

# STATISTICS, BS

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The Bachelor of Science in Statistics is designed to provide a framework for students to develop connections between statistical concepts and theories and their applications to statistical practice. It will prepare statisticians who can use modern statistical techniques to design studies, collect data, analyze and visualize high dimensional data sets, and draw valid conclusions in an increasingly data-centric world. In this program, students will meld the time-tested concepts and theories of statistics with modern methods of analysis, in order to interpret the data that is collected in nearly every discipline and every sector of industry and government.

The BS in Statistics requires a total of 120 credit hours, including major core requirements, concentration requirements, and Mason Core requirements. The program's major core curriculum provides students with a firm foundation in statistics, mathematics, and computing. Selection of a concentration allows a student to specialize in applied, theoretical, or computational aspects of statistical practice.

Students will select one of three concentrations: Applied Statistics, Mathematical Statistics, or Statistical Analytics. The Applied Statistics concentration focuses on developing proficiency in analytical methods applicable to a specific discipline of the student's choosing. This is accomplished through the requirement to complete a minor in a field that makes substantial use of data analysis. The Mathematical Statistics concentration is designed for students interested in mastering the theoretical underpinnings of statistics and probability; this concentration is recommended for students who intend to continue graduate studies in statistics or whose main focus is on research. The Statistical Analytics concentration blends the disciplines of computer science and statistics in a very modern way and is designed for students interested in applying concepts from statistics and computer science to the analysis of massive data sets.

Graduates of this program can look forward to careers in local, state, and federal government, and in the many industries that conduct scientific research, collect, and analyze data. They will enter the workforce with the ability to impact science, public policy, technology, and industry in a positive way through their expertise in data collection, analysis, synthesis, and interpretation, each with the highest ethical standards. Graduates will also be well prepared to continue their studies in graduate schools if they so desire.

## Admissions & Policies

### Policies

#### Advanced Placement, Credit by Exam

A score of 5 on the Advanced Placement (AP) statistics exam qualifies students for credit in STAT 260.

#### Change of Major

Students considering changing their major to Statistics should consult with the Volgenau School of Engineering Coordinator of Undergraduate

Advising, 2500 Nguyen Engineering Building. These students must have a cumulative GPA of at least 2.75 and completed MATH 114 with a grade of C or better. See Change of Major (<http://catalog.gmu.edu/colleges-schools/engineering/#requirementspoliciestext>) for more information.

### Grades

Students must earn a C or better in Major Core requirement courses as well as in courses required to satisfy prerequisites. Also, students must earn a C or better in at least 6 credits of the courses used to fulfill the 9 credits of Statistics Restricted Electives.

### 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.

In addition, students in the Volgenau School with evidence of continued failure to make adequate progress toward declaring or completing a Volgenau School major will be terminated from the school. Adequate progress is determined by the major program. For more information, see AP.5.2.4 Termination from the Major (<https://catalog.gmu.edu/policies/academic/undergraduate-policies/#ap-5-2-4>).

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. A third attempt of a Volgenau School of Engineering course requires support by the student's major department as well as permission by the department offering the course. This permission is not guaranteed. 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) (<http://catalog.gmu.edu/mason-core/>) and STAT 250 Introductory Statistics I (Mason Core) (<http://catalog.gmu.edu/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.

## Requirements

### Degree Requirements

Total credits: 120

**Major Core****Statistics Core**

Code	Title	Credits
STAT 260	Introduction to Statistical Practice I	3
STAT 334	Introduction to Probability Models and Simulation <sup>1</sup>	3
or STAT 346	Probability for Engineers	
STAT 354	Probability and Statistics for Engineers and Scientists II	3
or STAT 360	Introduction to Statistical Practice II	
STAT 362	Introduction to Computer Statistical Packages	3
STAT 456	Applied Regression Analysis	3
STAT 463	Introduction to Exploratory Data Analysis	3
STAT 489	Pre-Capstone Professional Development	3
STAT 490	Capstone in Statistics (Mason Core) ( <a href="http://catalog.gmu.edu/mason-core/">http://catalog.gmu.edu/mason-core/</a> )	3
Total Credits		24

<sup>1</sup> Students in the Mathematical Statistics concentration must take STAT 346.

**Mathematics Core**

Code	Title	Credits
MATH 113	Analytic Geometry and Calculus I (Mason Core) ( <a href="http://catalog.gmu.edu/mason-core/">http://catalog.gmu.edu/mason-core/</a> ) <sup>1,2</sup>	4
MATH 114	Analytic Geometry and Calculus II <sup>3</sup>	4
MATH 203	Linear Algebra	3
Total Credits		11

<sup>1</sup> Math 123-124 (<http://catalog.gmu.edu/courses/math/>) may be taken in place of MATH 113 if student does not have sufficiently high math placement scores to be eligible for MATH 113.

<sup>2</sup> MATH 115 may be taken in place of MATH 113 if student qualifies.

<sup>3</sup> MATH 116 may be taken in place of MATH 114 if student qualifies.

**Computational Skills Core**

Code	Title	Credits
CS 112	Introduction to Computer Programming	4
Total Credits		4

**Restricted Electives****Statistics**

Code	Title	Credits
Select nine credits of STAT electives <sup>1,2</sup>		9
STAT 356	Statistical Theory	
STAT courses numbered 440-499 ( <a href="http://catalog.gmu.edu/courses/stat/">http://catalog.gmu.edu/courses/stat/</a> )		
Total Credits		9

<sup>1</sup> May not be used to fulfill other degree requirements.

<sup>2</sup> Grades of C or better are required in at least 6 credits.

**Technical**

Code	Title	Credits
Select nine credits of technical electives. Specific course selections must be pre-approved by the undergraduate coordinator. Students may need to choose electives to satisfy prerequisites for some of these courses. In some cases, students will need to contact other departments for permission to enroll. <sup>1</sup>		9
CDS courses numbered between 100-399 ( <a href="http://catalog.gmu.edu/courses/cds/">http://catalog.gmu.edu/courses/cds/</a> )		
CS courses numbered above 200 ( <a href="http://catalog.gmu.edu/courses/cs/">http://catalog.gmu.edu/courses/cs/</a> )		
MATH 125	Discrete Mathematics I (Mason Core) ( <a href="http://catalog.gmu.edu/mason-core/">http://catalog.gmu.edu/mason-core/</a> )	
MATH courses numbered above 200 ( <a href="http://catalog.gmu.edu/courses/math/">http://catalog.gmu.edu/courses/math/</a> )		
OR courses numbered above 300 ( <a href="http://catalog.gmu.edu/courses/or/">http://catalog.gmu.edu/courses/or/</a> )		
BENG 322	Health Data Challenges	
CYSE 101	Introduction to Cyber Security Engineering	
CYSE 325	Discrete Events Systems Modeling	
ENGH 388	Professional and Technical Writing	
IT 214	Database Fundamentals	
SOCI 391	Big Data, Technology, and Society	
SYST 438	Analytics for Financial Engineering and Econometrics	
SYST 468	Applied Predictive Analytics	
SYST 473	Decision and Risk Analysis	
SYST 488	Financial Systems Engineering	
Total Credits		9

<sup>1</sup> May not be used to fulfill other degree requirements.

**Concentrations**

Select one concentration and complete all requirements.

**Concentrations**

- Concentration in Applied Statistics (ASTA)
- Concentration in Mathematical Statistics (MTHS)
- Concentration in Statistical Analytics (STLA)

**Concentration in Applied Statistics (ASTA)**

Focuses on developing proficiency in analytical methods applicable to a specific discipline of the student's choosing. This is accomplished through the requirement to complete a minor in a field that makes substantial use of data analysis.

Code	Title	Credits
Students must complete 15 - 21 credits in a pre-approved minor, selected in consultation with the undergraduate coordinator. Courses taken to fulfill the minor requirements that are not used to fulfill Major Core or Restricted Electives requirements are considered unique to the minor. At least 15 credits of the minor coursework, technical electives, general electives, and additional Mason Core courses must be at or above the 300 level.		15-21

### Concentration in Mathematical Statistics (MTHS)

Designed for students interested in mastering the theoretical underpinnings of statistics and probability; this concentration is recommended for students who intend to continue graduate studies in statistics or whose main focus is on research.

Code	Title	Credits
STAT 356	Statistical Theory	3
CDS 130	Computing for Scientists	3
MATH 125	Discrete Mathematics I (Mason Core) ( <a href="http://catalog.gmu.edu/mason-core/">http://catalog.gmu.edu/mason-core/</a> )	3
MATH 213	Analytic Geometry and Calculus III <sup>1</sup>	3
MATH 300	Introduction to Advanced Mathematics	3
MATH 315	Advanced Calculus I	3
Total Credits		18

<sup>1</sup> MATH 215 may be taken in place of MATH 213 if student qualifies.

Code	Title	Credits
At least 9 credits of the technical electives, general electives, and additional Mason Core courses must be at or above the 300 level.		

### Concentration in Statistical Analytics (STLA)

Blends the disciplines of computer science and statistics in a very modern way and is designed for students interested in applying concepts from statistics and computer science to the analysis of massive data sets.

Code	Title	Credits
STAT 472	Introduction to Statistical Learning	3
CS 211	Object-Oriented Programming	3
CS 310	Data Structures	3
CS 330	Formal Methods and Models	3
CS 450	Database Concepts	3
or CDS 302	Scientific Data and Databases	
CS 484	Data Mining	3
or CDS 303	Scientific Data Mining	
MATH 125	Discrete Mathematics I (Mason Core) ( <a href="http://catalog.gmu.edu/mason-core/">http://catalog.gmu.edu/mason-core/</a> )	3
OR 481	Numerical Methods in Engineering	3
Total Credits		24

### Additional Mason Core

Code	Title	Credits
<b>Foundation Requirements</b>		
Written Communication ( <a href="http://catalog.gmu.edu/mason-core/#written">http://catalog.gmu.edu/mason-core/#written</a> )		6
Oral Communication ( <a href="http://catalog.gmu.edu/mason-core/#oral">http://catalog.gmu.edu/mason-core/#oral</a> )		3
<b>Core Requirements</b>		
Literature ( <a href="http://catalog.gmu.edu/mason-core/#literature">http://catalog.gmu.edu/mason-core/#literature</a> )		3
Arts ( <a href="http://catalog.gmu.edu/mason-core/#arts">http://catalog.gmu.edu/mason-core/#arts</a> )		3
Western Civilization/World History ( <a href="http://catalog.gmu.edu/mason-core/#western-civilization-world-history">http://catalog.gmu.edu/mason-core/#western-civilization-world-history</a> )		3
Global Understanding ( <a href="http://catalog.gmu.edu/mason-core/#global">http://catalog.gmu.edu/mason-core/#global</a> )		3

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
Natural Science ( <a href="http://catalog.gmu.edu/mason-core/#natural-science">http://catalog.gmu.edu/mason-core/#natural-science</a> )	7
Total Credits	31

### General Electives

Code	Title	Credits
The number of general elective credits varies with choice of concentration		8-17
Total Credits		8-17

## 4-Year Plan

### Bachelor of Science in Statistics Sample Plan of Study

Detailed four year plans and degree planning checklists can be found at <https://advising.gmu.edu/current-student/majors-at-mason/>.

## Accelerated Master's

### Statistics, BS/Biostatistics, Accelerated MS

#### Overview:

Highly-qualified students in Statistics, BS have the option of obtaining an accelerated Biostatistics, MS (<http://catalog.gmu.edu/colleges-schools/engineering/statistics/biostatistics-ms/>). Students in an accelerated degree program must fulfill all university requirements for the master's degree.

For more detailed information, see AP.6.7 Bachelor's/Accelerated Master's Degrees (<https://catalog.gmu.edu/policies/academic/graduate-policies/#ap-6-7>). For policies governing all graduate degrees, see AP.6 Graduate Policies (<https://catalog.gmu.edu/policies/academic/graduate-policies/>).

#### Admission Requirements:

Students enrolled in a BS degree in Statistics may apply to this option if they have earned 90 undergraduate credits with an overall GPA of 3.00.

#### Accelerated Option Requirements:

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

Students must complete all credits that satisfy requirements for the BS and MS programs, with 6 credits overlapping with grades of B or better in two 500-level STAT selected from STAT 544 (<https://catalog.gmu.edu/search/?P=STAT%20544/>) Applied Probability, STAT 554 (<https://catalog.gmu.edu/search/?P=STAT%20554/>) Applied Statistics I, and STAT 560, Biostatistical methods.

#### 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 Graduate

Recruitment and Enrollment Services. At the completion of MS requirements, a master's degree is conferred.

## Statistics, BS/Data Analytics Engineering, Accelerated MS

### Overview

Highly-qualified students in the Statistics, BS program have the option of applying to the accelerated Data Analytics Engineering, MS (<http://catalog.gmu.edu/colleges-schools/engineering/data-analytics-engineering-ms/>) program.

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/>).

### Admission Requirements

Students in the Statistics, BS program may apply to the accelerated Data Analytics Engineering, MS (<http://catalog.gmu.edu/colleges-schools/engineering/data-analytics-engineering-ms/>) program if they have earned 90 undergraduate credits with an overall GPA of at least 3.30.

### Accelerated Option Requirements

Students must complete all credits that satisfy requirements for the BS and MS programs, with six credits overlap chosen from the following courses:

Code	Title	Credits
CS 504	Principles of Data Management and Mining	3
or CS 584	Theory and Applications of Data Mining	
OR 541	Operations Research: Deterministic Models (Credit may not be received for both OR 441 and OR 541.)	3
or OR 531	Analytics and Decision Analysis	
STAT 515	Applied Statistics and Visualization for Analytics	3
or STAT 554	Applied Statistics I	

All graduate course prerequisites must be completed prior to enrollment.

Each 500-level course must be completed with a grade of B or better to apply toward the MS program. The graduate courses selected for overlap must be approved by the academic advisors of both the BS and MS programs. The graduate courses may be counted as Technical Electives toward the Statistics, BS program requirements, with approval of Statistics Department undergraduate coordinator.

### 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 (<https://registrar.gmu.edu/forms/>) that is submitted to the Office of the University Registrar and the VSE Graduate Admissions and Recruitment office. At the completion of MS requirements, a master's degree is conferred.

## Statistics, BS/Operations Research, Accelerated MS

### Overview

Highly-qualified students in the Statistics, BS have the option of obtaining an accelerated Operations Research, MS (<http://catalog.gmu.edu/colleges-schools/engineering/systems-operations-research/operations-research-ms/#text>).

For more detailed information, see AP.6.7 Bachelor's/Accelerated Master's Degrees (<http://catalog.gmu.edu/policies/academic/graduate-policies/#text>). For policies governing all graduate degrees, see AP.6 Graduate Policies (<http://catalog.gmu.edu/policies/academic/graduate-policies/>).

### Admission Requirements

Mason undergraduate students majoring in Statistics, BS may apply to this option if they have earned 90 undergraduate credits with an overall GPA of at least 3.30 and completed all MATH and PHYS requirements. Criteria for admission are identical to criteria for admission to the Operations Research, MS (<http://catalog.gmu.edu/colleges-schools/engineering/systems-operations-research/operations-research-ms/#text>) program.

### Accelerated Options Requirement

Students must complete all credits that satisfy requirements for both the BS and MS programs. Up to two courses (6 credit hours) of approved master's level courses taken as part of the undergraduate degree may be applied to the graduate degree. The courses selected for this purpose must be approved by the academic advisors of both the BS and MS programs and by the SEOR department chair. For the BS programs that allow undergraduate electives from the department of system engineering and operations research, the students may choose the graduate version of such electives to replace the corresponding undergraduate courses.

### 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.

## Statistics, BS/Systems Engineering, Accelerated MS

### Overview

Highly-qualified students in the Statistics, BS have the option of obtaining an accelerated Systems Engineering, MS (<http://catalog.gmu.edu/colleges-schools/engineering/systems-operations-research/systems-engineering-ms/>).

For more detailed information, see AP.6.7 Bachelor's/Accelerated Master's Degrees (<http://catalog.gmu.edu/policies/academic/graduate-policies/#text>). For policies governing all graduate degrees, see AP.6 Graduate Policies (<http://catalog.gmu.edu/policies/academic/graduate-policies/>).

## Admission Requirements

Mason undergraduate students majoring in Statistics, BS may apply to this option if they have earned 90 undergraduate credits with an overall GPA of at least 3.30 and completed all MATH and PHYS requirements. Criteria for admission are identical to criteria for admission to the Systems Engineering, MS (<http://catalog.gmu.edu/colleges-schools/engineering/systems-operations-research/systems-engineering-ms/>) program.

## Accelerated Options Requirement

Students must complete all credits that satisfy requirements for both the BS and MS programs. Up to two courses (6 credit hours) of approved master's level courses taken as part of the undergraduate degree may be applied to the graduate degree. The courses selected for this purpose must be approved by the academic advisors of both the BS and MS programs and by the SEOR department chair. For the BS programs that allow undergraduate electives from the department of system engineering and operations research, the students may choose the graduate version of such electives to replace the corresponding undergraduate courses.

## 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.

# Statistics, BS/Statistical Science, Accelerated MS

## Overview

Highly-qualified students in the Statistics, BS program have the option of applying to the accelerated Statistical Science, MS (<http://catalog.gmu.edu/colleges-schools/engineering/statistics/statistical-science-ms/>) program.

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/>).

## Admission Requirements

Students in the Statistics, BS program may apply to the accelerated Statistical Science, MS (<http://catalog.gmu.edu/colleges-schools/engineering/statistics/statistical-science-ms/>) program if they have earned 90 undergraduate credits with an overall GPA of 3.00. Students must have successfully completed the following Mason courses each with a grade of C or better prior to admission to the accelerated program:

Code	Title	Credits
MATH 114	Analytic Geometry and Calculus II	4
MATH 203	Linear Algebra	3
STAT 334	Introduction to Probability Models and Simulation	3
or STAT 346	Probability for Engineers	

STAT 354	Probability and Statistics for Engineers and Scientists II	3
or STAT 360	Introduction to Statistical Practice II	
STAT 362	Introduction to Computer Statistical Packages	3

## Accelerated Option Requirements

Students must complete all credits satisfying degree requirements for the BS and MS programs, with 6 credits overlap chosen from the following courses: STAT 515 Applied Statistics and Visualization for Analytics, STAT 544 Applied Probability, STAT 554 Applied Statistics I, STAT 560 Biostatistical Methods, and STAT 574 Survey Sampling I. All graduate course prerequisites must be completed prior to enrollment. Each graduate course must be completed with a grade of B or better to apply toward the MS degree. For Statistics, BS candidates:

- STAT 560 Biostatistical Methods replaces the corresponding undergraduate version STAT 460 Introduction to Biostatistics as a Statistical Elective. Credit may not be received for both STAT 460 and STAT 560.
- STAT 574 Survey Sampling I replaces the corresponding undergraduate version STAT 474 Introduction to Survey Sampling as a Statistical Elective. Credit may not be received for both STAT 474 and STAT 574.
- STAT 515 Applied Statistics and Visualization for Analytics, STAT 544 Applied Probability, and STAT 554 Applied Statistics I may be counted as Technical Electives toward the BS program requirements.

While still in undergraduate status, a maximum of 6 additional graduate credits may be taken as reserve graduate credit and applied to the master's program. Reserve graduate credits do not apply to the undergraduate degree.

## 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 and Recruitment Office. At the completion of MS requirements, a master's degree is conferred.