

Mathematics and Computer Science

FACULTY: Martha Gady (Chair), Lyle Cochran, Rod Hansen, Kent Jones, Susan Mabry, Rick Otteson

mathcomputersci@whitworth.edu

Requirements for a Mathematics Major, B.A. (39)

MA 110	Calculus I	4
MA 111	Calculus II	4
MA 210	Calculus III	4
MA 256	Elementary Probability and Statistics	3
MA 316	Discrete Mathematics	3
MA 330	Linear Algebra	3
CS 171	Computer Science I	3
CS 172	Computer Science II	3
Four of the following upper-division courses		12
MA 317	Introduction to Complex Variables	
MA 340	Advanced Calculus I	
MA 341	Advanced Calculus II	
MA 350	Numerical Analysis	
MA 360	Number Theory	
MA 365*	Modern Geometry	
MA 410	Algebraic Structures	
MA 430W	Graph Theory and Combinatorics	
MA 456	Mathematical Statistics I	
MA457	Mathematical Statistics II	
MA 481	Topics Seminar	

*This course is required for students seeking teacher certification.

Required for teacher certification:

EDU454	Mathematics in Secondary School	2
--------	---------------------------------------	---

Requirements for a Mathematics Major, B.S. (51-53)

MA 110	Calculus I	4
MA 111	Calculus II	4
MA 210	Calculus III	4
MA 316	Discrete Mathematics	3
MA 330	Linear Algebra	3
MA 340	Advanced Calculus I	3
MA 341	Advanced Calculus II	3
MA 430W	Graph Theory and Combinatorics	3
CS 171	Computer Science I	3
CS 172	Computer Science II	3
Four of the following upper-division courses		12
MA 317	Introduction to Complex Variables	
MA 350	Numerical Analysis	
MA 360	Number Theory	
MA 365*	Modern Geometry	
MA 410	Algebraic Structures	
MA 456	Mathematical Statistics I	
MA457	Mathematical Statistics II	
MA 481	Topics Seminar	
PS 357	Math Methods for Engineers/Scientists	

Two courses as follows: 6-8
 PS 151 and 153 General Physics I and II, or
 EC 210 and 211 Microeconomics and Macroeconomics
 *This course is required for students seeking teacher certification.
 Required for teacher certification:
 EDU454 Mathematics in Secondary School 2

Requirements for a Quantitative Analysis Major, B.A. (51)

MA 110	Calculus I	4
MA 111	Calculus II	4
MA 210	Calculus III	4
MA 256	Elementary Probability and Statistics	3
MA 330	Linear Algebra	3
MA 456	Mathematical Statistics I	3
MA 457	Mathematical Statistics II	3
CS 171	Computer Science I	3
CS 172	Computer Science II	3
CS 301	Internet Applications Development	3
Two of the following:		6
CS 313	Networks	
CS 373	Data Structures	
CS 374	Database Management	
EC 210	Microeconomics	3
EC 211	Macroeconomics	3
BU 318W	Marketing	3
BU 357	Financial Management	3

Recommended:

MA 316	Discrete Mathematics
MA 430	Graph Theory and Combinatorics

Note: A student may not pursue a major in mathematics and quantitative analysis.

Requirements for a Computer Science Major, B.A. (54) (Business Option)

CS 171	Computer Science I	3
CS 172	Computer Science II	3
CS 271	Object-Oriented Programming	3
CS 278	Computer Organization and Assembler Programming	3
CS 373	Data Structures and Algorithm Analysis	3
CS 374	Database Management	3
CS 472W	Software Engineering	3
CS 475	Operating Systems	3
BU 230	Financial Accounting	4
BU 231	Managerial Accounting	4
BU 333	Accounting Systems and Theory	3
BU 374	Principles of Management	3
BU 376	Operations Management	3
EC 210	Microeconomics	3
EC 211	Macroeconomics	3
MA 256	Elementary Probability and Statistics	3

One of the following: 4

MA 108	Finite Math for Social Sciences
MA 110	Calculus I

Recommended:

CS 313	Networks
CS 372	Java Programming

Requirements for a Computer Science Major, B.A. (52)

(Network Systems Option)

CS 171	Computer Science I	3
CS 172	Computer Science II	3
CS 271	Object-Oriented Programming	3
CS 278	Computer Organization and Assembler Programming	3
CS 313	Networks	3
CS 314	Microsoft® Networks	3
CS 315	Multi-platform Networks	3
CS 373	Data Structures and Algorithm Analysis	3
CS 374	Database Management	3
CS 401	Computer Architecture	3
CS 472W	Software Engineering	3
CS 475	Operating Systems	3
	Three upper-division computer science courses	9
	One of the following:	4
MA 108	Finite Math for Social Sciences	
MA 110	Calculus I	
MA 256	Elementary Probability and Statistics	3

Requirements for a Computer Science Major, B.S. (56)

CS 171	Computer Science I	3
CS 172	Computer Science II	3
CS 271	Object-Oriented Programming	3
CS 278	Computer Organization and Assembler Programming	3
CS 373	Data Structures and Algorithm Analysis	3
CS 374	Database Management	3
CS 401	Computer Architecture	3
CS 472W	Software Engineering	3
CS 475	Operating Systems	3
MA 110	Calculus I	4
MA 111	Calculus II	4
MA 330	Linear Algebra	3
PS 151	General Physics I	4
PS 153	General Physics II	4
PS 373	Electronics	4
	One of the following:	3
CS 313	Networks	
CS 357	Computer Graphics	
CS 457	Artificial Intelligence	
	One of the following:	3
MA 350	Numerical Analysis	
MA 410	Algebraic Structures	
MA 430W	Graph Theory/Combinatorics	
	Recommended:	
MA 210	Calculus III	
MA 256	Probability and Statistics	
CS 315	Multi-platform Networks	
CS 372	Java Programming	

Computer Science Honors Program

The intent of the Honors Program is to provide motivated students with the social and academic activities necessary to foster their growth as individuals and their commitment to excellence and service to others. Students enrolled in the program must complete a major in computer science. To qualify for graduation as a Computer Science Honors Program graduate, candidates must successfully complete the following requirements by the end of their senior year. Each requirement will be documented in the student's portfolio.

1. Apply for admission into the Honors Program after completing CS 172.
2. Maintain an overall cumulative GPA of 3.5 or above.
3. Complete the professional learning requirement by fulfilling each of the following activities:
 - Join either the Association for Computing Machinery (ACM) or the IEEE Computer Society.
 - Regularly attend ACM/IEEE Computer Society meetings.
 - Participate in the planning and presentation of a minimum of two ACM meetings. Document the meeting plans and presentations in the portfolio.
 - Participate in ACM/IEEE activities (i.e. social, special topics seminars, etc.)
4. Complete the service requirement by serving in at least one of the following areas:
 - teaching assistant for computer science courses
 - research assistant for a computer science faculty member
 - lab assistant for the general computing labs
 - technician for the Computing Services Department
 - participation in related service-learning projects
5. Complete the internship requirement by satisfactory completion of an internship and/or research assistantship.
6. Complete and defend a senior research project.

Requirements for a Mathematics Minor (21)

MA 110	Calculus I	4
MA 111	Calculus II	4
MA 210	Calculus III	4
MA 256	Elementary Probability and Statistics	3
MA 330	Linear Algebra	3
CS 171	Computer Science I	3

Requirements for Mathematics as a Supporting Endorsement (19)

MA 110	Calculus I	4
MA 111	Calculus II	4
MA 256	Elementary Probability and Statistics	3
MA 316	Discrete Mathematics	3
MA 365	Modern Geometry	3
One of the following:		2
EDU341	Methods of Teaching Elementary School Mathematics	
EDU454	Math in Secondary School	

Note: Students pursuing elementary certification will also take MA 221.

Requirements for Computer Science Minor (19)

CS 171	Computer Science I	3
CS 172	Computer Science II	3
CS 278	Computer Organization/Assembler Programming	3
CS 373	Data Structures and Algorithm Analysis	3
MA 256	Elementary Probability and Statistics	3
One of the following:		4
MA 108	Finite Math for Social Sciences	
MA 110	Calculus I	

Requirements for Information Technology Minor (18)

CS 171	Computer Science I	3
CS 172	Computer Science II	3
CS 301	Internet Applications	3
CS 313	Networks	3

Two of the following:	6
CS 302	Multimedia Applications
CS 314	Microsoft® Networks
CS 315	Multi-Platform Environments
CS 372	Java Programming
CS 374	Database Management

Mathematics Courses

MA 064	Arithmetic Review	2
Self-paced tutorial course for students needing to learn (or relearn) the arithmetic skills necessary for other coursework. Whole numbers, integers, fractions, decimals, percentages, ratios, proportions. Credit not applicable toward graduation requirements. Fall and spring semesters.		
MA 094	Introduction to Algebra	2
Self-paced tutorial course for students needing to learn (or relearn) the algebraic skills necessary for other coursework. Linear equations, polynomials, graphing and systems of linear equations. Credit not applicable toward graduation requirement. Fall and spring semesters.		
MA 101	Intermediate Algebra	3
For those desiring more preparation for MA 108 or MA 109. Fundamental algebraic operations, factoring, fractions, exponents and radicals, with an emphasis on problem-solving. Does not apply toward the math/science general requirement. Fall and spring semesters.		
MA 107	Basic Concepts in Modern Mathematics	3
Mathematics for the liberal arts student. An introduction to contemporary mathematics and its role in society. Current and past applications of mathematics in the real world will be examined. Topics may include management science, coding information, geometric applications and statistics. Periodic offering.		
MA 108	Finite Mathematics for Social Sciences	4
A study of mathematical applications to business, economics, social sciences and personal finance. Topics include mathematics of finance, taxes, insurance and investing. Prerequisite: MA 101 or equivalent. Fall and spring semesters.		
MA 109	Algebra and Trigonometry	4
Preparation for the calculus sequence. Polynomial, rationale, exponential, logarithmic and trigonometric functions with applications in the social and natural sciences. Prerequisite: MA 101 or equivalent. Fall and spring semesters.		
MA 110	Calculus I	4
Functions, limits, continuity, differentiation and antidifferentiation. Emphasis on solving problems numerically and graphically as well as algebraically. Prerequisite: MA 109 or equivalent. Fall and spring semesters, Summer Term.		
MA 111	Calculus II	4
Applications of integration, transcendental functions, techniques of integration and infinite series. Solving problems using <i>Mathematica</i> will also be examined. Prerequisite: MA 110. Fall and spring semesters.		
MA 196	Topics in Mathematics	1-3
Selected lower-division topics in mathematics. Periodic offering.		
MA 210	Calculus III	4
Multivariable calculus, including partial differentiation, vector analysis and multiple integrals. Prerequisite: MA 111. Fall and spring semesters.		

- MA 212 Differential Equations** **3**
 Ordinary differential equations, their use in mathematical models in the physical, biological and social sciences, and economics. Continuous and numerical solutions. Prerequisites: MA 210 and CS 171 or permission. Spring semester.
- MA 221 Math for Elementary School Teachers** **4**
 For the prospective elementary teacher. Development of number systems, vocabulary and symbolism in the present-day usage of arithmetic, algebra, statistics and geometry. Does not apply toward the math/science general requirement for graduation except for candidates for elementary teaching certificates. Prerequisite: MA 064 and MA 094 or permission. Fall and spring semesters.
- MA 256 Elementary Probability and Statistics** **3**
 Descriptive statistics, probability, probability distributions, hypothesis testing, confidence intervals, correlation, regression. Prerequisite: MA 108, MA 109, or instructors permission. Fall and spring semester, Jan Term, Summer Term.
- MA 316 Discrete Mathematics** **3**
 A study of the foundations of mathematics (including sets, logic, relations and functions), algorithms, combinatorics, and graph theory. Focus will be on developing logic and problem-solving skills involved in higher mathematics. Prerequisite: MA 110. Fall semester.
- MA 317 Introduction to Complex Variables** **3**
 Introduction to complex numbers, analytic and elementary functions and integration, series, residues and poles, and conformal mapping. Prerequisite: MA 210, MA 316 strongly recommended. Spring semester, odd years.
- MA 330 Linear Algebra** **3**
 Vector spaces, linear transformations, matrices, determinants, Euclidean spaces, systems of equations, eigenvalues. Prerequisites: MA 111 and CS 171. MA 316 strongly recommended. Spring semester.
- MA 340, 341 Advanced Calculus I, II** **3**
 The real number system, elements of point set theory sequences and series, differentiation, integration, multiple integrals. Prerequisite: MA 210. MA 316 strongly recommended. Fall semester, even years; spring semester, odd years.
- MA 350 Numerical Analysis** **3**
 Elementary discussion of errors, polynomial interpolation, quadrature, linear systems of equations, solutions of non-linear equations. Numerical differentiation, integration, solutions to differential equations. Prerequisites: MA 210, MA 330 and CS 172. MA 316 strongly recommended. Spring semester, even years.
- MA 360 Number Theory** **3**
 Divisibility, congruence, prime numbers, diophantine equations, quadratic reciprocity, number theoretic functions. Emphasis on mathematics education and problem-solving. Prerequisite: MA 111, MA 316. Fall semester, even years.
- MA 365 Modern Geometry** **3**
 Sets and propositions, postulation systems, affine geometry, Euclidean and non-Euclidean geometry. Required for high school mathematics teachers. Prerequisite: MA 110 or instructor permission required. MA 316 strongly recommended. Spring semester and Summer Term.
- MA 396 Topics in Mathematics** **1-3**
 Mathematical topics of current interest to the mathematics faculty and advanced students. May be repeated for credit. Prerequisite: permission of department chair. Periodic offering.

MA 410 Algebraic Structures **3**
 Logic, sets, relations, functions, groups, rings, fields and vector spaces. Mathematics education and computing applications studied. Prerequisites: MA 111, MA 316, and CS 171. Fall semester, odd years.

MA 430W Graph Theory and Combinatorics **3**
 Paths and circuits, trees, planarity and duality, coloring of graphs, digraphs and networks, permutations and combinations, multinomial theorem, generating functions, difference equations, principle of inclusion and exclusion, mobius function, Polya's theorem. Prerequisites: MA 111, MA 316, and CS 171. Spring semester, even years.

MA 456 Mathematical Statistics I **3**
 A theoretical study of probability, random variables and their distributions, confidence intervals, and tests of hypothesis, regression and correlation. Prerequisites: MA 210, MA 256 and CS 171. MA 316 strongly recommended. Fall semester, odd years.

MA 457 Mathematical Statistics II **3**
 A theoretical study of confidence intervals and estimators, test of hypothesis, ANOVA, regression and correlation, and non-parametric methods. Spring semester, even years.

Computer Science Courses

CS 170 Introduction to Computer Information Systems **3**
 Basic concepts of computer hardware, software and information processing. Impact of computers on society and the ethics of information technology. Hands-on experience with operating systems, file systems, word processors, spreadsheets, databases and communication tools. Fall and spring semesters.

CS 171 Computer Science I **3**
 Introduction to problem-solving, abstraction and design using the C++ language. Special emphasis on development of algorithms and writing programs in a structured form. Prerequisite: MA 108 or equivalent. Fall and spring semesters.

CS 172 Computer Science II **3**
 Problem-solving, abstraction and design using the C++ language. Special emphasis on pointer variables, recursion and file handling. Introduction to data structures (including stacks, queues, linked lists, and binary trees), classes and object-oriented programming. Prerequisite: CS 171. Fall and spring semesters.

CS 196 Topics in Computer Science **1-3**
 Selected lower-division topics in computer science. Periodic offering.

CS 271 Object-Oriented Programming **3**
 Introduction to object-oriented programming and object-oriented design using the programming language C++. Prerequisite: CS 172. Jan Term, even years.

CS 278 Computer Organization and Assembler Programming **3**
 Computer organization and the structure of digital computers. Work in MASM assembler language programming on a PC computer. Prerequisite: CS 172. Fall semester.

CS 301 Internet Applications Development **3**
 An information technology course designed as an introduction to the tools and methods of Internet applications development. Special emphasis on Internet programming languages and the design of interactive WWW documents. Spring semester, odd years.

CS 302 Multimedia Applications Development **3**
 An information technology course designed as an introduction to the tools and methods of multimedia applications development. Students will learn how to integrate text, graphics, animation, digital video, and sound to create interactive multimedia applications. Prerequisite: CS 170. Spring semester, even years.

- CS 313 Networks** **3**
 Fundamental concepts of computer network theory, topologies, architecture, protocol layers. Provides a foundation in current networking technology for local-area networks, wide-area networks and the Internet. Fall semester, odd years.
- CS 314 Microsoft® Networks** **3**
 A network systems technology course designed to provide students with the knowledge and skills necessary to complete day-to-day administration tasks in a single-domain or multiple-domain Microsoft®-based network. Students will learn how to install, configure, customize, optimize, troubleshoot and support local- and wide-area network environments. Prerequisite: CS 313. Spring semester, even years.
- CS 315 Multi-Platform Environments** **3**
 Introduction to a wide range of computing platforms. Emphasis on Linux, enterprise computing, system interfaces, client/server computing and distributed processing. Prerequisite: CS 313. Fall semester, even years.
- CS 357 Computer Graphics** **3**
 Hands-on experience with state-of-the-art computer graphics rendering and display techniques. Emphasis on texture mapping, ray tracing, 2-D and 3-D object manipulation and animation. Spring semester, odd years. Prerequisite: CS 172.
- CS 372 Java Programming** **3**
 Developing conventional applications in object-oriented Java. Topics include Java programming constructs, multithreading, graphical user interface components, exception handling and Java networking. Prerequisite: CS 172 or CS 301. Jan Term, odd years.
- CS 373 Data Structures and Algorithm Analysis** **3**
 An introduction to stacks, queues, recursion, linked lists, trees, graphs, sorting and searching. Emphasis on algorithm analysis. Prerequisite: CS 172. Fall semester.
- CS 374 Database Management** **3**
 Comprehensive introduction to design and development of databases. Combined approach of relational database theory and SQL Server environment. Also includes current trends such as object-oriented databases, data warehousing and web interfaces. Prerequisite: CS 172. Fall semester, even years.
- CS 396 Topics in Computer Science** **1-3**
 Selected upper-division topics in computer science. Periodic offering.
- CS 401 Computer Architecture** **3**
 Digital computer system design and analysis. Topics include synchronous/asynchronous sequential machines, parallel structures, pipelining, input/output. Includes laboratory experience in microprocessor design and architecture. Prerequisite: CS 278. Fall semester, odd years.
- CS 457 Artificial Intelligence** **3**
 Introduction to artificial intelligence concepts. A foundation for understanding methods such as problem-solving by searching, dynamic networks, neural and belief networks, knowledge bases and expert systems, machine learning and robotics. Prerequisite: CS 172. Spring semester, even years.
- CS 472W Software Engineering** **3**
 Introduction to software system analysis and design. Software life cycle, structured analysis, structured design, software tools, software documentation, software maintenance. Prerequisite: CS 172. Spring semester, even years.
- CS 475 Operating Systems** **3**
 Introduction to basic operating systems concepts. Memory management, scheduling algorithms, resource allocation, file systems, security, concurrent processes. Prerequisite: CS 278 or permission. Spring semester, odd years.

Directed Studies

Independent Studies (191, 291, 391, 491); Readings (386, 486); Internships (290, 490); Field Studies (280, 480); and Teaching Assistantships (395, 495). See Page 169 for details.