

Computing

Department: Mathematics and Computing

Department Chair: P. Fonstad

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Majors: Computer Science, Software Engineering

Minors: Computer Science, Software Engineering

Related Major: Data Science

Related Minor: Data Science

Courses and majors in mathematics and computing are designed to provide students with fundamental knowledge of and facility with concepts and processes in mathematics and computing. Also, the program is intended to help develop interpersonal and lifetime learning skills so students can adapt to new challenges and situations in their personal and professional lives. The department seeks to promote active learning in the classroom through the implementation of cooperative learning, discovery learning, and the incorporation of technology in a variety of hands-on experiences.

All required courses for a major or minor in mathematics or computing, including all related field and prerequisite requirements, must be completed with a C- or better. Prerequisites for non-majors must also be completed with a C- or better. Education students should consult the education department for minimum requirements.

Majors in Computing

Two separate majors are available in the computing field: computer science and software engineering. Both programs provide professional education within the liberal arts setting in the rapidly developing field of computing.

A **major in computer science** provides the student with a knowledge of both computer applications and higher mathematics that will allow the student to pursue a career as a computer programmer or as a network administrator immediately following graduation or to enter graduate school.

A **major in software engineering** is intended to provide preparation for a student who wishes to pursue a career as a software developer in business, industry, or government.

Computer Science Major

Computing Core Requirements

- CMP 141** Python for Computing and Data Science I
- CMP 142** Python for Computing and Data Science II
- CMP 283** Web Software Construction and Testing I
- CMP 285** Web Software Construction and Testing II
- CMP 337** Programming Languages
- CMP 352** Data Structures
- CMP 370** Database Design and Processing
- CMP 372** Computer Networks and Security
- CMP 385** Software Engineering I: Analysis and Design
- CMP 387** Software Engineering II: Implementation and Maintenance
- CMP 470** Senior Software Maintenance Project
- CMP 473** Senior Software Development Project (includes professional experience and portfolio)
- CMP 499** Senior Competency Practicum

Computer Science Program Track

- CMP 240** Cybersecurity Essentials
- CMP 345** Computer Architecture and Operating Systems

Professional Development Requirements

- PDP 200** Preparing for Your Internship

Related Field Requirements

- MAT 135** Calculus
- MAT 181** Discrete Mathematics I
- MAT 182** Discrete Mathematics II
- MAT 224** Basic Applied Statistics

Software Engineering Major

Computing Core Requirements

- CMP 141** Python for Computing and Data Science I
- CMP 142** Python for Computing and Data Science II
- CMP 240** Cybersecurity Essentials
- CMP 283** Web Software Construction and Testing I
- CMP 285** Web Software Construction and Testing II
- CMP 337** Programming Languages
- CMP 352** Data Structures
- CMP 370** Database Design and Processing
- CMP 385** Software Engineering I: Analysis and Design
- CMP 387** Software Engineering II: Implementation and Maintenance
- CMP 470** Senior Software Maintenance Project
- CMP 473** Senior Software Development Project (includes professional experience and portfolio)
- CMP 499** Senior Competency Practicum

Software Engineering Program Track**CMP 130** Introduction to Computing**CMP 300** Topics in Computing**Professional Development Requirements****PDP 200** Preparing for Your Internship**Related Field Requirements****BUS 101** Introduction to the Business Mindset**MAT 181** Discrete Mathematics I**MAT 182** Discrete Mathematics II**MAT 224** Basic Applied Statistics**One of the following courses****ACC 221** Principles of Accounting I**ECO 115** Principles of Economics***Data Science Major***Please see [separate Data Science section](#) in this course catalog.**Minors in Computing*****Computer Science Minor*****Required Courses****CMP 130** Introduction to Computing**CMP 141** Python for Computing and Data Science I**CMP 142** Python for Computing and Data Science II**CMP 352** Data Structures**One of the following courses****CMP 240** Cybersecurity Essentials**CMP 337** Programming Languages**CMP 345** Computer Architecture and Operating Systems**CMP 372** Computer Networks and Security***Software Engineering Minor*****CMP 130** Introduction to Computing**CMP 141** Python for Computing and Data Science I**CMP 283** Web Software Construction and Testing I**CMP 285** Web Software Construction and Testing II**CMP 385** Software Engineering I***Data Science Minor***Please see [separate Data Science section](#) in this course catalog.

Computing Course Descriptions

CMP 130 Introduction to Computing		3 credit hours
Fall and spring	Fulfills LA 103 requirement	Note: Placement into LA 103 or above based upon mathematics placement criteria

An introduction to the field of computing and the use of software applications to enhance quantitative reasoning, problem-solving, and decision-making. Topics include data storage, data manipulation, operating systems, networking and the Internet, algorithms, programming languages, software engineering, data abstractions, database systems, artificial intelligence, and the theory of computation. Hands-on experience with applications, such as spreadsheets and database management systems, is included.

CMP 141 Python for Computing and Data Science I		3 credit hours
Fall		Prereq: knowledge of high school algebra

An introduction to computers and structured programming using the Python programming language. Computer science topics include: problem-solving strategies, algorithm formulation, primitive data types, expressions, control structures, proper coding style, debugging, testing, and documentation. Data science topics include: basic descriptive statistics, data visualization, and data frames. Same as DAT 141.

CMP 142 Python for Computing and Data Science II		3 credit hours
Spring		Prereq: CMP 141

An introduction to object-oriented design and programming using the Python programming language. Computer science topics include: recursion, object-oriented design, encapsulation, inheritance, polymorphism, file input and output, exception handling, and regular expressions. Data science topics include: natural language processing, data mining, machine learning algorithms, and an introduction to deep learning. Same as DAT 142.

CMP 150 Computer Tools for Problem Solving		2 credit hours
Spring		

A course in which students learn to apply professional scientific computing software to mathematical problems. Topics will include matrices and matrix operations; random number generation; plotting graphs of functions; and curve fitting and interpolation. Students will also learn and apply basic elements of computer programming (relational and logical operators, conditional statements, and loop structures) within MATLAB and R.

CMP 240 Cybersecurity Essentials		3 credit hours
Spring, odd academic years		Prereq: CMP 130 or CMP 141 or demonstrated coding experience as approved by department chair

This course is an introduction to the fundamental principles of cybersecurity. Topics include cryptography, data integrity and authentication, access control, network security, and human security. Students will learn common hacking techniques to better understand how to protect and secure their devices and systems. Personal and professional ethics and legal issues will be discussed.

CMP 283 Web Software Construction and Testing I		3 credit hours
Fall		Prereq: CMP 141 or consent of instructor

An introduction to the fundamental concepts of web software construction and testing. Topics include the client-server model and server-side programming languages (e.g., ASP.NET, C#.NET).

CMP 285 Web Software Construction and Testing II		3 credit hours
Spring		Prereq: CMP 283 or consent of instructor

An advanced study of the concepts of web software construction and testing. Topics include database connectivity and client-side programming languages (e.g., JavaScript).

CMP 300 Topics in Computing		1-3 credit hours
Spring, odd academic years		Prereq: CMP 142 and junior standing, or consent of instructor

A topic of current interest in computing will be taught. Topics will vary depending on technological developments and faculty interests. Offered at the request of a faculty member and with approval of the Vice President of Academic Affairs.

CMP 337 Programming Languages		3 credit hours
Spring, odd academic years		Prereq: CMP 142

An introduction to programming languages and the major paradigms. The structure of the languages as well as their approach to problem-solving will be studied. Topics may include imperative, functional, object-oriented, and logic-based languages.

CMP 345 Computer Architecture and Operating Systems		3 credit hours
Spring, even academic years		Prereq: CMP 142

This course is an introduction to computer architecture and operating systems. Computer architecture topics include digital logic, circuit design, machine-level representation of data, assembly-level machine organization, and memory system organization. Operating system topics include an overview of the components and principles of an operating system, concurrency, scheduling, memory management, file systems, and security and protection.

CMP 352 Data Structures		3 credit hours
Fall, odd academic years		Prereq: CMP 142

This is an advanced course in the use, development, and analysis of data structures and the algorithms that operate on them. Students will gain a firm understanding of the fundamental data structures of arrays and linked lists and how they are used to implement other formal data structures such as stacks, queues, binary search trees, and graphs. This course will particularly emphasize data encapsulation of such structures, as well as include significant experience with tree and graph representations. Multithreaded and parallel programming will be introduced. Complete and detailed algorithm analyses will also be introduced.

CMP 360 Operations Research		3 credit hours
Fall, odd academic years		Prereq: MAT 135, MAT 181, MAT/SOC 224, or consent of instructor

Introduction to the field of operations research. PERT, linear and integer programming, use of statistical reasoning, and computer methods are included.

CMP 370 Database Design and Processing		3 credit hours
Fall, odd academic years		Prereq: CMP 142 and junior standing, or consent of instructor

An introduction to database concepts. Topics include file systems and databases, the relational database model, structured query language, entity relationship modeling, database table normalization, transaction management and concurrency control, and data warehouses.

CMP 372 Computer Networks and Security		3 credit hours
Fall, even academic years		Prereq: CMP 142 or consent of instructor

This course is an introduction to computer networks and security. Topics include: methods of data transmission, data encoding and error correction, internet and transport protocols, routing algorithms and flow control, network design, internetworking, and security. Students will learn and develop network applications.

CMP 385 Software Engineering I: Analysis and Design		3 credit hours
Fall, even academic years		Prereq: CMP 285 and junior standing, or consent of instructor

An introduction to the concepts associated with the analysis and design activities of the software engineering process. Topics include software activities and tasks, process models, methodology development and tailoring, project scheduling, monitoring, and control, requirements analysis, project estimation, decision analysis, back-end design, front-end design, and component design.

CMP 387 Software Engineering II: Implementation and Maintenance		3 credit hours
Spring, even academic years		Prereq: CMP 385 and junior standing, or consent of instructor

An introduction to the concepts associated with the implementation and maintenance activities of the software engineering process. Topics include software quality assessment, quality control, measurement, metric construction, configuration management, change control, construction, testing, system conversion, and maintenance.

CMP 470 Senior Software Maintenance Project		No credit
Fall		Prereq: senior standing and departmental consent

A supervised, pre-approved experience which requires the student to select an existing system maintenance project from a pool of requests and perform the necessary activities to solve the maintenance problem.

CMP 473 Senior Software Development Project		6 credit hours
Spring		Prereq: CMP 470, senior standing, and departmental consent; Co-req: CMP 499

Requires the selection and completion of the senior project, which involves the analysis, design, implementation, and delivery of a fully-functioning computer system as well as the development of all relevant technical documentation.

CMP 482 Computer Practicum		1-2 credit hours
		Prereq: instructor permission

A supervised, pre-approved experience which allows a student to pursue specific learning goals and/or be involved in a field experience during the regular academic semester.

CMP 490 Independent Study		1-2 credit hours
		Prereq: departmental consent

Courses are designed to encourage student initiative and to provide a degree of flexibility in the departmental program. Normally the subject is not sufficiently or appropriately covered in departmental course offerings. Course work is planned by student and instructor jointly to meet student's individual needs.

CMP 499 Senior Competency Practicum		No credit
Spring		Co-req: CMP 473

The senior competency practicum consists of two components. The first component, the written part of the senior competency requirement, is written documentation from the senior project completed in CMP 473. The second component, the oral part of the senior competency requirement, is a formal presentation of the senior project. A team of at least four individuals will judge the student's skill in presentation, knowledge of the system, and ability to communicate with the audience. Students must earn a C- or higher.