Mathematics and Computer Science

In a society becoming ever more mathematical and computerized, the department seeks to provide courses which introduce all students to the ideas of mathematics and computer science. The department also provides advanced courses for those wishing to specialize in one of these areas. We teach these technical concepts in a manner consistent with the liberal arts aim of the College and in a way that encourages the student to use these abilities to serve others.

Mathematics Curriculum
The purpose of the mathematics curriculum is to present the basic concepts and methods in modern mathematics, to develop the student’s ability to think critically using the axiomatic method, and to apply these ideas to other disciplines. This major provides the mathematical background for students preparing for:

1. Licensure in secondary education
2. Graduate study in a mathematical discipline
3. A career in an area using mathematics, such as engineering, economics, statistics, or actuarial science

Students who complete a Mathematics major are granted a Bachelor of Science degree unless they request a Bachelor of Arts degree.

Calculus Readiness Assessment:
Students who plan to enroll in MATH 231 Calculus I must take Wheaton College’s Calculus Readiness Assessment. The Calculus Readiness Assessment (CRA) is a dynamic, online assessment that evaluates students’ strengths in arithmetic, algebra, and other pre-calculus skills. We will allow up to 3 hours for the test but it is typically completed in 60-90 minutes. It is accessible with a Wheaton student login at http://portal.wheaton.edu > New Undergrad Student > New Student Checklist. The assessment has a $15 fee, charged to a credit card.

Students should sign into the CRA area and take a practice test any time after July 1st, but prior to coming to campus. After taking this practice test, the CRA offers specialized learning modules through the student login to “brush up” on skills. We will administer the first official proctored attempt will be held one week into the semester. Students who need it, a second proctored attempt will be held one week into the semester. Students who earn below a 65 and need calculus for their program are encouraged to enroll in MATH 131 Precalculus.

Computer Science Curriculum
The curriculum in computer science presents the fundamentals of computation—the science underlying the computing technologies that have become so pervasive in contemporary society. This foundation better prepares one to make choices about how those technologies can and should be applied, at the organizational and societal levels, as well as individually. The deeper study required of a computer science major provides experience in the discipline’s methods of analysis and problem-solving. Furthermore, experimental work throughout the curriculum allows majors to develop skills in the design, analysis, and development of software systems, and so provides excellent preparation for a computing-related career, as well as for graduate study in computer science or engineering.

Students who complete a Computer Science major are granted a Bachelor of Science degree unless they request a Bachelor of Arts degree.

Faculty
Chair, Professor Mary Vanderschoot
Professors Robert Brabenec, Darcie Delzell, Paul Isihara, Stephen Lovett
Associate Professors Danilo Diedrichs, Hyunjoo Kim, Thomas VanDrunen
Assistant Professors Devin Pohly

Programs
- Computer Science Major (https://catalog.wheaton.edu/undergraduate/arts-sciences/mathematics-computer-science/computer-science-major)
- Computer Science Minor (https://catalog.wheaton.edu/undergraduate/arts-sciences/mathematics-computer-science/computer-science-minor)

Courses
Mathematics Courses
MATH 106. Mathematics for the Benefit of Mission and Society. (4 Credits)
An overview of how mathematics benefits the mission of the Church and society worldwide, with special regard for those who are suffering and/or marginalized. Examples will be drawn both from history and our contemporary world.

Tags: AAQR

MATH 107. Finite Mathematics and Applications. (4 Credits)
Designed to provide the mathematical tools that a college graduate is likely to encounter in his or her work. Core topics include systems of linear equations, mathematics of finance, and basic probability and statistics. Additional topics may include game theory for decision making, linear programming, iterated processes, or networks. Extensive use of spreadsheet programs. The course illustrates the relevance of mathematics to life applications by taking real or realistic examples from business, economics, social sciences, and life sciences.

Tags: AAQR
MATH 125. Mathematics for Elementary and Middle Grade Education. (4 Credits)
Numeration systems, set theory, the whole number, integer number, and rational number systems with associated axioms, operations, relations, and counting principles. Topics from geometry, measurement, logic, and probability and statistics. For elementary education majors only.

MATH 131. Precalculus. (4 Credits)
A course in elementary functions intended to prepare students for MATH 221 or MATH 231. Topics include the properties of the real number system, inequalities and absolute values, functions and their graphs, solutions of equations, polynomial functions, trigonometric functions, exponential, and logarithmic functions. Emphasis on using functions to model physical or social systems.

Tags: AAQR

MATH 211. Applied Calculus. (4 Credits)
This course covers the ideas of calculus, emphasizing applications to business and the social sciences. It includes a wider range of topics than MATH 231 but with less depth of coverage. Topics include limits, definitions and applications of the derivative and integral, and functions of one or more variables. Prerequisite: MATH 131 or Precalculus competence. This course does not count towards the mathematics major. Only one of MATH 221 or MATH 231 may be taken for credit.

Tags: AAQR

MATH 231. Calculus I. (4 Credits)
This course covers differential and integral calculus of functions of a single real variable, including trigonometric, exponential, and logarithmic functions. Derivatives and integrals are studied symbolically, graphically, and numerically. Applications of calculus are emphasized throughout the course. Three lectures, two hours drill. Prerequisite: MATH 131 or precalculus competence (see Calculus Readiness Assessment).

Tags: AAQR

MATH 232. Calculus II. (4 Credits)
Infinite series, polar coordinates and parametric curves. Three-dimensional geometry and vector algebra, functions of two variables, partial differentiation, double integration. Applications of these topics are emphasized throughout the course. Three lectures, two hours drill. Prerequisite: MATH 231 or 233 with a minimum grade of C-, or AP Calculus AB score of 4 or 5, or BC score of 3.

MATH 233. Calculus I B. (2 Credits)
This is a 2-hour course that covers the B-Quad material of MATH 231. It meets concurrently with MATH 231 in B-Quad. Three lectures, two hours drill. Prerequisite: AP Calculus AB score of 3 or BC score of 2.

Tags: AAQR

MATH 234. Calculus II B. (2 Credits)
This is a 2-hour course that covers the B-Quad material of MATH 232. Prerequisite: AP Calculus BC score of 4 or 5.

MATH 241. Introduction to Proofs. (2 Credits)
Propositional logic, quantifiers, elementary proof techniques and strategies. An introduction to set theory, including operations on sets, definition of functions, relations. Basic number theory including divisibility, primes, greatest common divider, Euclidean Algorithm. Induction and well-ordering. Permutations and combinations. Axiomatic systems. Prerequisite: MATH 232.

MATH 243. Discrete Mathematics and Functional Programming. (4 Credits)
Sets, logic, the nature of proof, induction, algorithms, algorithm correctness, relations, lattices, functions, and graphs. Functional programming and recursion using the ML programming language. May not be taken after MATH 341 or MATH 351.

Tags: AAQR

MATH 245. Linear Algebra. (4 Credits)
Starting with solving systems of linear equations, matrix algebra is used to explore vector spaces and linear transformations. Emphasis is given to bases, dimension, eigenvectors, and orthogonality. Prerequisite: MATH 231 or 233.

MATH 263. Introduction to Statistics. (4 Credits)
An introduction to statistics, sampling theory, and statistical decision making from a solid mathematical basis for non-mathematics majors. Topics chosen from discrete and continuous distributions, moments, hypothesis testing, correlation and multiple correlation, regression (linear, multivariate, logistic), ANOVA, contingency tables with tests for independence, sampling theory, and rudimentary non-parametric statistics. Students will use selected software packages for data processing and analysis. Prerequisite: MATH 131 or Precalculus knowledge.

Tags: AAQR

MATH 301. Intro to Upper-Level Math. (2 Credits)
Introduction to learning and communication processes used in upper-level mathematics: primary literature sources, presenting mathematics in writing and orally using specialized software. The vocation of a mathematician: ongoing research developments, professional opportunities in academia and in the industry. Prerequisite: MATH 231 or 233. For sophomore or junior math or applied math majors only.

MATH 302. Applied Project I. (2 Credits)
Submission of Applied Project proposal. Preliminary draft of research project including problem statement, scope of project, background, design and methodology in consultation with faculty project advisor(s). Prerequisite: MATH 301.

MATH 314. Problem Solving Seminar. (2 Credits)
Mathematical problem solving aimed at students who enjoy solving problems in a variety of areas of mathematics, and who would like to strengthen their creative mathematical thinking. Students are required to take the William Lowell Putnam Undergraduate Mathematics Competition. Prerequisites: MATH 232 or 234, and 245.

MATH 324. Methods of Teaching Mathematics. (2 Credits)
Theories and methods for teaching mathematics at the secondary level. Topics include cooperative learning, classroom management, and creative teaching ideas. Consideration of current math technology and curriculum standards. Required of mathematics majors in WheTEP prior to student teaching. Prerequisite: Acceptance to WheTEP.

MATH 325. Methods of Teaching Middle Grade Mathematics. (2 Credits)
Theories and methods for teaching mathematics at the middle grade level. Topics include effective teaching strategies, planning, and assessment of math content. Based on the Common Core State Standards for Mathematics and the Illinois Professional Teaching Standards. Prerequisite: Acceptance to WheTEP.

MATH 331. Vector Calculus. (2 Credits)
Vector algebra, properties of transformations, curves and surfaces, line, surface, and volume integrals, Green's, Stokes', and the divergence theorems. Prerequisite: MATH 232 or 234.
MATH 333. Differential Equations. (4 Credits)
An introduction into the theory, methods of solution, and selected applications of ordinary differential equations. Topics include first order equations, second order linear equations with constant coefficients, numerical analysis of ordinary differential equations, Laplace Transforms, series solutions, and systems of differential equations. Prerequisite: MATH 232 or 234.

MATH 341. Modern Algebra. (4 Credits)
An introduction to the theory of groups, rings, and fields. Topics in group theory include Lagrange's theorem, quotient groups, applications to geometry, public key cryptography, and finitely generated abelian groups. Topics in ring theory include ideals, quotient rings, and polynomial rings. Topics in field theory include field extensions, Euclidean construction problems, cubic and quartic equations. Prerequisite: MATH 245 or consent of instructor.

MATH 343. Discrete Mathematics. (4 Credits)
Basic and advanced topics selected from sets and logic, Boolean algebra, functions, algorithms, relations and recursion, combinatorics, graph theory, nature of proof, number theory and cryptography. Prerequisite: MATH 231, 233 or consent of instructor. Offered spring of even-numbered years.

MATH 351. Analysis I. (4 Credits)
Derivation of the properties of continuity, differentiability, integrability, and convergence by use of the limit concept and basic axioms of the real number field. Prerequisites: MATH 232 (or MATH 234) and MATH 245, or consent of instructor.

MATH 352. Complex Analysis. (4 Credits)
An introduction to functions of a complex variable. Topics include the algebra and geometry of complex numbers, mappings of the complex plane, elementary analytic functions, complex functions defined by power series, and differentiation and integration of complex functions. Prerequisite: MATH 331 (MATH 351 recommended). Offered spring of odd-numbered years.

MATH 362. Geometry. (4 Credits)
Selected topics from finite, affine, projective, Euclidean and non-Euclidean geometry from both the axiomatic and transformational approaches. Prerequisite: MATH 245. Offered spring of odd-numbered years.

MATH 363. Probability and Statistics I. (4 Credits)
An introduction to probability theory, including discrete and continuous distributions. Topics covered include independence, conditional probability, expectation, variance and covariance, random vectors, and the central limit theorem. Prerequisites: MATH 232 (or MATH 234) and MATH 245.

MATH 364. Mathematical Modeling. (4 Credits)
A course designed to develop an appreciation for, an understanding of, and a facility in the use of mathematics in the social and life sciences. Particular problems in political science, ecology, psychology, sociology, economics, anthropology, epidemiology, and business management provide the motivation for the development of tools and techniques employed throughout applied mathematics. Prerequisites: MATH 232 (or MATH 234) and MATH 245.

MATH 385. Topics in Applied Mathematics. (4 Credits)
A topic selected for each semester in which the course is offered that focuses upon a particular applied mathematics discipline in a way that brings important mathematical theory and methods to practice. Possibilities include Numerical Analysis, Dynamical Systems, Applied Linear Algebra, Operations Research, Cryptography, or Applied Discrete Math. Prerequisites: MATH 232 (or MATH 234) and MATH 245 or consent of instructor.

MATH 386. Topics in Statistics. (4 Credits)
A topic selected for each semester in which the course is offered that focuses upon a particular application in depth and goes beyond methods covered in MATH 363. Some possible topics include Bayesian Analysis, Machine Learning, Nonparametric Methods, Regression, or Structural Equation Modeling. Prerequisite: MATH 363.

MATH 394. Seminar. (2 Credits)
Faculty and student collaboration on a project of mutual interest. Limited enrollment - faculty approval required.

MATH 433. Partial Differential Equations. (4 Credits)
Partial differential equations (PDE's) are differential equations involving functions of multiple independent variables and partial derivatives. PDEs are ubiquitous in the natural sciences, especially physics and engineering, appearing in mathematical models that vary in time and space such as diffusion, fluid flow, vibrating strings and membranes, waves (sound, electromagnetic), transport phenomena, and quantum mechanics. The course focuses on analytical methods for solving PDEs with extensions into Fourier theory, L2 theory, and Sturm-Liouville theory. Prerequisites: MATH 245 and 333.

MATH 441. Algebra II. (4 Credits)
Advanced group theory, including group actions and Sylow topics. Module theory with selected applications. Galois theory of field extensions. Multivariable polynomial rings with applications of Groebner bases. Introduction to the concept of categories. Prerequisite: MATH 341. Offered fall of even-numbered years.

MATH 451. Analysis II. (2 or 4 Credits)
Study of topics from real analysis. Prerequisite: MATH 351. Alternate years.

MATH 463. Probability & Statistics II. (4 Credits)
Starting from a review of probability distributions and their underlying assumptions and features, this course focuses upon statistical inference and data analysis. Topics will be chosen from parametric hypothesis testing, ANOVA, contingency tables and tests for independence, regression techniques and some Bayesian/non-parametric methodology. Prerequisite: MATH 363.

MATH 485. Advanced Topics in Mathematics. (4 Credits)
Selected topics from advanced mathematics, such as Number Theory, Partial Differential Equations, or Differential Geometry. Prerequisite: MATH 245.

MATH 493. Mentored Research Seminar. (2 or 4 Credits)
Faculty and student collaboration on a project of mutual interest. Limited enrollment - faculty approval required.
MATH 494. Senior Seminar. (2 Credits)  
494-1. (Section 1) "Mathematics and Its Foundations". A study of the historical development of the main ideas in mathematics, with an emphasis on the nineteenth-century developments in axiomatics, logic, number and set theory which led to the twentieth-century developments in the philosophy and foundations of mathematics. As a Christ at the Core Capstone course, students will actively participate in this learning experience by extensive reading, group discussions and several written assignments. Prerequisites: Senior standing in the mathematics major, MATH 341 and 351; 494-2. (Section 2) "Applied Mathematics Senior Seminar". Christ at the Core Capstone course integrating the applied math program with liberal arts learning. Historical survey and current applications of important mathematical equations and models. Applied project work and oral presentations connecting applied mathematics with other disciplines, humanitarian organizations, and/or faith-based mission in under-served communities, and also with Christ at the Core learning. Reflection on diverse and distinctive callings of Christian mathematicians and the Christ at the Core student calling to grow in knowledge, wisdom and Christian character. Prerequisites: Senior standing in the applied math major including MATH 302, or consent of instructor.

MATH 495. Problems In Mathematics. (1 to 4 Credits)  
Independent study for senior majors. A maximum of two hours can be applied to the major.

MATH 496. Internship. (1 to 4 Credits)  
Graded pass/fail. Prerequisite: junior or senior standing with Mathematics or Applied Mathematics major.

Computer Science Courses

CSCI 233. Introduction to Scientific Computing. (4 Credits)  
Introduction to programming and computer analysis of data for scientific applications. Scripting and treatment of numerical issues are integrated into the content stream.

CSCI 235. Programming I: Problem Solving. (4 Credits)  
A first course in computer programming for beginners. Structured and object-oriented programming in Java or a similar programming language. Types, control structures, methods, and recursion; objects, classes, interfaces, encapsulation and polymorphism; exceptions, library classes, file I/O, linked lists, and graphical user interfaces.  
Tags: AAQR

CSCI 243. Discrete Mathematics and Functional Programming. (4 Credits)  
Sets, logic, the nature of proof, induction, algorithms, algorithm correctness, relations, lattices, functions, and graphs. Functional programming and recursion using the ML programming language. May not be taken after MATH 341 or MATH 351.  
Tags: AAQR

CSCI 245. Programming II: Object-Oriented Design. (4 Credits)  
A gateway to the computer science major, introducing a range of themes in the field of computer science. Object-oriented programming in Java or a similar language: code reuse with composition and inheritance; generic types; design patterns. Software development: development tools, attributes of good design. Algorithmic analysis; searching and sorting algorithms. Abstract data types: stacks, queues, trees, hashing; linked vs array-based implementation. Systems programing in C; pointers and dynamic allocation; model of machine memory, organization, and execution. Prerequisite: CSCI 235 or departmental approval.

CSCI 335. Software Development. (4 Credits)  
Principles and practices of software development including design patterns, validation and testing, coordination of team projects. Introduction to databases and user interface design. Professional issues in computing. Prerequisite: CSCI 245; Pre or Corequisite: CSCI 243.

CSCI 345. Data Structures & Algorithms. (4 Credits)  
Formal and experimental approaches to verifying algorithms’ correctness and analyzing their efficiency. Abstract data types and their implementations. Efficient implementations of maps using balanced binary search trees and hash tables. Graph algorithms. Dynamic programming. Prerequisites: CSCI 243 and CSCI 245.

CSCI 351. Introduction to Computer Systems. (4 Credits)  
An introduction to low-level systems issues from the perspective of the programmer. Representation of both data and program as produced by a compiler; hardware support for memory, input/output, and parallelism; fundamental ideas in operating systems and networking. Prerequisite: CSCI 245.

CSCI 357. Networking. (4 Credits)  
Examination of the fundamental problems in computer internetworking, from the link to application levels, with particular attention to the Internet protocols. Issues include naming/addressing, error-handling, routing, and decentralized control. Prerequisite: CSCI 351.

CSCI 361. Computer Graphics. (4 Credits)  
Introduction to graphical programming environments, OpenGL libraries. Rendering three-dimensional images, transformations, windowing, clipping, shading, and image enhancements. Prerequisite: CSCI 345.

CSCI 365. Programming Language Concepts. (4 Credits)  
A survey of the design and implementation of programming languages: grammars, parsing, and abstract syntax; compilers, interpreters, and other language systems; type-checking and other static analyses; formal semantic specifications; implementation of imperative, functional, and object-oriented language features; type-soundness proofs; tail form and continuation passing style. Prerequisites: CSCI 335 and CSCI 351.

CSCI 371. Database Management Systems. (4 Credits)  

CSCI 384. Computational Linguistics. (4 Credits)  
An exploration of big ideas in computational linguistics, natural language processing, and/or language technologies. Language models, n-grams, information theory and entropy, and semantics. Applications of computational linguistics such as part-of-speech tagging, authorship attribution, automatic translation, and sentiment analysis. Prerequisite: CSCI 345 (non-majors without the prerequisite may enroll with departmental approval).

CSCI 394. Seminar. (2 or 4 Credits)  
Selected topics in Computer Science at each offering, including such subjects as object-oriented design, e-commerce, human computer interface, networking services. May be taken again when a different topic is offered. Prerequisite: Departmental approval.
CSCI 445. Analysis of Algorithms. (4 Credits)
An introduction to algorithmic efficiency and to techniques for the design and analysis of efficient algorithms. General topics include review of asymptotics, algorithm design techniques (such as divide-and-conquer, dynamic programming, and greedy algorithms), graph algorithms, languages and automata, and NP-completeness. Prerequisite: CSCI 345.

CSCI 455. Operating Systems. (4 Credits)
Dynamic process activation, system structure, abstract machines, kernels, performance evaluation, memory management, processor management, time management, recovery procedures, file systems, security, scheduling, device management, networks. Prerequisites: CSCI 335 and CSCI 351.

CSCI 493. Mentoring Seminar. (2 or 4 Credits)
Faculty and student collaboration on a project of mutual interest. Limited enrollment - faculty approval required.

CSCI 494. Social and Ethical Issues in Computing. (2 Credits)
A study of the ways in which the computer and communications revolution is changing society to develop an awareness of and sensitivity to the ethical issues that arise in computer science and related professions. Prerequisite: Senior standing in the major.

CSCI 495. Independent Study. (1 to 4 Credits)
An individually adapted study of any aspect of computing science or its relationship to other fields of study.

CSCI 496. Internship. (2 or 4 Credits)
Graded pass/fail. Prerequisite: junior or senior standing with Computer Science major. May repeat once for a total of 4 hours.