/bioinformatics-management-professional-science-masters/>) degrees within an accelerated timeframe. Upon completion of this 138 credit accelerated program, students will be exceptionally well prepared for entry into their careers or into a doctoral program in the field or in a related discipline.

Students are eligible to apply for this accelerated program once they have earned at least 60 undergraduate credits and can enroll in up to 18 credits of graduate coursework after successfully completing 75 undergraduate credits. This flexibility makes it possible for students to complete a bachelor's and a master's in five years.

For more detailed information, see AP.6.7 Bachelor's/Accelerated Master's Degrees (<http://catalog.gmu.edu/policies/academic/graduate-policies/#ap-6-7>). For policies governing all graduate degrees, see AP.6 Graduate Policies (<http://catalog.gmu.edu/policies/academic/graduate-policies/>). For more information on undergraduates enrolling in graduate courses, see AP.1.4.4 Graduate Course Enrollment by Undergraduates (<https://catalog.gmu.edu/policies/academic/registration-attendance/#text>).

## Application Requirements

Applicants to all graduate programs at George Mason University must meet the admission standards and application requirements for graduate study as specified in the Graduate Admission Policies (<http://catalog.gmu.edu/admissions/graduate-policies/>) section of this catalog.

Important application information and processes for this accelerated master's program can be found here (<https://www2.gmu.edu/admissions-aid/how-apply/accelerated-masters/>).

Students in the Biology, BS (<https://catalog.gmu.edu/colleges-schools/science/biology/biology-bs/>); Chemistry, BS (<https://catalog.gmu.edu/colleges-schools/science/chemistry-biochemistry/chemistry-bs/>); Computational and Data Sciences, BS (<https://catalog.gmu.edu/colleges-schools/science/computational-data-sciences/computational-data-sciences-bs/>); Neuroscience, BS (<https://catalog.gmu.edu/colleges-schools/science/neuroscience-program/neuroscience-bs/>); or Physics, BS (<https://catalog.gmu.edu/colleges-schools/science/physics-astronomy/physics-bs/>) with an overall GPA of at least 3.00 in their last 60 credits are welcome to apply to the Bioinformatics Management, PSM (<http://catalog.gmu.edu/colleges-schools/science/systems-biology/bioinformatics-management-professional-science-masters/>) accelerated master's program. Applicants to this accelerated master's should have previously taken courses in molecular biology, computer science, calculus, physical chemistry, and statistics. Students with deficiencies in one or more of these areas may be required to take additional courses from the undergraduate curriculum.

The GRE requirement is waived for students accepted into this accelerated program.

Students should seek out the graduate program's advisor who will aid in choosing the appropriate graduate courses and help prepare the student for graduate studies.

## Accelerated Option Requirements

After the completion of 75 undergraduate credits, students may complete 3 to 12 credits of graduate coursework that can apply to both the undergraduate and graduate degrees.

In addition to applying to graduate from the undergraduate program, students in the accelerated program must submit a bachelor's/accelerated master's transition form (available from the Office of the University Registrar (<https://registrar.gmu.edu/forms/>)) to the College of Science's Office of Academic and Student Affairs (<https://cos.gmu.edu/about/contact-us/>) by the last day to add classes of their final undergraduate semester. Students should enroll for courses in the master's program in the fall or spring semester immediately following conferral of the bachelor's degree, but should contact an advisor if they would like to defer up to one semester.

Students must maintain an overall GPA of 3.00 or higher in all graduate coursework and should consult with their faculty advisor to coordinate their academic goals.

## Reserve Graduate Credits

Accelerated master's students may also take up to 6 graduate credits as reserve graduate credits. These credits do not apply to the undergraduate degree, but will reduce the master's degree by up to 6 credits. With 12 graduate credits counted toward the undergraduate and graduate degrees plus the maximum 6 reserve graduate credits, the credits necessary for the graduate degree can be reduced by up to 18.

## Graduate Course Suggestions

The following list of suggested courses is provided for general reference. To ensure an efficient route to graduation and post-graduation readiness, students are strongly encouraged to meet with an advisor before registering for graduate-level courses.

Code	Title	Credits
BINF 630	Bioinformatics Methods	3
BINF 631	Molecular Cell Biology for Bioinformatics	3
GBUS 623	Marketing Management	3
GBUS 643	Managerial Finance	3
GBUS 738	Data Mining for Business Analytics	3