Mathematics, Statistics, and Computer Science, Catalog 2025-26

MAJORS, MINORS

- **ASSISTANT PROFESSOR:** Molly Weselcouch (chair), Timothy Magee, Giancarlo Schrementi
- **LECTURER:** Erin Levering

The study of mathematics is motivated by its intrinsic beauty as well as its applicability to everyday life. Mathematics promotes the strengthening of critical and analytical problem-solving skills.

A student graduating with a mathematics major from Hollins will be a logical thinker who is well educated in major areas of mathematics (calculus, linear algebra, statistics, algebra, and analysis), in the application of mathematical concepts to problem solving, and in the development and communication of applied and theoretical mathematics. A recent survey of mathematics majors shows careers as bankers, teachers, defense analysts, actuaries, and programmers and graduate school placements in mathematics, forensic science, medicine, and law.

*Note: Hollins does not offer a major or minor in either statistics or computer science.

REQUIREMENTS FOR A MAJOR IN MATHEMATICS (B.A.):

13 courses (40–46 credits)

- MATH 241: Calculus I (6)

- MATH 242: Calculus II (4)

- MATH 246: Laboratories in Mathematical Experimentation (2)

- MATH 255: Methods of Matrices and Linear Algebra (4)

- MATH 310: A Transition to Advanced Mathematics (4)

- MATH 316: Several-Variable Calculus (4)

- A 300-level MATH course in algebra (2) (Alg)

- A 300-level MATH course in analysis (2) (Ana)

- At least two additional 300-level MATH, STAT or CMPS 2 or 4 credit courses (4-8)

- MATH 471: Senior Seminar (2)

- MATH 490 (2, 2) or MATH 480 (2 and Short Term) or MATH 472 (2) as determined in consultation with members of the department

- STAT 251: Statistical Methods (4)

A student is exempted from MATH 241 and MATH 242 if she can demonstrate to the department's satisfaction her knowledge of the course(s).

REQUIREMENTS FOR A MAJOR IN MATHEMATICS (B.S.):

19 courses (64–78 credits)

REQUIRED COURSES IN MATHEMATICS AND STATISTICS:

- MATH 241: Calculus I (6)

- MATH 242: Calculus II (4)

- MATH 246: Laboratories in Mathematical Experimentation (2)

- MATH 255: Methods of Matrices and Linear Algebra (4)

- MATH 310: A Transition to Advanced Mathematics (4)

- MATH 316: Several-Variable Calculus (4)

- A 300-level MATH course in algebra (2) (Alg)

- A 300-level MATH course in analysis (2) (Ana)

- At least four additional 300-level MATH, STAT or CMPS 2 or 4 credit courses (8-16)

- MATH 471: Senior Seminar (2)

- MATH 490 (2, 2) or MATH 480 (2 and Short Term) or MATH 472 (2) as determined in consultation with members of the department

- STAT 251: Statistical Methods (4)

A student may be exempted from MATH 241 and MATH 242 if she can demonstrate to the department's satisfaction her knowledge of the course(s).

REQUIRED ALLIED COURSES:

Complete either:

1. Two laboratory courses at the 200 level or higher from at least two different departments among biology, chemistry, computer science, or physics. Note: A 4-credit CMPS course is considered equivalent to a lab course for this requirement.

2. OR four laboratory courses at the 200 level or higher from a single department (biology, chemistry, or physics).

- CHEM 105/105L (Principles of Chemistry) may count as one of the required lab courses in either option.
- CMPS 160 (Applied Computing I with Python) may count as one of the required lab courses only for option 1 (not option 2).

REQUIREMENTS FOR A MAJOR IN MATHEMATICS WITH A DATA SCIENCE CONCENTRATION (B.S.):

19 courses (62-68 credits)

- MATH 241: Calculus I (6)
- MATH 242: Calculus II (4)
- MATH 246: Laboratories in Mathematical Experimentation (2)
- MATH 255: Methods of Matrices and Linear Algebra (4)
- MATH 310: A Transition to Advanced Mathematics (4)
- MATH 316: Several-Variable Calculus (4)
- A 300-level MATH course in algebra (2) (Alg)
- A 300-level MATH course in analysis (2) (Ana)
- At least two additional 200- or 300-level MATH, STAT or CMPS 2-4 credit courses (4-8)
- MATH 471: Senior Seminar (2)
- MATH 490 (2, 2) or MATH 480 (2 and Short Term) or MATH 472 (2) as determined in consultation with members of the department
- STAT 251: Statistical Methods (4)

REQUIRED ALLIED COURSE:

- One course with laboratory at or above the 200-level from one of the following departments: biology, chemistry, or physics.

REQUIRED COURSES IN COMPUTER SCIENCE:

- CMPS 160: Applied Computing I with Python (4)
- CMPS 217: Data Structures (4)
- CMPS 260 Applied Computing II: How to Think Like a Data Scientist (4)

- CMPS 335: Data Mining Techniques (2)

A student may be exempted from MATH 241 and MATH 242 if she can demonstrate to the department's satisfaction her knowledge of the course(s).

REQUIREMENTS FOR A MINOR IN MATHEMATICS:

5 courses (20 credits)

- MATH 241: Calculus I (6)
- MATH 242: Calculus II (4)
- MATH 246: Laboratories in Mathematical Experimentation (2)
- MATH 255: Methods of Matrices and Linear Algebra (4) or STAT 251: Statistical Methods (4)
- MATH 310: A Transition to Advanced Mathematics (4)

REQUIREMENTS FOR A MINOR IN DATA SCIENCE:

7 courses (22 credits)

- STAT 251: Statistical Methods I (4)
- STAT 324: Data Wrangling (2)
- CMPS 160: Applied Computing I with Python (4)
- CMPS 217: Data Structures (4)
- CMPS 260 Applied Computing II: How to Think Like a Data Scientist (4)
- CMPS 335: Data Mining Techniques (2)
- One 300-level STAT or CMPS 2 or 4-credit elective course

PLACEMENT IN MATHEMATICS AND STATISTICS COURSES:

A diagnostic/placement examination is recommended as a prerequisite for initial enrollment in any one of the following courses: MATH 130, MATH 140, MATH 152, MATH 241, STAT 140, and STAT 251.

COURSES IN MATHEMATICS:

MATH 100: INTRODUCTION TO QUANTITATIVE REASONING (4)

This course is for students who need practice in applying fundamental mathematical skills (algebra, graphing, geometry, data analysis, and linearity) to real-life applications. The goal of the course is to develop the quantitative skills that promote problem solving with confidence. Prerequisite: appropriate score on Math/QR assessment. (q, QL)

MATH 105: QUANTITATIVE REASONING IN TODAY'S WORLD (4)

This course focuses on the application of mathematics to the students' personal and social issues. It is designed to prepare students for the mathematics they will encounter in other college classes, particularly in the social and natural sciences such as problem solving, financial management, and growth. The course provides students with critical thinking and quantitative reasoning skills needed to understand major issues in life. It develops students' ability to reason with quantitative information necessary to achieve success in a career. Prerequisite: appropriate score on Math/QL assessment. (q, QL)

MATH 130: MATHEMATICAL MODELING WITH PRECALCULUS (4)

Emphasis is on the application of algebra, precalculus, and mathematical models to many exciting real-world problems in art, music, business, economics, statistics, and biology and other sciences. Recommended for prospective teachers and non-mathematicians. Prerequisite: appropriate score on Math/QL assessment.. (q, QL)

MATH 140: PRECALCULUS (4)

A study of precalculus involving the application of functions and mathematical models to real-world problems in the natural sciences as well as art, music, business, economics, and the social sciences. Provides a minimal preparation for the calculus sequence. Recommended for prospective teachers. Prerequisites: q or appropriate score on Math/QL assessment. (Q, QL)

MATH 211: SYMBOLIC LOGIC (4)

Also listed and described as PHIL 211. Open to first-year students with permission. Prerequisite: q. Offered Term 1. (Q)

MATH 241, 242: CALCULUS I, II (6, 4)

The calculus of real functions of one real variable with emphasis on application of concepts to real world problems. Calculus I: functions, limits, continuity, the derivative, and applications of the derivative. Calculus II: antiderivatives, integrals, applications of the integral, improper integrals, sequences, and series. Open to first-year students. Prerequisites: for MATH 241: q and MATH 140 or equivalent; for MATH 242: MATH 241. MATH 241 meets daily and satisfies QL. MATH 241 offered every fall, MATH 242 offered every spring. (Q, QL)

MATH 246: LABORATORIES IN MATHEMATICAL EXPERIMENTATION (2)

A course in mathematical discovery. Students "do" mathematics by designing mathematical experiments, obtaining mathematical results, analyzing data, and making

mathematical conjectures. Topics include fractals, cryptology, function iteration and chaos, strategy of games, and graph theory. Prerequisite: MATH 241. Open to first-year students. Offered every spring.

MATH 255: METHODS OF MATRICES AND LINEAR ALGEBRA (4)

Properties of matrices; methods of finding an inverse; matrix equations and solutions; characteristic roots, important matrix forms; applications in social and physical sciences. Prerequisites: q and one college mathematics course above MATH 140 and permission. Open to first-year students. (Q)

MATH 290: INDEPENDENT STUDY (2 OR 4)

Independent study conducted below the advanced level. Application must be made with faculty prior to registration. Offered any term.

MATH 310: A TRANSITION TO ADVANCED MATHEMATICS (4)

An introduction to the standard methods of mathematical proof and their validity. Methods of proof are examined in detail, and examples of each method are analyzed carefully. The emphasis is on enhancing students' ability to write and understand mathematical proofs. Prerequisite: MATH 242 or permission. Offered every fall.

MATH 316: SEVERAL-VARIABLE CALCULUS (4)

The calculus of functions of several real variables: vector spaces; differentiation of vector functions; partial derivatives; maxima and minima; and multiple integrals. Prerequisites: MATH 242. Offered every fall.

MATH 343: COMBINATORICS (2)

An introduction to combinatorics, with potential topics including basic counting principles, recursions, permutations, graph theory, and partially ordered sets. Prerequisite: MATH 242 or equivalent.

MATH 351: DIFFERENTIAL EQUATIONS (4)

An introduction to ordinary differential equations with an emphasis on applications. The course topics include first order differential equations, separable equations, linear second order differential equations, the Laplace Transform, series solutions, and numerical methods. Prerequisite: Math 242 or equivalent.

MATH 352: FIELDS AND CODES (2)

An introduction to algebraic coding theory using finite fields and number-theory. Codes studied include binary, hexadecimal, ASCII, the error-correcting Hamming codes, BHC, and Reed-Solomon codes. Prerequisite: MATH 242 or equivalent. (Alg)

MATH 361: COMPLEX VARIABLES (2)

An introduction to complex analysis, with topics including the algebra of complex numbers, analytic functions, elementary functions, contour integrals, and Laurent series. (Ana) Prerequisite: Math 242 or equivalent.

MATH 362: REAL ANALYSIS (2)

An introduction to advanced calculus. Students will be reading and writing mathematical proofs that provide the theoretical basis for important topics from single-variable calculus, including limits, continuity, differentiation, integration, sequences, and series. (Ana) Prerequisite: Math 242 and MATH 310.

MATH 390: INDEPENDENT STUDY (2 OR 4)

Independent study conducted at the advanced level. Application must be made with faculty prior to registration.

MATH 391: INDEPENDENT RESEARCH IN MATHEMATICS (4)

This course is intended for students conducting independent mathematical research. In conjunction with a faculty member, the student will formulate and execute an original research project that will culminate in a paper and/or presentation. Registration for this course must occur before the semester in which the research is to take place. This course will count as a 300 level elective towards the major.

MATH 397: TEACHING MATHEMATICS IN THE ELEMENTARY AND MIDDLE SCHOOLS (4)

This course will address content knowledge, curriculum development, methodologies, assessment and evaluation, using resources and technology, and approaches to teaching elementary and middle school mathematics, within the framework of the NCTM Standards of Learning, the VA Standards of Learning, and VA Early Learning and Development Standards. Attention will be given to problems that students have in learning and understanding mathematics and ways to address those problems. Prerequisite: q.

MATH 399: INTERNSHIP (2 OR 4)

Application must be made with faculty prior to registration. May be proposed in any term.

MATH 471: SENIOR SEMINAR (2)

Emphasis is on written and oral communication of mathematical ideas. Senior mathematics majors complete a mathematics portfolio based on select assignments from previous mathematics, computer science, and statistics courses. Prerequisite: senior standing. Offered every fall.

MATH 472: SENIOR SEMINAR (2)

In this course students have an opportunity to explore advanced and/or new mathematical topics. Students may suggest projects to departmental faculty for their approval and guidance. Students will present completed projects at the end of the semester. Offered every spring.

MATH 480: SENIOR THESIS (2)

An extensive research project to be carried out over one semester and Short Term. Open to qualified senior mathematics majors. Prerequisite: MATH 471.

MATH 490: SENIOR HONORS (2, 2)

Open to majors with permission. Required both regular terms and Short Term. Interested majors should consult with the chair of the department no later than the end of the second term of their junior year. Application must be made with faculty prior to registration.

COURSES IN STATISTICS:

STAT 140: INTRODUCTION TO STATISTICS (4)

Topics are methods of description, measures of location and dispersion, simple linear regression, normal distributions, sampling distributions, interval estimation, and significance tests of proportions. Applications in both physical and social sciences. Prerequisite: q, MATH 100/105, or appropriate recommendation from Math/QL assessment. (Q, QL)

STAT 251: STATISTICAL METHODS (4)

Statistical inference for surveys and controlled experiments. Use of a statistical computer package required. Measures of central tendency and dispersion, normal, binomial, and t-distributions; Fisher's exact test, sampling distributions; estimation and significance testing; analysis of variance; linear regression and correlation and commonly used transformations. Prerequisite: q and appropriate recommendation from Math/QR assessment. Offered every fall. (Q, QL)

STAT 324: DATA WRANGLING WITH R (2)

An introduction to skills necessary for data wrangling and other modern techniques of statistical interpretation. Students will learn and practice techniques for acquiring, tidying, mutating, and merging data and data visualization, using R-Studio and the RMarkdown document writing system. Pre-requisite: q.

STAT 343: PROBABILITY (2)

An introduction to combinatorial analysis, the axioms of probability, conditional probability, independence, discrete and continuous random variables, expectation and moment generating functions and stochastic processes. Students will actively investigate probabilistic situations and perform simulations. Open to first-year students. Prerequisite: Math 242.

STAT 361: REGRESSION (2)

The analysis of continuous response data. The focus is on linear and multiple regression with theoretical and practical training in statistical modeling. This is a hands-on, applied course where students will become proficient using R-Studio and Minitab to analyze data from a variety of fields and will learn what assumptions underlie their models, how to test whether the data meet the assumptions, and what can be done when the assumptions are not met. Prerequisites: STAT 140 or STAT 251, or equivalent.

COURSES IN COMPUTER SCIENCE:

CMPS 110: COMPUTER BASICS AND APPLICATIONS (2)

An introduction to the basics of personal computers and applications using Microsoft Office, including word processing, spreadsheets, presentations, email, and database management. Course is offered online and requires students to work independently.

CMPS 160: APPLIED COMPUTING I WITH PYTHON (4)

This introduction to computer science, developed by Google and their university partners, emphasizes problem solving and data analysis skills along with computer programming skills. Using Python, students will learn design, implementation, testing, and analysis of algorithms and programs. Within the context of programming, students will learn to formulate problems, think creatively about solutions, and express those solutions clearly and accurately. Problems will be chosen from real-world examples such as graphics, image processing, cryptography, data analysis, and video games. Prerequisite: q. Offered every fall. (Q)

CMPS 217: DATA STRUCTURES (4)

Students will study fundamental data structures and their applications to problem solving. Object-oriented programming (OOP) is introduced, and OOP techniques are explored, including inheritance, polymorphism, interfaces, and abstract classes. Software engineering concepts of design principles and testing methods are also covered. Prerequisite: CMPS 160 or permission. Offered every spring.

CMPS 260: APPLIED COMPUTING II: HOW TO THINK LIKE A DATA SCIENTIST (4)

Introduces students to the importance of gathering, cleaning, normalizing, visualizing and analyzing data to drive informed decision-making, no matter the field of study. Real-world datasets will be analyzed using a combination of tools and techniques, including spreadsheets, Python, and SQL. Students will learn to ask good, exploratory questions and develop metrics for designing a well-thought-out analysis. Presenting and discussing an analysis of datasets will be an important component of the course. Prerequisite CMPS 160. Offered every spring.

CMPS 290: INDEPENDENT STUDY (2 OR 4)

Independent study conducted below the advanced level. Application must be made with faculty prior to registration.

CMPS 325: MACHINE LEARNING (2)

An introduction to machine learning with a focus on understanding the fundamentals of neural network learning. Topics include Hebbian learning, single and multi-layer perceptrons, and data preparation techniques for improving learning. Open to first-year students. Prerequisite: MATH 241 or permission.

CMPS 335: DATA MINING TECHNIQUES (2)

Students will study supervised and unsupervised strategies for data analysis and predictive modeling, including decision trees, clustering, and association rule learning. Prerequisite/Corequisite: MATH 241 or permission.