

# Bachelor of Science Mathematics with a Major in Big Data Analytics (BS)

## Requirements

### Lower-Division General Education

Written Communication ( <a href="http://catalog.odu.edu/undergraduate/requirements-undergraduate-degrees/#written">http://catalog.odu.edu/undergraduate/requirements-undergraduate-degrees/#written</a> )	6
Oral Communication ( <a href="http://catalog.odu.edu/undergraduate/requirements-undergraduate-degrees/#oral">http://catalog.odu.edu/undergraduate/requirements-undergraduate-degrees/#oral</a> )	3
Mathematics ( <a href="http://catalog.odu.edu/undergraduate/requirements-undergraduate-degrees/#math">http://catalog.odu.edu/undergraduate/requirements-undergraduate-degrees/#math</a> )	3
Language and Culture ( <a href="http://catalog.odu.edu/undergraduate/requirements-undergraduate-degrees/#language">http://catalog.odu.edu/undergraduate/requirements-undergraduate-degrees/#language</a> )	0-6
Information Literacy and Research ( <a href="http://catalog.odu.edu/undergraduate/requirements-undergraduate-degrees/#information">http://catalog.odu.edu/undergraduate/requirements-undergraduate-degrees/#information</a> )	3
Human Behavior ( <a href="http://catalog.odu.edu/undergraduate/requirements-undergraduate-degrees/#behavior">http://catalog.odu.edu/undergraduate/requirements-undergraduate-degrees/#behavior</a> )	3
Human Creativity ( <a href="http://catalog.odu.edu/undergraduate/requirements-undergraduate-degrees/#creativity">http://catalog.odu.edu/undergraduate/requirements-undergraduate-degrees/#creativity</a> )	3
Interpreting the Past ( <a href="http://catalog.odu.edu/undergraduate/requirements-undergraduate-degrees/#interpret">http://catalog.odu.edu/undergraduate/requirements-undergraduate-degrees/#interpret</a> )	3
Literature ( <a href="http://catalog.odu.edu/undergraduate/requirements-undergraduate-degrees/#literature">http://catalog.odu.edu/undergraduate/requirements-undergraduate-degrees/#literature</a> )	3
Philosophy and Ethics ( <a href="http://catalog.odu.edu/undergraduate/requirements-undergraduate-degrees/#philosophy">http://catalog.odu.edu/undergraduate/requirements-undergraduate-degrees/#philosophy</a> )	3
The Nature of Science ( <a href="http://catalog.odu.edu/undergraduate/requirements-undergraduate-degrees/#nature">http://catalog.odu.edu/undergraduate/requirements-undergraduate-degrees/#nature</a> )	8
Impact of Technology ( <a href="http://catalog.odu.edu/undergraduate/requirements-undergraduate-degrees/#impact">http://catalog.odu.edu/undergraduate/requirements-undergraduate-degrees/#impact</a> )	3

Written Communication: A grade of C or better is required in both courses.

Mathematics: met in the major by MATH 211

Information Literacy and Research: CS 121G (preferred); IT 150G is an acceptable substitute.

Philosophy and Ethics: PHIL 120P recommended

The Nature of Science: The eight credit hours of Nature of Science with labs need not be in the same science.

### Upper-Division General Education

A minor or second major in computer science, which includes CS 361 Advanced Data Structures and Algorithms, is required.

### Requirements for Graduation

Requirements for graduation include the following:

- Minimum of 120 credit hours.
- Minimum of 30 credit hours overall and 12 credit hours of upper-level courses in the major program from Old Dominion University.
- Minimum overall cumulative grade point average of C (2.00) in all courses taken.
- Minimum overall cumulative grade point average of C (2.00) in all courses taken toward the major.
- Minimum overall cumulative grade point average of C (2.00) in all courses taken toward a minor.

- Completion of ENGL 110C, ENGL 211C or ENGL 231C, and the writing intensive (W) course in the major with a grade of C or better. The W course must be taken at Old Dominion University.
- Completion of Senior Assessment.

## Mathematics Core

### Mathematics Core Course Requirements \*

CS 151 or CS 153	Introduction to Programming with Java Introduction to Programming with Python	4
MATH 211	Calculus I	4
MATH 212	Calculus II	4
MATH 307	Ordinary Differential Equations	3
MATH 311W	Abstract Algebra	3
MATH 312	Calculus III	4
MATH 316	Introductory Linear Algebra	3
MATH 317	Calculus IV: Introductory Analysis	3
STAT 310	Introductory Data Analysis	3
STAT 330 or STAT 331	An Introduction to Probability and Statistics Theory of Probability	3
<b>Total Credit Hours</b>		<b>34</b>

\* A grade of C+ or higher is required in MATH 211 and MATH 212. A cumulative GPA of 2.3 or higher is required in all 300 and 400 level core courses with no grade lower than a C. In addition, a grade of C or higher is required in mathematics and statistics prerequisite courses to advance to the next course.

## Big Data Analytics Major

### General Education

Complete lower-division requirements	38-44
Complete upper-division requirements (minor or second major in computer science required; minimum of 12 credit hours)	12

### Mathematics Core

Complete mathematics core requirements	34
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### Big Data Analytics Major

STAT 405	Introduction to Data Handling	3
BDA 411	Introduction to Machine Learning	3
BDA 431	Modern Statistical Methods for Big Data Analytics	3
BDA 432	Introduction to Optimization in Data Science	3
BDA 450	Senior Project in Big Data Analytics I	3
At least three of the following courses:		9
STAT 431	Theory of Statistics	
STAT 437	Applied Regression and Time Series Analysis	
MATH 401	Partial Differential Equations	
MATH 408	Applied Numerical Methods I	
MATH 421	Applied Mathematics II: Mathematical Modeling	
<b>Total Credit Hours</b>		<b>108-114</b>

### Practicum

Any student who wishes to receive a practicum or internship experience may do so as an integral part of the degree program. Students may substitute the practicum experience for one of the optional courses listed in the major.

### Elective Credit

Elective credit may be needed to meet the minimum requirement of 120 credit hours for all students earning a BS in Mathematics.

# Degree Program Guide

The Degree Program Guide is a suggested curriculum to complete this degree program in four years. It is just one of several plans that will work and is presented only as broad guidance to students. Each student is strongly encouraged to develop a customized plan in consultation with their academic advisor. Additional information can also be found in Degree Works.

Course	Title	Credit Hours
<b>Freshman</b>		
<b>Fall</b>		
ENGL 110C	English Composition (Grade of C or better required)	3
MATH 211	Calculus I	4
	Human Behavior (ECON 202S required for the Actuarial Mathematics major)	3
	Information Literacy and Research (CS 121G preferred. IT 150G is acceptable substitute for the Actuarial Mathematics major or the Big Data Analytics major)	3
	Elective or Language & Culture I (May be waived; See requirement details)	3
<b>Credit Hours</b>		<b>16</b>
<b>Spring</b>		
	Select one of the following:	3
ENGL 211C	Writing, Rhetoric, and Research	
ENGL 231C	Writing, Rhetoric, and Research: Special Topics	
MATH 212	Calculus II	4
	Oral Communication	3
	Impact of Technology (IT 360T suggested for Actuarial Mathematics major)	3
	Elective or Language & Culture II (May be waived; See requirement details)	3
<b>Credit Hours</b>		<b>16</b>
<b>Sophomore</b>		
<b>Fall</b>		
MATH 307	Ordinary Differential Equations	3
	Human Creativity	3
CS 151 or CS 153	Introduction to Programming with Java or Introduction to Programming with Python	4
	Nature of Science I (Course depends on major chosen. See requirement details)	4
<b>Credit Hours</b>		<b>14</b>
<b>Spring</b>		
MATH 312	Calculus III	4
	Interpreting the Past	3
	Philosophy and Ethics (PHIL 120P recommended)	3
	Nature of Science II (Course depends on major chosen. See requirement details)	4
<b>Credit Hours</b>		<b>14</b>
<b>Junior</b>		
<b>Fall</b>		
MATH 311W	Abstract Algebra (C or better required)	3
	STAT 310 or STAT 331 (Statistics/Biostatistics and Actuarial Mathematics Majors must take STAT 331)	3

Literature		3
Major course		3
Upper-Division General Education Course or Minor		3
<b>Credit Hours</b>		<b>15</b>
<b>Spring</b>		
MATH 316	Introductory Linear Algebra	3
MATH 317	Calculus IV: Introductory Analysis	3
	STAT 330 or STAT 431 (Statistics/Biostatistics and Actuarial Mathematics majors take STAT 431)	3
Major course		3
Upper-Division General Education Course or Minor		3
<b>Credit Hours</b>		<b>15</b>
<b>Senior</b>		
<b>Fall</b>		
Major course		3
Major course		3
	Elective or Major Course if Big Data Analytics major	3
	Elective or STAT 310	3
	Minor or Elective	3
<b>Credit Hours</b>		<b>15</b>
<b>Spring</b>		
Major course		3
Major course		3
	Elective or Major Course if Big Data Analytics major	3
	Elective	3
	Minor or Elective	3
<b>Credit Hours</b>		<b>15</b>
<b>Total Credit Hours</b>		<b>120</b>

## Linked Bachelor of Science in Mathematics and Master of Science in Computational and Applied Mathematics

The linked program allows students to count up to 12 credits of graduate coursework toward both their undergraduate and master's degrees. Students must earn a minimum of 150 credits (120 discrete credit hours for the undergraduate degree and 30 discrete credit hours for the graduate degree).

### Admission

To be admitted to the linked program, students must have completed at least 60 undergraduate credit hours with at least 24 credit hours from ODU. Students must have completed MATH 307, MATH 312, MATH 317 and all prerequisites for those courses. At the time of admission, they must have an overall GPA of 3.00 or better and a GPA of 3.00 or better in MATH and STAT courses.

Interested students who meet the admission requirements should apply to the graduate program director, after consulting with the undergraduate chief departmental advisor, as soon as possible upon completing the required courses and 60 credit hours. In consultation with the graduate program director, a student will:

1. Officially declare an undergraduate Mathematics major with the undergraduate chief departmental advisor.
2. Draft a schedule of graduate courses to be taken as an undergraduate to be presented to the undergraduate chief departmental advisor.

3. Apply, during their senior year, to the Office of Graduate Admissions for admission to the master's in computational and applied mathematics program.

Students who have completed at least six hours of graduate courses upon attaining senior standing (completion of 90 credit hours) and who have earned a GPA of 3.00 or better in those courses will not be required to take the Graduate Record Exam (GRE) for admission to the master's program. Otherwise, in keeping with normal admission requirements for the MS in computational and applied mathematics, students will take the GRE as an undergraduate and will subsequently be reevaluated for continuation into the master's program.

Once students have been awarded their bachelor's degree and fulfilled all regular admission requirements for the MS in computational and applied mathematics, they will be officially admitted into the MS program.

### **Program Requirements**

Students in the program will fulfill all normal admission and curricular requirements for both a BS in mathematics and an MS in computational and applied mathematics with the following exceptions:

1. Students in the program may count up to 12 hours of 500 or 600 level graduate courses, excluding independent study, taken as an undergraduate for which they have earned a grade point average of 3.0 or greater with no course grade lower than a B- toward both the BS in mathematics and the MS in computational and applied mathematics.
2. Students in the program may substitute mathematics or statistics graduate courses for undergraduate courses according to the following schema. All students must complete an undergraduate writing intensive course in the major.
  - a. All students must complete the prescribed undergraduate program including all 400-level required courses and electives.
  - b. All students may substitute 500- and 600-level courses for the remaining credit hours in the 120-hour requirement in the undergraduate program so long as they have the prerequisites for those courses. 700- or 800-level courses may not be used.
  - c. Students will not receive credit for both the 400 and 500 level version of the same course.
  - d. Students in the program may make a written petition for other substitutions to the graduate program director, who will consider them in consultation with the chief departmental advisor and the instructor(s) of the courses involved.

#### **NOTES:**

1. In accordance with University policy, up to 21 hours of graduate courses taken as an undergraduate may be counted toward the bachelor's degree; however, only 12 hours of graduate courses taken as an undergraduate may also be counted toward the MS degree. This will limit students' scheduling flexibility subsequently.

### **BA or BS to MBA (Master of Business Administration) Linked Program**

The linked BA/MBA or BS/MBA program is an early entry to the MBA program of study. The early-entry program is designed for well qualified non-business undergraduate ODU students to start their MBA program prior to completing their undergraduate degree. Well qualified non-business undergraduate students may take MBA-level courses as early as three semesters prior to graduation and count up to 12 graduate credits toward their undergraduate degree. Students participating in the early-entry program must earn a minimum of 150 credit hours (120 discrete credit hours for the undergraduate degree and 30 discrete credit hours for the graduate degree). Early-entry program students should carefully consider their undergraduate degree program requirements when planning their course of study. Students in the early-entry program work in close consultation with the MBA Program Office and should refer to information in the Strome College of Business section in the graduate catalog (<http://catalog.odu.edu/graduate/stromecollegeofbusiness/>) to develop an individualized plan of study based on the required coursework.

### **BA or BS to MPA (Master of Public Administration) Linked Program**

The linked BA/MPA or BS/MPA program provides qualified Old Dominion University undergraduate students with the opportunity to earn a master's degree in public administration while taking credits in the MPA program as an undergraduate student. The program is designed for highly motivated students with the desire to immediately continue their education after the bachelor's degree. The program is especially relevant to individuals seeking to work (or currently working) in the public or non-profit sectors, but is suitable for students from any undergraduate major. Graduate courses may be taken during the fall and spring semester of the student's senior undergraduate year. Up to 12 graduate credits can count toward both the undergraduate and graduate degree and can meet upper-level General Education requirements. After receiving the undergraduate degree, a student will continue with the MPA program, taking MPA courses until completing the required 39 credit hours. Students in the linked program must earn a minimum of 150 credit hours (120 discrete credit hours for the undergraduate degree and 30 discrete credit hours for the graduate degree).

Requirements for admission to the graduate program can be found in the School of Public Service section of the Graduate Catalog (<http://catalog.odu.edu/graduate/business/public-service/>). For additional information, please contact the School of Public Service in the Strome College of Business.