Mathematics and Computer Science

The Mathematics and Computer Science Department at Benedictine College is committed to maintaining a curriculum that provides students with the necessary tools to enter a career in their field with a broad, solid knowledge of mathematics or computer science. Our students are provided with the knowledge, analytical, and problem solving skills necessary to function as mathematicians or computer scientists in our world today.

The mathematics curriculum prepares students for graduate study, for responsible positions in business, industry, and government, and for teaching positions in secondary and elementary schools. Basic skills and techniques provide for entering a career as an actuary, banker, bio-mathematician, computer programmer, computer scientist, economist, engineer, industrial researcher, lawyer, management consultant, market research analyst, mathematician, mathematics teacher, operations researcher, quality control specialist, statistician, or systems analyst.

Computer science is an area of study that is important in the technological age in which we live. The computer science major at Benedictine College provides a balanced approach to the discipline, treating computing both as an art and as a tool for varied use. The major prepares students for graduate study in the field of computer science or for employment in an ever-expanding spectrum of occupations dependent upon computing. The minor provides a useful addition to many areas of study, including mathematics, science, business, and mass communications.

Requirements for a major in Mathematics:

Ma 131, Calculus I
Ma 132, Calculus II
Ma 233, Calculus III
Ma 250, Linear Algebra
Ma 255, Discrete Mathematical Structures I
Ma 315, Probability and Statistics
Ma 356, Modern Algebra I
Ma 360, Modern Algebra II or
  Ma 480, Introduction to Real Analysis
Ma 488, Senior Comprehensive
Ma 493, Directed Research
six hours of upper-division math electives
and Cs 114, Introduction to Computer Science I or Cs 230, Programming for Scientists and Engineers

Requirements for a major in Computer Science:

Cs 114, Introduction to Computer Science I
Cs 115, Introduction to Computer Science II
Ma 255, Discrete Mathematical Structures I
Cs 256, Discrete Mathematical Structures II
Cs 300, Information & Knowledge Management
Cs 351, Algorithm Design and Data Analysis
Cs 421, Computer Architecture
Cs 440, Operating Systems and Networking
Cs 488, Senior Comprehensive
Cs 492, Software Development and Professional Practice
Cs 493, Senior Capstone
And one course in mathematics selected from Ma 131 or Ma 211.

The requirements for a minor in Mathematics:

Ma 131, Calculus I
Ma 132, Calculus II
Ma 250, Linear Algebra or
  Ma 255, Discrete Mathematical Structures I
and six additional hours of mathematics, three of which must be upper-division.

The requirements for a minor in Computer Science:

Cs 114, Introduction to Computer Science I
Cs 115, Introduction to Computer Science II
Ma 255, Discrete Mathematical Structures I
and two courses selected from Cs 256, Cs 300, Cs 351, Cs 421, or Cs 440

For each of the above curricula, the student's upper-division program is to be planned with an advisor from the department and approved by the chair of the department.

Transfer students majoring in Mathematics or Computer Science must take a minimum of 40% of the coursework required for the major at Benedictine College.

Transfer students pursuing a minor in Mathematics or Computer Science must take a minimum of 25% of the coursework required for the minor at Benedictine College.

Admission to the Mathematics Major:

In order to be admitted to the mathematics major, a student must have completed at Benedictine College at least one required mathematics course from the list above, and must have a grade point average of at least 2.7 in mathematics courses at Benedictine College.

Prospective Mathematics Teachers:

Those preparing to teach mathematics in elementary schools should choose Ma 211, Ma 110, and Ma 111. In addition, those who choose mathematics as an area of concentration should take Ma 131, Ma 255, and Cs 114.

Those preparing to teach mathematics in secondary schools must complete requirements for a major in mathematics that includes Ma 360 and Ma 465. In addition, they must take Ma 290 and Ma 457. The prospective secondary teacher should consult with the chair of the department regarding additional mathematics content assessments that must be completed prior to student teaching. The secondary teacher is required to take education courses for a B.A. in Secondary Education to receive certification and should consult with the chair of the Department of Education.

Recommendations: A student should not attempt a mathematics or computer science course unless he or she received at least a 'C' in its prerequisite. For a natural world foundation, Pc 210 is recommended for mathematics majors.

Those students planning to enroll in graduate school in mathematics should include both Ma 360 and Ma 480 in their course of study.

Placement Procedure Information:

The Department of Mathematics and Computer Science has set up placement procedures to help students enroll in mathematics courses in which they will more likely be successful.

For further information on placement procedures, contact the chair of the Department of Mathematics and Computer Science.

Cs 101
Computer Science Fundamentals (3) (F)
This course provides an introduction to computer science and programming fundamentals for students who have had no previous programming experience. Topics include hardware, networks, databases, artificial intelligence, operating systems, and the Internet. The students will use a high level programming language to learn about variables, conditional execution, user interaction, looping, and functions. There is an integral laboratory component. (QA)

Cs 114
Introduction to Computer Science I (4) (S)
This course introduces the fundamental concepts of computer programming from an object-oriented perspective. Topics covered include simple data types and some simple data structures, message passing, subclasses, inheritance, polymorphism, and conditional and iterative control structures. Through study of object design, this course also introduces the basics of software engineering. A closed lab is an integral part of this course. *Prerequisite: Ready to take Pre-calculus or higher.* (QA)

Cs 115
Introduction to Computer Science II (4) (F)
This course continues the introduction of object-oriented programming begun in Cs 114, with an emphasis on algorithms, data structures, software engineering, and the social context of computing. A closed lab is an integral part of the course. *Prerequisite: Cs 114.*

Cs 198
Special Topics (1–4)
These are topics not included in the regular catalogue. They may be taken more than once if the subject matter varies sufficiently. *Prerequisite: Permission of instructor.*

Cs 200
Programming Short Course (2) (D)
This course is designed to provide the student with a working knowledge of a particular programming language. Students write programs of moderate complexity in the given language. May be taken more than once if the programming language is different. *Prerequisite: Permission of instructor.*

Cs 230
Programming for Scientists and Engineers (3) (S)
This course introduces the fundamentals of computer programming using C++. The focus of the course is programming for scientific and engineering needs. Topics include basic data types and data structures, pointers, expressions, iterative and conditional control structures, visualization, and object-oriented programming. *Corequisite: Ma 131. Students who have received credit for Cs 115 may not take this course without permission of instructor.*

Cs 256
Discrete Mathematical Structures II (3) (S)
This course continues the discussion of discrete mathematical structures introduced in Ma 255, focusing particularly on topics that contribute to further study of computer science as a discipline. Topics include relations, matrices, computational complexity, elementary computability, discrete probability, recurrence relations, and a continuation of the study of graph theory begun in the previous course. *Prerequisites: Ma 255, Cs 114.*

Cs 300
Information and Knowledge Management (4) (F)
This course uses the idea of information as a unifying theme to investigate a range of issues focusing on database systems design and management. Topics include ER modeling, relational algebra and calculus, SQL, functional dependency theory, normalization techniques, query processing and optimization, and other issues such as concurrency and security. A closed lab is an integral part of the course. *Prerequisites: Cs 115 and Ma 255.*

Cs 351
Algorithm Design and Data Analysis (4) (S)
This course introduces formal techniques to support the design and analysis of algorithms, focusing on both the underlying mathematics theory and practical considerations of efficiency. Topics include asymptotic complexity bounds, techniques of analysis, and algorithmic strategies. A closed lab is an integral part of the course. *Prerequisites: Cs 115 and Cs 256.*

Cs 398
Special Topics (1–4)
These are topics not included in the regular catalogue. They may be taken more than once if the subject matter varies sufficiently. *Prerequisite: Permission of instructor.*

Cs 421
Computer Architecture (4) (F)
This course introduces students to the organization and architecture of computer systems, beginning with the standard von Neumann

model and then moving forward to more recent architectural concepts. Topics include digital logic, data representations, as well as multiprocessors and alternate and contemporary architectures. A closed lab is an integral part of the course. *Prerequisites: Cs 115 and Ma 255.*

Cs 440
Operating Systems and Networking (4) (S)
This course introduces the fundamentals of operating systems together with the basics of networking and communications. The main topics include basic operating systems principles, concurrency, scheduling, memory management, security, and basics of networking and communications including World Wide Web technologies. A closed lab is an integral part of the course. *Prerequisites: Cs 115 and Ma 255.*

Cs 479
Internship in Computer Science (1–4)
This program offers the student an opportunity for hands-on experience. It involves practical application of course work on a project in a computer science discipline. This is usually done off campus. The student will have a qualified supervisor at the site of the experience in addition to a faculty advisor. *Prerequisite: Permission of chair of the department.*

Cs 488
Senior Comprehensive (cr)

Cs 492
Software Development and Professional Practice (3) (F)
This course combines a range of topics integral to the design, implementation, and testing of a medium-scale software system with the practical experience of implementing such a project as a member of a programming team. This course also treats material on professionalism and ethical responsibilities in software development and human-computer interaction. *Prerequisites: Senior computer science major and two upper-division computer science courses.*

Cs 493
Senior Capstone (2) (S)
This course, a continuation of Cs 492, provides a structured opportunity for the students to complete the software project they designed and began implementing in Cs 492. Formal presentations, both oral and written, of the students' work are integral components. *Prerequisite: Cs 492.* (OC, VC, WC)

Cs 499
Independent Study (credit arranged)
Prerequisite: Permission of the department chair.

Ma 104
College Algebra (3) (D)
This course covers analytical geometry and elementary functions, namely polynomial, rational, logarithmic and exponential functions. *Prerequisite: Approval through placement.* (QA)

Ma 110
Mathematics for Elementary Teachers I (4) (F)
The course examines the structures and properties of mathematics while focusing on the development of problem-solving skills. Emphasis is placed on acquiring an understanding of basic mathematical concepts including numeration, the fundamental operations of arithmetic, fractions, proportional reasoning, and functions. *Prerequisite: Intend to major in Elementary Education.* (QA)

Ma 111
Mathematics for Elementary Teachers II (3) (S)
This course, a continuation of Ma 110, examines the structures and properties of mathematics while focusing on the development of problem-solving skills. Emphasis is

placed on acquiring an understanding of basic mathematical concepts including probability and statistics, geometry, and measurement. *Prerequisite: Intent to major in Elementary Education.* (QA)

Ma 124
Pre-Calculus (4) (D)
This course is designed for the student with good algebra skills but lacking adequate preparation to enter calculus. The course focus is on functions modeling change. Stress is placed on conceptual understanding and multiple ways of representing mathematical ideas. The goal is to provide the students with a clear understanding of the function concept and the use of functional notation. Exponential, logarithmic, trigonometric, polynomial and rational functions are covered. *Prerequisite: Intend to take Ma 131, but lack necessary skills.* (QA)

Ma 131
Calculus I (4) (B)
This course covers functions, analytical geometry, limits and continuity, differential and integral calculus of algebraic and transcendental functions and applications of differential calculus. *Prerequisites: Ma 124 or its equivalent.* (QA)

Ma 132
Calculus II (4) (S)
This course covers further integration techniques and applications, limits and approximations, sequences, series and improper integrals, and parametric equations. *Prerequisite: Ma 131.* (QA)

Ma 198
Special Topics (1–4)
These are topics not included in the regular catalogue. They may be taken more than once if the subject matter varies sufficiently. *Prerequisite: Permission of instructor.*

Ma 211
Applied Statistics (4) (B)
This course is designed primarily for students in disciplines other than mathematics and the physical sciences. After a short discussion of descriptive statistics and elementary probability, the course emphasizes inferential statistics. Topics include measures of central tendency and dispersion; random variables and probability distributions; statistical inference from large and small samples, linear regression and correlation. Note: Credit will not be given if the student has taken Ba 265. *Prerequisite: Ma 104 or its equivalent.* (QA)

Ma 233
Calculus III (4) (F)
This course covers geometry of n-space, functions of several variables, limits and continuity, differential and integral calculus of functions of several variables, and vector analysis. *Prerequisite: Ma 132.* (QA)

Ma 250
Linear Algebra (3) (S)
This course covers linear equations and matrices, vector spaces, determinants, linear transformations and matrices, characteristic equations, eigenvectors and eigenvalues, and related topics. *Prerequisite: Ma 131.* (QA)

Ma 255
Discrete Mathematical Structures I (3) (F)
This course introduces students to non-continuous models that are important in the application of mathematics to various disciplines. The principal topics treated are mathematical logic and set language, functions, Boolean expressions and combinational circuitry, counting principles, graph theory, and an introduction to elementary number theory. Attention is given to various methods of proof, in particular to mathematical induction. *Prerequisite: Approval through placement.* (QA)

Ma 290
History of Mathematics (2) (S)
This course is an introduction to the history of mathematics designed for mathematics and mathematics education majors. Emphasis is placed on the historical development of those topics in mathematics that appear in the high school and undergraduate curriculum. *Prerequisites: Sophomore standing and Ma 131 (Calculus I).* (WP)

Ma 310
Differential Equations (3) (S)
This course covers first- and second-order differential equations, including linear and nonlinear equations, Laplace transforms, series solutions, and numerical techniques. *Prerequisite: Ma 233.*

Ma 315
Probability and Statistics (3) (F)
This course covers probability and statistical inference, discrete and continuous random variables, distributions, hypothesis testing, correlation and regression, testing for goodness of fit. *Prerequisite: Ma 233.*

Ma 331
Numerical Computation (3) (D)
This course covers finite differences, numerical differentiation and integration, linear systems and matrices, difference equations, error analysis and related topics. *Prerequisites: Ma 250, and either Cs 114 or Cs 230, or permission of the instructor.*

Ma 345
Introduction to Cryptography (3) (S)
This course provides students with an introduction to the mathematical theory of cryptography, the practice of encoding information for the purpose of keeping it secret. Topics include classical, stream, and block ciphers, the Data Encryption Standard (DES), the Advanced Encryption Standard (AES), public-key cryptography, and methods of cryptanalysis. The course will touch on multiple areas of mathematics as needed, including matrix algebra, modular arithmetic, finite fields, and elementary probability theory. *Prerequisite: Ma 255 or permission of instructor.*

Ma 356, Ma 360
Modern Algebra I and II (3, 3) (F, S)
This two-semester sequence of courses provides an in-depth introduction to some of the structures and techniques of modern algebra. The principal subjects are the theory of groups, rings, and fields. Specific examples of these will be discussed. For each structure we will discuss the appropriate substructure, quotient structure, and other topics such as homomorphisms. Current applications of algebra are also discussed. *Prerequisites: Ma 250 and Ma 255.*

Ma 398
Special Topics (1–4)
Topics not included in the regular catalog, usually treated in a lecture/discussion format. May be taken more than once if subject matter varies sufficiently. *Prerequisite: Permission of instructor.*

Ma 457
Secondary School Mathematics Curriculum and Methodology (2) (F)
This course is designed to acquaint the future mathematics teacher with an overview of the methodology of teaching mathematics at the middle and secondary school level. Topics include but are not limited to planning and teaching effective lessons, assessment, and the use of technology in instruction. Available resources are examined in an effort to generate an enthusiastic and creative approach to teaching. Application of concepts in twenty hours of field experience is required. *Prerequisites: Enrollment in Secondary Mathematics Education and Ed 257.*

Ma 465
Modern Geometries (3) (F)
This course covers foundations and axiomatics, Euclidean and non-Euclidean geometries, transformation geometry, projective geometry, and the geometry of inversion. *Prerequisites: Ma 250 and Ma 255.*

Ma 480
Introduction to Real Analysis (3) (S)
This course covers the real number system, metric spaces, continuity, sequences and series, differentiation, integration, sequences and series of functions. *Prerequisites: Ma 233 and Ma 255.*

Ma 488
Senior Comprehensive (cr)

Ma 493
Directed Research (2) (F)
Prerequisites: Junior or senior mathematics major and permission of the department chair. (OC, VC, WC)

Ma 499
Independent Study (credit arranged)
Prerequisite: Permission of the department chair.

Suggested sequence of courses for a bachelor's degree in Mathematics

	Freshman Year		
En 101, English Composition	3	Ma 132, Calculus II	4
Ma 131, Calculus I	4	Foreign Language	4
Foreign Language	4	Historical Foundation	3
Th 101, Introduction to Theology	3	Cs 114, Intro to Computer Science I or Natural World Foundation	4
Pe 115, Wellness for Life	1		
Gs 150, BC Experience	cr	Pe Activity course	1
	15		16
	Sophomore Year		
Ma 233, Calculus III	4	Ma 250, Linear Algebra	3
Ma 255, Discrete Math. Structures I	3	Aesthetic Foundation	3
Natural World Foundation (with lab)	4	Faith Foundation	3
Ph 175, Principles of Nature	3	Historical Foundation	3
Person and Community Foundation	3	Natural World Foundation or Cs 114	4
	17		16
	Junior Year		
Ma 356, Modern Algebra I	3	Ma 360, Modern Algebra II or Ma 480, Intro to Real Analysis	3
Ma 315, Probability and Statistics or Mathematics elective	3	Mathematics elective	3
Electives	4	Electives	4
Aesthetic Foundation	3	Faith Foundation	3
Philosophical Inquiry Foundation	3	Philosophical Inquiry Foundation	3
	16		16
	Senior Year		
Mathematics elective or Ma 315, Probability and Statistics	3	Ma 480, Intro to Real Analysis or Ma 360, Modern Algebra II	3
Ma 493, Directed Research	2	Mathematics elective	3
Electives	11	Electives	10
		Ma 488, Senior Comprehensive	cr
	16		16

Suggested sequence of courses for a bachelor's degree in Mathematics with secondary school teaching certification

Freshman Year

En 101, English Composition	3	Ma 132, Calculus II	4
Ma 131, Calculus I	4	Foreign Language	4
Foreign Language	4	Cs 114, Intro to Computer Science I or Natural World Foundation	4
Th 101, Introduction to Theology	3	Ed 200, Introduction to Education	2
Py 100, General Psychology	3	Ed 201, Intro to Educ Field Experience	1
Gs 150, BC Experience	cr	Hi 105 or Hi 106, World Civilization	3
	17		18

Sophomore Year

Ma 233, Calculus III	4	Ma 250, Linear Algebra	3
Ma 255, Discrete Math. Structures I	3	Ed 222, Psych of Indv with Excep or Mathematics elective	3
Ph 175, Principles of Nature	3	Aesthetic Foundation	3
Pe 115, Wellness for Life	1	Faith Foundation	3
Ed 257, Gen Secondary Methods/Media	2	So 290, World Geography	3
Ed 258, Gen Secondary Methods Prac	1	Philosophical Inquiry Foundation	3
Hi 212 or Hi 213, U.S. History	3		
	17		18

Junior Year

Ma 356, Modern Algebra I	3	Ma 360, Modern Algebra II	3
Ed 220, Psychoeducational Development	3	Mathematics elective (or Ed 222)	3
Ma 315, Probability and Statistics or or Ma 465, Modern Geometries	3	So 354, Soc. of Race & Ethnic Relations	3
Ma 290, Math History or Ma 457, Secondary Math Curriculum	2	Ed 332, Teaching Reading in the Content Areas	2
Natural World Foundation (with lab)	4	Ed 451, Philosophy of Education	3
Aesthetic Foundation	3	Faith Foundation	3
		Pe Activity course	1
	18		18

Senior Year

Ma 493, Directed Research	2	Ed 460, Personal and Social Well Being	3
Ma 465, Modern Geometries or Ma 315, Probability and Statistics	3	Ed 462, Classroom Management	2
Ma 457, Secondary Math Curriculum or Ma 290, Math History	2	Ed 470, Student Teaching Seminar	1
Ed 312, School as Community	3	Ed 496, Supervised Student Teaching in Secondary Schools	10
Ed 313, School as Community Research and Field Experience	1	Ed 488, Senior Comp/PLT	cr
Electives	6		
Ma 488, Senior Comprehensive	cr		
	17		16

Suggested sequence of courses for a bachelor's degree in Computer Science

Freshman Year

Cs 101, Comp Sci Fund (suggested)	3	Cs 114, Intro to Computer Science I	4
Ma 131, Calculus I (optional) or Natural World Foundation (with lab)	4	Th 101, Introduction to Theology	3
Foreign Language	4	Foreign Language	4
En 101, English Composition	3	Person and Community Foundation	3
Pe 115, Wellness for Life	1	Ph 175, Principles of Nature	3
Pe Activity course	1		
Gs 150, BC Experience	cr		
	16		17

Sophomore Year

Cs 115, Intro to Computer Science II	4	Cs 256, Discrete Math. Structures II	3
Ma 255, Discrete Math. Structures I	3	Ma 211, Applied Statistics (optional) or Natural World Foundation (with lab)	4
Historical Foundation	3	Aesthetic Foundation	3
Philosophical Inquiry Foundation	3	Faith Foundation	3
Natural World Foundation	4	Historical Foundation	3
	17		16

Junior Year

Cs 300, Information & Knowledge Mgt or Cs 421, Computer Architecture	4	Cs 351, Algorithm Design & Analysis or Cs 440, Operating Sys. & Network	4
Elective	3	Electives	12
Aesthetic Foundation	3		
Faith Foundation	3		
Philosophical Inquiry Foundation	3		
	16		16

Senior Year

Cs 421, Computer Architecture or Cs 300, Info. & Knowledge Mgt.	4	Cs 440, Op. Systems & Network or Cs 351, Algorithm Design & Anal.	4
Cs 492, Software Dev. & Prof. Practice	3	Cs 493, Senior Capstone	2
Electives	9	Cs 488, Senior Comprehensives	cr
		Electives	9
	16		15