Computing

Department: Mathematics and Computing
Department Chair: P. Fonstad
Department Members: R. Beasley, J. Boardman, P. Fonstad, J. Gash, S. Hoehn, K. Smith, A. Walls

Majors: Computer Science, Cybersecurity, Software Engineering (Optional Software Engineering Track: Game Development)
Minors: Computer Science, Cybersecurity, Software Engineering, Software Engineering: Game Development
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 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

Computer Science Program Track

CMP 372 Computer Networks and Security
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

Cybersecurity Major

This major is offered partially online through a consortium of accredited colleges and universities. Seven courses within the program are delivered by faculty employed by partner institutions in the consortium, with technology and administrative support provided by Rize Education.
Oversight of courses offered through the consortium are reviewed and approved by Franklin College. Students register through Franklin College and receive academic credit from Franklin College.

Computing Core Requirements

CMP 141 Python for Computing and Data Science I
CMP 142 Python for Computing and Data Science II
CMP 222 Network and System Security
CMP 224 Cybercrime and Governance
CMP 240 Cybersecurity Essentials
CMP 320 Security Operations
CMP 322 Ethical Hacking
CMP 324 The Future of Cybersecurity
CMP 345 Computer Architecture and Operating Systems
CMP 352 Data Structures
CMP 372 Computer Networks and Security

CMP 422 Cybersecurity Capstone

Professional Development Requirements

PDP 200 Preparing for Your Internship
CMP 220 Career Navigation and Exploration in Cybersecurity
INT XXX Cybersecurity Internship

Related Field Requirements

MAT 181 Discrete Mathematics I
MAT 182 Discrete Mathematics II
MAT 224 Basic Applied Statistics
PJM 226 Project Management Fundamentals

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 121 Principles of Microeconomics
ECO 123 Principles of Macroeconomics

Software Engineering Major: Game Development Track

This major is offered partially online through a consortium of accredited colleges and universities. Five courses within the program are delivered by faculty employed by partner institutions in the consortium, with technology and administrative support provided by Rize Education. Oversight of courses offered through the consortium are reviewed and approved by Franklin College. Students register through Franklin College and receive academic credit from Franklin College.

Computing Core Requirements

CMP 110 Introduction to Games
CMP 130 Introduction to Computing
CMP 141 Python for Computing and Data Science I
CMP 142 Python for Computing and Data Science II
CMP 210 Content and Systems Design
CMP 283 Web Software Construction and Testing I
CMP 285 Web Software Construction and Testing II
CMP 310 Unity I: Working with Unity
CMP 345 Computer Architecture and Operating Systems
CMP 352 Data Structures and Algorithms
CMP 410 Unity II: Advanced Unity Programming
CMP 420 Capstone Project: Building a Game
CMP 470 Senior Software Maintenance Project
CMP 473 Senior Software Development Project (includes professional experience and portfolio)
CMP 499 Senior Competency Practicum

Professional Development Requirements

PDP 200 Preparing for Your Internship

Related Field Requirements

MAT 181 Discrete Mathematics I
MAT 182 Discrete Mathematics II
MAT 224 Basic Applied Statistics
PSY 117 General Psychology
PSY 328 Cognitive Psychology

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

Cybersecurity Minor

This minor is offered partially online through a consortium of accredited colleges and universities. Three courses within the program are delivered by faculty employed by partner institutions in the consortium, with technology and administrative support provided by Rize Education. Oversight of courses offered through the consortium are reviewed and approved by Franklin College. Students register through Franklin College and receive academic credit from Franklin College.

CMP 141 Python for Computing and Data Science I
CMP 222 Network and System Security
CMP 240 Cybersecurity Essentials
CMP 320 Security Operations
CMP 324 The Future of Cybersecurity

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: Analysis and Design

Software Engineering: Game Development Minor

This minor is offered partially online through a consortium of accredited colleges and universities. Three courses within the program are delivered by faculty employed by partner institutions in the consortium, with technology and administrative support provided by Rize Education. Oversight of courses offered through the consortium are reviewed and approved by Franklin College. Students register through Franklin College and receive academic credit from Franklin College.

CMP 110 Introduction to Games
CMP 141 Python for Computing and Data Science I
CMP 142 Python for Computing and Data Science II
CMP 210 Content and Systems Design
CMP 310 Unity I: Working with Unity
CMP 352 Data Structures and Algorithms

Data Science Minor

Please see separate Data Science section in this course catalog.

Computing Course Descriptions

CMP 110 Introduction to Games*		3 credit hours
Fall and Spring		

Games sit at the intersection of technology, art, and culture, so success within the games industry requires you to understand all three. This course explores why we love games, what role they play in society, and the industry that produces them. You'll also learn the basics of game development. This course was developed in partnership with Unity and the IGDA to help everyone interested in the games industry start on the right foot. This online class has optional live sessions.

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 210 Content and Systems Design*		3 credit hours
Spring		

If you've ever enjoyed the experience of playing a video game, you've had a first-hand lesson in how important content and systems design are. The experience of a game is driven by four major components: content, systems, narrative, and user experience. This class will help you learn to design all four components, and build a deeper understanding of the game development process and an introduction to concepts in scripting. This online class has optional live sessions.

CMP 215 Introduction to Cybersecurity*		3 credit hours
Fall		May substitute for CMP 240 for Cybersecurity majors only

In today's world, no one is safe from cyber-attacks, but everyone can be prepared. This course will teach you how malicious actors use social manipulation and technology to launch devastating attacks – and provide you with the tools you'll need to defend against them. Whether you pursue one of the many available jobs in cybersecurity or just want to secure your own privacy, you'll learn how to make the Internet safer.

CMP 220 Career Navigation and Exploration in Cybersecurity*		3 credit hours
Fall and spring		Prereq: CMP 215 OR CMP 240

This course will help you find a job in Cybersecurity upon graduation. Not just any job; one that meets your personal and financial needs and makes you excited about the future. In this course, you'll explore career paths in Cybersecurity, potential salary outcomes, and different roles. Then, you'll pick target jobs and opportunities that are the best fit for you, and make a clear plan of action toward securing them.

CMP 222 Network and System Security*		3 credit hours
Spring		

Modern organizations know that even the strongest systems can be vulnerable to cyberattacks. As a result, jobs in cybersecurity are rapidly expanding as companies look to secure their digital assets. This course will teach you how to secure those assets by identifying and fixing potential security vulnerabilities. By the end of the course, you will be able to identify and remedy common network and systems vulnerabilities.

CMP 224 Cybercrime and Governance*		3 credit hours
Spring		

This course explores the critical role of governance in mitigating cybercrime and ensuring the integrity of digital environments. You will learn how governments detect and stop cybercrimes, and become familiar with the laws and policies in place to deter cybercriminals. Develop and implement robust security policies procedures that align with legal and ethical standards and help create a resilient, compliant digital ecosystem.

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, date 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 310 Unity I: Working with Unity*		3 credit hours
Fall and Spring		

The Unity engine powers nearly 50% of all games and nearly 75% of mobile games. This course, built in collaboration with Unity and the IGDA, will introduce you to developing games in Unity. By the end of this course, you'll learn how to build a fully functioning game within the Unity system, including all key elements. This online course has optional live sessions.

CMP 320 Security Operations*		3 credit hours
Fall		Prereqs: CMP 222 and CMP 240

The moments after a breach can make or break an organization. When the unthinkable happens and a cybercrime is discovered, the actions taken by the security operations team can either contain the damage and restore order or lead to catastrophic consequences. This course examines the tools and techniques used to conduct investigations into cybercrimes and teaches the defensive skills necessary to ensure a breach doesn't occur in the first place.

CMP 322 Ethical Hacking*		3 credit hours
Fall and spring		Prereq: CMP 222

To stop a hacker, you need to be able to think like a hacker. In this course, you will learn hands-on techniques for attacking and penetrating networks and systems. You'll learn the tools to launch these offensive tactics, and then complete a hands-on project where you will be asked to ethically hack a real system.

CMP 324 The Future of Cybersecurity*		3 credit hours
Fall		Prereq: CMP 222

Technology is racing forward, and cybersecurity must stay ahead to meet new challenges and threats. In this class, you will learn about the changing landscape of cybersecurity, emerging mobile technologies that are likely to be targeted, and new forms of cyber-attacks being launched. By the end of the course, you will be able to implement the most cutting-edge practices in cybersecurity in order to protect against attacks.

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 410 Unity II: Advanced Unity Programming*		3 credit hours
Fall		Prereq: CMP 285 & CMP 310

This course is intended to provide students with the skills and knowledge to bring their mastery of the Unity game engine and C# programming up to a professional standard. Students will learn how to perform a range of vital code-based tasks within the Unity platform, and will grow their skills in building core gameplay functionality, supporting systems and platform-specific optimizations. This course was built in collaboration with Unity. Upon successful completion, students will be prepared to sit for the Unity Certified Associate: Programmer exam. This online course has optional live sessions.

CMP 420 Capstone Project: Building a Game*		3 credit hours
Spring		Prereq: CMP 352, CMP 410, CMP 470, senior standing, and departmental consent

This course is intended as a culmination of all a student's work in the Unity Game Development major. Students will work in groups to build a game in the unity engine that uses real-time 2D or 3D visuals and showcases their understanding of the core principles of game design. Students will pitch their game, design, prototype, build and test their game. Students will be evaluated based on the quality of their game, and their internal project management processes. This online course has optional live sessions.

CMP 422 Cybersecurity Capstone*		3 credit hours
Spring		Prereqs: CMP 222, CMP 224, CMP 240, CMP 320, CMP 322, CMP 324

The Capstone course is the culmination of the Cybersecurity program, allowing students to apply their knowledge to real-world challenges. Students will undertake a comprehensive project integrating various aspects of cybersecurity, including log analysis, vulnerability assessment, incident response, ethical hacking, and cloud security. This project will develop critical thinking skills and prepare students for major cybersecurity certifications.

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.

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