

COMPUTER SCIENCE

Computer Science Department (<http://www.csuchico.edu/csci/>)
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Who is Computer Science at Chico State?

Computer Science at Chico State is defined by its faculty, students, and alumni.

We are Faculty

We faculty in the Department of Computer Science feel strongly about being actively involved in your education. Our classes are taught by us, the faculty, not by assistants. We are also constantly assessing and updating our curriculum to ensure it reflects not only the "science" underlying computer science, but also the current and emerging technologies that our computer science and computer information systems graduates develop and use. This drive for currency is reflected in our research in areas such as security, data science, computer vision, robotics, bioinformatics, and quantum computing. We invite you to contact us, come for a visit, and apply. We love what we do. Let us to share our enthusiasm with you and help you discover the same passion we and our students share for computer science.

We are Students

We students are not nameless faces in a classroom. Computer science professors develop a more personal relationship with us. And the assigned projects have character; they are remarkably effective at demystifying computer technology. We also know that the portrayal of computer science as a solitary endeavor pursued by social misfits is entirely wrong. At Chico State we have found computer science to be a uniquely human experience. Engineering software is the effort of many people working together, solving large, difficult, captivating problems. Social interaction embodies the student culture here at Chico State.

And the support—help is everywhere. Student tutors are available most times during the day and faculty office hours are plentiful. Study groups are the norm, and there are numerous clubs to join. The most remarkable aspect of being a student in Chico State's Computer Science Department is how friendly and sociable everyone is. Everyone wants you to succeed. We students spend a lot of time with each other. We work well together and are establishing lasting friendships. We even created our own Computer Science Discord server where someone is always available to help when working through difficult material.

We are Alumni

We alumni find ourselves returning to the Computer Science Department from which we graduated. We come to hire the new graduates into the companies we now work for, knowing they have the same preparation that put us on a path to success. We serve on the department's Industry Advisory Board, ensuring the program's continued strength and relevance. We even visit the student's Discord server to reminisce and help the occasional student who wanders into our conversation with a question.

"I found a job within a couple months of graduating. The education enables one to speak fluently about many computer science topics, and the clubs enable one to tackle and practice myriad problem-solving skills for the technical aspects of interviews. The education

provides real opportunity that I am thankful for. As well as what I hope are lifelong friends, in both faculty and alumni."—Stephen Anderson (Computer Science, '21)

"I got a FAANG¹ internship during my rising senior summer. With my practical experience from Chico State classes and professors I was able to execute well during my internship and received a full-time return offer. After some experience at my first company, I used my class assignments to prep for another FAANG company, which I was given an offer that I took. I consistently stack up and over-perform against fellows from Ivy Leagues and other tech colleges, and all of this from a college that I was able to graduate from without taking out loans."—James Krepelka (Computer Science, '15)

¹ FAANG: prominent technology companies Facebook, Amazon, Apple, Netflix, and Google

Programs

Undergraduate

Bachelor's

- Computer Information Systems BS (<https://catalog.csuchico.edu/colleges-departments/college-engineering-computer-science-construction-management/computer-science/computer-information-systems-bs/>)
- Computer Science BS (<https://catalog.csuchico.edu/colleges-departments/college-engineering-computer-science-construction-management/computer-science/computer-science-bs/>)

Minors

- Computer Science Minor (<https://catalog.csuchico.edu/colleges-departments/college-engineering-computer-science-construction-management/computer-science/computer-science-minor/>)

Certificates

- Data Science Certificate (<https://catalog.csuchico.edu/colleges-departments/college-engineering-computer-science-construction-management/computer-science/data-science-certificate/>)

Graduate

Master's

- Computer Science MS (<https://catalog.csuchico.edu/colleges-departments/college-engineering-computer-science-construction-management/computer-science/computer-science-ms/>)

See Course Description Symbols and Terms (<https://catalog.csuchico.edu/academic-standards-policies/course-description-symbols-terms/>) for an explanation of course description terminology and symbols, the course numbering system, and course credit units.

Computer Information Systems

CINS 220 PCs and Peripherals

3 Units

Typically Offered: Fall and spring

This course focuses on the hardware and software of the modern PC, currently available peripherals and upgrades, and the basics of networking. Included will be a survey of the pros and cons of different hardware choices for various PCs, peripherals, and networking options. 2 hours activity, 2 hours discussion. (002337)

Grade Basis: Graded

Repeatability: You may take this course for a maximum of 3 units

Course Attributes: Lower Division

CINS 242 Information Systems Design

3 Units

Prerequisite: CSCI 111 with a grade of C or higher.

Typically Offered: Fall only

Systems analysis and design, and the role of Information Systems in organizations. Emphasis is on the project-team design approach. Operational criteria, system feasibility, requirements, and cost trade-offs. Integration of personnel, equipment, hardware, and software. 3 hours discussion. (002377)

Grade Basis: Graded

Repeatability: You may take this course for a maximum of 3 units

Course Attributes: Lower Division

CINS 370 Introduction to Databases

3 Units

Prerequisite: CSCI 211; CSCI 211 or MATH 217, both with a grade of C or higher.

Typically Offered: Fall and spring

This course provides an introduction to the theory and methodology for database design and implementation. Topics may include a survey/lecture component as well as a project component. The survey component covers entity-relationship modeling, relational algebra and calculus theories, data definition and data manipulation languages such as SQL, file structures, transactions, concurrency control, recovery, tuning and optimization, and object-oriented databases. The project entails requirements definition, design, and implementation of a database application. 2 hours activity, 2 hours discussion. (002338)

Grade Basis: Graded

Repeatability: You may take this course for a maximum of 3 units

Course Attributes: Upper Division

CINS 448 Computer Security

3 Units

Prerequisite: CSCI 446 or EECE 446, with a grade of C or higher.

Typically Offered: Fall and spring

This course provides a broad overview of some of the more technical aspects of Information Systems Security. The content is designed to prepare students for the Certified Information Systems Security Professional/Associate (CISSP/A) examination from the International Information Systems Security Certification Consortium (ISP2), including a discussion of each of the following topics: security management practices; access control systems; telecommunications and network security; cryptography; security architecture and models; operations security; applications and systems development; business continuity planning and disaster recovery planning; law, investigation, and ethics; and physical security. 3 hours lecture. (020232)

Grade Basis: Graded

Repeatability: You may take this course for a maximum of 3 units

Course Attributes: Upper Division

CINS 465 Web Programming Fundamentals

3 Units

Prerequisite: CINS 370 with a grade of C or higher, CSCI 211 and MINS 335, or MINS 325 and MINS 335.

Typically Offered: Fall and spring

A hands-on project course that examines languages, tools, protocols, and techniques for developing interactive and dynamic web applications. Topics include the model-view-controller pattern, document object model, server side and client side scripting, using a server side database, and web applications security. The course includes several web projects using a web programming framework. 3 hours discussion. (002368)

Grade Basis: Graded

Repeatability: You may take this course for a maximum of 3 units

Course Attributes: Upper Division

CINS 467 Mobile Application Development

3 Units

Prerequisite: CINS 370 (with a grade of C or higher), CSCI 211 and MINS 335, or MINS 325 and MINS 335.

Typically Offered: Spring only

Implementation of native mobile applications using a modern framework. Topics include the model-view-controller design pattern, multi-touch event handling, sensory input handling, web service integration, multi-threading and custom user interface design. 3 hours discussion. (002365)

Grade Basis: Graded

Repeatability: You may take this course for a maximum of 3 units

Course Attributes: Upper Division

CINS 490 Computer Information Systems Capstone

3 Units

Prerequisite: CSCI 311 with a grade of C or higher; CINS 465 or CINS 467 with a grade C or higher; Senior Standing.

Typically Offered: Fall and spring

This capstone course provides a culminating activity in computer information systems. Students work independently to specify, design, develop, test, and document a complete information systems application under faculty supervision. Students present status reports at weekly meetings, and present their finished project at the end of the semester. 9 hours supervision. (020996)

Grade Basis: Report in Progress: Graded

Repeatability: You may take this course for a maximum of 3 units

Course Attributes: Upper Division

CINS 548 Advanced Computer Security

3 Units

Prerequisite: CINS 448 with a grade of C or higher.

Typically Offered: Fall only

This course provides advanced training in the engineering and management of information systems security, particularly those systems that play a role in U.S. national security, and is aimed at professionals who plan to work either as contractors or federal employees in the area of national security or defense. The course also prepares students for the Information Systems Security Engineering Professional (ISSEP) certification test prepared by the International Information Systems Security Certification Consortium (ISP2) in collaboration with the National Security Agency. Specific areas of concentration are systems security engineering; certification and accreditation (CA); technical management; and U.S. Government Information Assurance (IA) regulations. 3 hours lecture. (020234)

Grade Basis: Graded

Repeatability: You may take this course for a maximum of 3 units

Course Attributes: Upper Division

CINS 570 Advanced Database Management Systems 3 Units**Prerequisite:** CINS 370 with a grade of C or higher or MINS 335.**Typically Offered:** Fall only

Course topics include database application programming using a high performance, high concurrency multi-user database management system. This course covers the SQL programming language including Data Definition Language, Data Manipulation Language, and Data Control Language. The course then focuses on a procedural database programming language including control structures, composite datatypes, explicit cursors, exception handling, and writing embedded SQL applications. 2 hours activity, 2 hours discussion. (002381)

Grade Basis: Graded**Repeatability:** You may take this course for a maximum of 3 units**Course Attributes:** Upper Division

Computer Science

CSCI 101 Introduction to Computer Science 3 Units**Typically Offered:** Fall and spring

Students who have had limited experience with computers should take CSCI 101 before CSCI 111. CSCI 101 provides an overview of the fundamentals of computer science. Number systems and data representation are introduced. An overview of hardware, including the control unit, memory, the ALU, and I/O is provided. Software is introduced with an overview of operating systems, programming languages, applications, and software tools. Students are exposed to common operating systems and applications. Student also design and implement several programs. 2 hours activity, 2 hours discussion. (002280)

Grade Basis: Graded**Repeatability:** You may take this course for a maximum of 3 units**Course Attributes:** Lower Division**CSCI 102 Living With Technology 🌱 3 Units GE****Typically Offered:** Fall and spring

This course explores the impact of technology on our lives. Aspects of our complex technological society are investigated through study of the various forms technology takes, and readings in contemporary literature regarding the impact these technologies have on individuals. Students are encouraged to reflect on technology in their own lives through journaling, and to discourse with their peers on the benefits and harm to individuals, society, and humanity that modern technology presents. 3 hours discussion. (020623)

General Education: Lifelong Learning and Self-Development (E)**Grade Basis:** Graded**Repeatability:** You may take this course for a maximum of 3 units**Course Attributes:** Lower Division; Sustainable Course**CSCI 111 Programming and Algorithms I 4 Units**

Prerequisite: GE Mathematics/Quantitative Reasoning (B4) requirement, MATH 119 (or completion of high school precalculus), MATH 120, or meet the Math department's requirements for enrollment in MATH 120. Recommended: CSCI 217 or MATH 217 (may be taken concurrently).

Typically Offered: Fall and spring

A first-semester programming course, providing an overview of computer systems and an introduction to problem solving and software design using procedural object-oriented programming languages. Coverage includes the software life cycle, as well as algorithms and their role in software design. Students are expected to design, implement, and test a number of programs. 2 hours activity, 3 hours lecture. (002281)

Grade Basis: Graded**Repeatability:** You may take this course for a maximum of 4 units**Course Attributes:** Lower Division**CSCI 198 Special Topics 1-3 Units****Prerequisite:** Department permission.**Typically Offered:** Fall and spring

This course is for special topics offered for 1.0-3.0 units. Typically the topic is offered on a one-time-only basis and may vary from term to term and be different for different sections. See the Class Schedule for the specific topic being offered. 3 hours supervision. (002307)

Grade Basis: Graded**Repeatability:** You may take this course more than once**Course Attributes:** Lower Division**CSCI 199 Special Problems 1-3 Units****Prerequisite:** Faculty permission.**Typically Offered:** Fall and spring

This course is a special topic offered for 1.0-3.0 units. You must register directly with a supervising faculty member. 0 hours supervision. (021848)

Grade Basis: Credit/No Credit**Repeatability:** You may take this course for a maximum of 6 units**Course Attributes:** Lower Division**CSCI 211 Programming and Algorithms II 4 Units**

Prerequisite: GE Mathematics/Quantitative Reasoning (B4) requirement; CSCI 111 with a grade of C or higher. Recommended: CSCI 217 or MATH 217 (may be taken concurrently).

Typically Offered: Fall and spring

A second semester object-oriented programming course in computer science that emphasizes problem solving. This course continues the study of software specification, design, implementation, and debugging techniques while introducing abstract data types, fundamental data structures and associated algorithms. Coverage includes dynamic memory, file I/O, linked lists, stacks, queues, trees, recursion, and an introduction to the complexity of algorithms. Students are expected to design, implement, test, and analyze a number of programs. 2 hours activity, 3 hours lecture. (002282)

Grade Basis: Graded**Repeatability:** You may take this course for a maximum of 4 units**Course Attributes:** Lower Division**CSCI 217 Discrete Mathematics 3 Units**

Prerequisite: GE Mathematics/Quantitative Reasoning Ready, CSCI 111 with a grade of C or higher (may be taken concurrently), MATH 119 (or equivalent).

Typically Offered: Fall and spring

Offers an intensive introduction to discrete mathematics as used in computer science. Topics include sets, relations, propositional and predicate logic, basic proof methods including mathematical induction, digital logic circuits, complexity of algorithms, elementary combinatorics, and solving linear recurrence relations. 3 hours discussion. (005550)

Cross listing(s): MATH 217**Grade Basis:** Graded**Repeatability:** You may take this course for a maximum of 3 units**Course Attributes:** Lower Division

CSCI 221 Assembly Language Programming**3 Units****Prerequisite:** CSCI 211 with a grade of C or higher. CSCI 217 or MATH 217 recommended.**Typically Offered:** Inquire at department

Topics include number systems and their rules for arithmetic; basic central processing unit (CPU) organization concepts such as registers, data paths, the arithmetic and logic unit (ALU) and the interface to random access memory (RAM); instruction formats, addressing modes and their uses with a variety of data structures; and parameter passing techniques including the use of a stack frame. The use of good programming methodologies to develop and document algorithms at the assembly language level is emphasized. 2 hours activity, 2 hours lecture. (002290)

Grade Basis: Graded**Repeatability:** You may take this course for a maximum of 3 units**Course Attributes:** Lower Division**CSCI 300 Computer Science Seminar****1 Unit****Prerequisite:** CSCI 211 with a grade of C or higher.**Typically Offered:** Fall and spring

This course exposes students to computer science topics not normally covered in the computer science curriculum. Guest speakers include faculty (including from other departments), students, alumni, and members of the computing industry. Topics include current computer science research and software development issues. Specific topics may include software development tools, bioinformatics, human computer interaction, security, machine learning, specific corporate approaches to software development, dev-ops, software job interviews, programming languages, simulation, graphics, game development, web and mobile applications, cloud computing, and networks. 1 hour lecture. (021889)

Grade Basis: Credit/No Credit**Repeatability:** You may take this course for a maximum of 3 units**Course Attributes:** Upper Division**CSCI 301W Computer's Impact on Society (W)****3 Units W, GW****Prerequisite:** GE Written Communication (A2) requirement; Junior standing.**Typically Offered:** Fall and spring

Impact of computers and high-tech systems on people, institutions, organizations, and environment. Examines the following: law, medicine, education, government, data banks, privacy, computer security, changing work, automation, robots, expert systems, AI, social responsibility, ethics, war, conflict resolution. Includes weekly reading, midterm, and final writing projects. Weekly lectures, discussions, films, and writing. No programming. 3 hours discussion. (002309)

Grade Basis: Graded**Repeatability:** You may take this course for a maximum of 3 units**Course Attributes:** Upper Division; Writing Course; Graduation Writing Assessment**CSCI 310 Programming Foundations****6 Units****Prerequisite:** Graduate Standing.**Typically Offered:** Fall only

An accelerated object-oriented programming course that prepares students without sufficient undergraduate preparation for the graduate program in computer science. Coverage includes software specification, design, implementation, debugging techniques, dynamic memory, I/O, linked lists, stacks, queues, recursion, trees, search structures, hashing, heaps, sorting algorithms, graph algorithms, and an introduction to the complexity of algorithms. Foundational data structures and algorithms are studied and analyzed using both mathematical and empirical measurements. The course includes a number of large programming assignments focusing on object-oriented software engineering and algorithm development. 2 hours activity, 5 hours discussion. (022021)

Grade Basis: Graded**Repeatability:** You may take this course for a maximum of 6 units**Course Attributes:** Upper Division**CSCI 311 Algorithms and Data Structures****4 Units****Prerequisite:** CSCI 211 with a grade of C or higher; CSCI 217 or MATH 217 with a grade of C or higher.**Typically Offered:** Fall and spring

This course focuses on object-oriented methodologies in designing and implementing a variety of data structures and algorithms. Coverage includes recursion, trees, search structures, hashing, heaps, sorting algorithms, and graph algorithms. Data structure and algorithm combinations will be studied and analyzed along with their relative merits using both mathematical and empirical measurements. The course includes a number of large programming assignments focusing on object-oriented software engineering and algorithm development. Students will be required to design, implement, test, and analyze their programs in at least one object-oriented language. 2 hours activity, 3 hours lecture. (002325)

Grade Basis: Graded**Repeatability:** You may take this course for a maximum of 4 units**Course Attributes:** Upper Division**CSCI 315 Programming Languages****3 Units****Prerequisite:** CSCI 311 with a grade of C or higher.**Typically Offered:** Spring only

An investigation into the structure and syntax of current programming languages, including binding, scoping, data types, transfer-of-control structures, subprograms, abstract data types, object-oriented programming, and logical and functional programming. 3 hours discussion. (002323)

Grade Basis: Graded**Repeatability:** You may take this course for a maximum of 3 units**Course Attributes:** Upper Division

- CSCI 344 Shell Programming** **3 Units**
Prerequisite: CSCI 211 with a grade of C or higher; CSCI 217 or MATH 217 with a grade of C or higher.
Typically Offered: Spring only
 This course examines the tools that allow software engineers to automate frequently performed operations and workflows, manipulate text and data, and develop software more quickly and easily than compiled languages. Shell programming in BASH or a similar shell, text processing languages such as sed and awk, and a scripting language such as Python or Ruby are covered. This course is recommended for students pursuing careers in software development and/or information systems. 2 hours activity, 2 hours discussion. (002330)
Grade Basis: Graded
Repeatability: You may take this course for a maximum of 3 units
Course Attributes: Upper Division
- CSCI 345 Linux System Administration** **3 Units**
Prerequisite: CSCI 211 with a grade of C or higher; CSCI 217 or MATH 217 with a grade of C or higher.
Typically Offered: Fall only
 This course guides students through the fundamentals of Linux system administration. Topics include an exploration of the Linux Standard Base, user account and file system management, process and service management, operating system installation and configuration, and virtual and cloud environments. 2 hours activity, 2 hours discussion. (002372)
Grade Basis: Graded
Repeatability: You may take this course for a maximum of 3 units
Course Attributes: Upper Division
- CSCI 385 Introduction to Data Science** **3 Units**
Prerequisite: CSCI 111, MATH 130, or MATH 230; MATH 109 or MATH 120.
Typically Offered: Fall only
 Data Science is the science of learning from data in order to gain useful predictions and insights. The course provides an overview of the wide area of data science, with a particular focus on the tools required to store, clean, manipulate, visualize, model, and ultimately extract information from various sources of data. Topics include the analytics life cycle, data integration and modeling in R/Python, relational databases and SQL, text processing and sentiment analysis, and data visualization. Emphasis is placed on reproducible research, code sharing, version control, and communicating results to a non-technical audience. 3 hours discussion. (021756)
Cross listing(s): MATH 385
Grade Basis: Graded
Repeatability: You may take this course for a maximum of 3 units
Course Attributes: Upper Division
- CSCI 389 Industry Internship** **1-3 Units**
Prerequisite: Department permission.
Typically Offered: Fall and spring
 This internship is offered for 1.0-3.0 units. Students must register directly with a supervising faculty member. 3 hours supervision. (002342)
Grade Basis: Credit/No Credit
Repeatability: You may take this course for a maximum of 15 units
Course Attributes: Upper Division
- CSCI 398 Special Topics** **1-3 Units**
Prerequisite: Department permission.
Typically Offered: Fall and spring
 This course is for special topics offered for 1.0-3.0 units. Typically the topic is offered on a one-time-only basis and may vary from term to term and be different for different sections. See the Class Schedule for the specific topic being offered. 3 hours lecture. (002350)
Grade Basis: Graded
Repeatability: You may take this course more than once
Course Attributes: Upper Division
- CSCI 399 Special Problems** **1-3 Units**
Prerequisite: Faculty permission.
Typically Offered: Fall and spring
 This course is a special topic offered for 1.0-3.0 units. You must register directly with a supervising faculty member. Independent study and investigation of special problems in student's area of concentration. Both registration and study plan must have approval of the instructor and the department chair. 9 hours supervision. (002351)
Grade Basis: Credit/No Credit
Repeatability: You may take this course for a maximum of 6 units
Course Attributes: Upper Division
- CSCI 411 Advanced Algorithms and Complexity** **4 Units**
Prerequisite: CSCI 311 with a grade of C or higher.
Typically Offered: Fall and spring
 Students design, implement, and analyze algorithms for solving problems. Topics include dynamic programming, graphs (topological sort, strongly connected components), shortest paths (Bellman-Ford, Floyd-Warshall), minimum spanning tree (Kruskal's), flow network (max flow, min cut, maximum bipartite matching), string search (suffix tree, suffix array, Burrows-Wheeler's Transform, longest common prefix array). In addition, basic automata computability and complexity are covered, including finite automata, regular expressions, context free grammars, Turing machines, P and NP classes, and NP complete classes and problems. This course integrates knowledge of data structures, algorithms, and programming. 4 hours discussion. (002371)
Grade Basis: Graded
Repeatability: You may take this course for a maximum of 4 units
Course Attributes: Upper Division
- CSCI 420 Applied Quantum Computing for Computer Scientists** **3 Units**
Prerequisite: CSCI 311 with a grade of C or higher; MATH 109, MATH 120, or MATH 315.
Typically Offered: Spring only
 This course introduces the practice of quantum computation and algorithms in computer science. Topics covered include the mathematics to understand the relationship between physical systems and quantum computation. Algorithms to be implemented include Deutsch's mapped function algorithm, Grover's search algorithm, Simon's periodicity algorithm, and Shor's prime factorization algorithm. Other concepts include quantum error correction, and quantum cryptography. Students will develop their code on a quantum computer. 2 hours activity, 2 hours lecture. (022275)
Grade Basis: Graded
Repeatability: You may take this course for a maximum of 3 units
Course Attributes: Upper Division; Laptop required

- CSCI 430 Software Engineering** **3 Units**
Prerequisite: CSCI 311 with a grade of C or higher.
Typically Offered: Fall and spring
 An overview of software engineering principles, practice, and tools. Topics include: agile software engineering methodologies, requirements engineering, test-driven development, software design patterns, MVC architecture, version control, software metrics, and static analysis. Students work in groups to design and implement a semester-long open source software project. 2 hours activity, 2 hours discussion. (002310)
Grade Basis: Graded
Repeatability: You may take this course for a maximum of 3 units
Course Attributes: Upper Division
- CSCI 431W Usability Engineering (W)** **3 Units GE, W**
Prerequisite: GE Oral Communication (A1); GE Written Communication (A2); GE Critical Thinking (A3); GE Mathematics/Quantitative Reasoning (B4) requirements, or consent of the instructor.
Typically Offered: Fall and spring
 Usability Engineering is the craft of designing and evaluating how people interact with products and technology. In this course, students learn qualitative and quantitative methods for conducting behavioral research to investigate human-computer interaction (HCI) and to iteratively improve user experience (UX) design of digital interfaces. Students engage in team projects and conduct user research to design, evaluate and revise interactive prototypes following the user-centered design process. 2 hours activity, 2 hours discussion. (020615)
General Education: Upper-Division Social Sciences (UDD); Innovation, Design, and the Arts Pathway
Grade Basis: Graded
Repeatability: You may take this course for a maximum of 3 units
Course Attributes: Upper Division; Laptop required; Writing Course
- CSCI 440 Operating Systems** **4 Units**
Prerequisite: CSCI 221 or EECE 237; CSCI 311 all with a grade of C or higher.
Typically Offered: Fall and spring
 Operating system fundamentals, including history, process and thread management, concurrency with semaphores and monitors, deadlocks, storage management, file systems, I/O, and distributed systems. 2 hours activity, 3 hours discussion. (002328)
Grade Basis: Graded
Repeatability: You may take this course for a maximum of 4 units
Course Attributes: Upper Division
- CSCI 446 Introduction to Computer Networks and Network Management** **3 Units**
Prerequisite: CSCI 211; CINS 220, CSCI 221, or EECE 237 all with a C or higher.
Typically Offered: Fall and spring
 This course is an introduction to basic networking technologies and network management concepts, including major network operating systems, communication architecture focusing on ISO and Internet models with discussion of current standards and protocols. Significant laboratory work using current networking equipment reinforces lectures and provides fundamental experience with router and switch management. 3 hours laboratory, 2 hours lecture. (002340)
Cross listing(s): EECE 446
Grade Basis: Graded
Repeatability: You may take this course for a maximum of 3 units
Course Attributes: Upper Division
- CSCI 485 Advanced Topics in Data Science** **3 Units**
Prerequisite: CSCI 385 or MATH 385; MATH 456 (may be taken concurrently).
Typically Offered: Spring only
 Getting connected to current events in Data Science and building an online presence. Ethics of predictive analytics and privacy and open data. Reporting and dissemination of research using interactive dashboards and web-publishing. Introduction to current scalable technologies to handle Big Data. Introduction to advanced statistical analysis and machine learning techniques for Data Science. 3 hours lecture. (021890)
Cross listing(s): MATH 485
Grade Basis: Graded
Repeatability: You may take this course for a maximum of 3 units
Course Attributes: Upper Division
- CSCI 490 Computer Science Capstone** **3 Units**
Prerequisite: CSCI 430; CINS 465, CINS 467, or MATH 485; Senior Standing.
Typically Offered: Fall and spring
 This capstone course provides a culminating activity in computer science. Students will work independently to specify, design, develop, test, and document a complete software application under faculty supervision. Students present status reports at weekly meetings, and present their finished project at the end of the semester. 9 hours supervision. (002343)
Grade Basis: Report in Progress: Graded
Repeatability: You may take this course for a maximum of 3 units
Course Attributes: Upper Division
- CSCI 498 Topics in Computer Science** **1-3 Units**
Typically Offered: Inquire at department
 This course is a special topic offered for 1.0-3.0 units. Exploration of selected topics in Computer Science. Consult semester schedules for specific listings. Standard letter grading only. 3 hours discussion. (002389)
Grade Basis: Graded
Repeatability: You may take this course more than once
Course Attributes: Upper Division
- CSCI 499 Special Problems** **1-3 Units**
Prerequisite: Faculty permission.
Typically Offered: Fall and spring
 This course is an independent study of special problems offered for 1.0-3.0 units. You must register directly with a supervising faculty member. 3 hours supervision. (002390)
Grade Basis: Credit/No Credit
Repeatability: You may take this course for a maximum of 6 units
Course Attributes: Upper Division
- CSCI 499H Honors Research Project/Thesis** **3 Units**
Prerequisite: Acceptance into Honors in the Major program.
Typically Offered: Fall and spring
 Open by invitation to computer science majors with a GPA of 3.5 or higher in the major. This Honors in the Major course focuses on the development of a creative research project in computer science, its presentation, discussion of relevant research materials, and the reporting of findings. 9 hours supervision. (002391)
Grade Basis: Graded
Repeatability: You may take this course for a maximum of 3 units
Course Attributes: Upper Division

<p>CSCI 511 Advanced Object-Oriented Programming 3 Units Prerequisite: CSCI 311 with a grade of C or higher. Typically Offered: Fall only This course is dedicated to the analysis, design, and implementation of programming problems using an object-oriented approach. Modern object-oriented languages are utilized. Topics include inheritance, the underlying implementation of polymorphism, exception handling, extending existing system libraries, and approaching algorithm development from an object-oriented perspective. 3 hours lecture. (002356) Grade Basis: Graded Repeatability: You may take this course for a maximum of 3 units Course Attributes: Upper Division</p>	<p>CSCI 530 Software Testing and Quality Assurance 3 Units Prerequisite: CSCI 430 with a grade of C or higher. Typically Offered: Fall only In-depth study of software verification and validation with a concentration on software testing methods, tools, and metrics. Topics include Test-Driven Development, unit testing, integration testing, acceptance testing, as well as software and testing metrics. Students work individually as well as in teams to verify and validate large open source projects. 3 hours discussion. (021620) Grade Basis: Graded Repeatability: You may take this course for a maximum of 3 units Course Attributes: Upper Division</p>
<p>CSCI 511H Object-Oriented Programming - Honors 3 Units Prerequisite: CSCI 311 with a grade of C or higher; acceptance into Honors in the Major program. Typically Offered: Fall only Honors version of CSCI 511. In addition to completing all course requirements for CSCI 511, the student is required to research a topic related to Object-Oriented Programming, and propose an independent study to be completed during the following semester. A written research report and proposal is required. A grade of B or higher in this course is necessary in order to use it to earn the Honors in the Major distinction. 3 hours discussion. (020790) Grade Basis: Graded Repeatability: You may take this course for a maximum of 3 units Course Attributes: Upper Division</p>	<p>CSCI 540 Systems Programming 3 Units Prerequisite: CSCI 340 with a grade of C or higher. Typically Offered: Fall only A hands-on project course that examines the development of systems software. It provides an introduction to writing low level programs in the UNIX/Linux environment. Topics include using system calls, processes, threads, concurrency, process/thread synchronization, signals, and interprocess communication. The course includes several large programming projects which provide students solid experience in lower level programming. 3 hours discussion. (002378) Grade Basis: Graded Repeatability: You may take this course for a maximum of 3 units Course Attributes: Upper Division</p>
<p>CSCI 515 Compiler Design 3 Units Prerequisite: CSCI 311 with a grade of C or higher. Typically Offered: Fall and spring The elements of lexical, syntactical, and semantic analysis including finite and push-down automata, top-down and bottom-up parsing, error detection and recovery, semantic actions and code generation. 3 hours discussion. (002369) Grade Basis: Graded Repeatability: You may take this course for a maximum of 3 units Course Attributes: Upper Division</p>	<p>CSCI 546 Computer Network Management 3 Units Prerequisite: CSCI 446 with a grade of C or higher. Typically Offered: Spring only This course covers advanced network management concepts and implementations including a network operating system, workstation management, and domain administration. Coverage also includes TCP/IP administration and router/hub management. The course provides hands-on experience on network management in a laboratory environment. 3 hours laboratory, 2 hours lecture. (002382) Grade Basis: Graded Repeatability: You may take this course for a maximum of 3 units Course Attributes: Upper Division</p>
<p>CSCI 515H Compiler Design - Honors 3 Units Prerequisite: CSCI 311 with a grade of C or higher, acceptance into Honors in the Major Program. Typically Offered: Fall and spring The elements of lexical, syntactical, and semantic analysis including finite and push-down automata, top-down and bottom-up parsing, error detection and recovery, semantic actions, and code generation. Honors students enrolled in this course are required to implement a significant additional feature in the semester project and to develop an approved proposal in the area of languages/compilers for their Honors Research Project/Thesis. 3 hours discussion. (020185) Grade Basis: Graded Repeatability: You may take this course for a maximum of 3 units Course Attributes: Upper Division</p>	<p>CSCI 551 Numerical Methods and Parallel Programming 3 Units Prerequisite: CSCI 440 with a grade of C or higher, MATH 109 or MATH 120. Typically Offered: Fall and spring Surveys numerical methods and parallel programming. Parallel architectures and algorithms for scientific programming applications, solution of simultaneous linear and non-linear equations, iterative techniques, matrix methods, and error analysis. Development of parallel algorithms, with a focus on efficient implementation and performance. 3 hours discussion. (002332) Grade Basis: Graded Repeatability: You may take this course for a maximum of 3 units Course Attributes: Upper Division</p>

CSCI 566 Computer Graphics Programming**3 Units****Prerequisite:** CSCI 311 with a grade of C or higher.**Typically Offered:** Fall only

This course covers algorithms and data structures in computer graphics. Topics include output primitives and their attributes, 2-D and 3-D geometric transformations and viewing, 3-D object modeling, parallel and perspective projections, visible surface detection, illumination models, and rendering algorithms. 3 hours discussion. (002363)

Grade Basis: Graded**Repeatability:** You may take this course for a maximum of 3 units**Course Attributes:** Upper Division**CSCI 580 Artificial Intelligence****3 Units****Prerequisite:** CSCI 311 with a grade of C or higher.**Typically Offered:** Fall and spring

This course introduces the basic principles, techniques, and applications of artificial intelligence. This course is organized in three sections: search, logic, and learning. Topics include but are not limited to problem-solving, heuristic search, genetic algorithm, game-playing, constraint-satisfaction problems, propositional and predicate logic, knowledge representation, feed-forward neural networks, and decision trees. Students implement and analyze artificial intelligence algorithms. 3 hours discussion. (002360)

Grade Basis: Graded**Repeatability:** You may take this course for a maximum of 3 units**Course Attributes:** Upper Division**CSCI 580H Artificial Intelligence - Honors****3 Units**

Prerequisite: CSCI 311 with a grade of C or higher, acceptance into Honors in the Major program.

Typically Offered: Fall and spring

An introduction to the basic principles, techniques, and applications of Artificial Intelligence. Coverage includes knowledge representation, logic, inference, problem solving, search algorithms, game theory, perception, learning, planning, and agent design. Students program with AI language tools. Additional areas may include expert systems, machine learning, natural language processing, and computer vision. Honors students enrolled in this course are held to more rigorous standards and expectations in both assignments, participation, and examination than students in CSCI 580. They are also expected to perform preliminary work for the follow-up course, typically in the form of a literature review and proposal. 3 hours discussion. (021882)

Grade Basis: Graded**Repeatability:** You may take this course for a maximum of 3 units**Course Attributes:** Upper Division**CSCI 581 Machine Learning****3 Units****Prerequisite:** CSCI 311 with a grade of C or higher; MATH 109 or MATH 120.**Typically Offered:** Fall only

This course introduces students to the concepts, theories, and experimental methods of machine learning. This course develops a broad understanding of the issues in implementing machine learning algorithms and systems, especially as they relate to modern data-intensive problems. Topics include but are not limited to experimental design, supervised learning (linear and non-linear regression, parametric and nonparametric learning, support vector machines, Bayesian networks, Hidden Markov Models, and advanced neural networks), unsupervised learning (clustering, dimensionality reduction, and kernel methods), ensemble approaches, learning theory, and reinforcement learning. Students implement and analyze machine learning algorithms. 3 hours discussion. (022009)

Grade Basis: Graded**Repeatability:** You may take this course for a maximum of 3 units**Course Attributes:** Upper Division**CSCI 581H Machine Learning- Honors****3 Units****Prerequisite:** CSCI 311 with a grade of C or higher.**Typically Offered:** Fall and spring

This course introduces students to the concepts, theories, and experimental methods of machine learning. This course develops a broad understanding of the issues in implementing machine learning algorithms and systems, especially as they relate to modern data-intensive problems. Topics include but are not limited to experimental design, supervised learning (linear and non-linear regression, parametric and nonparametric learning, support vector machines, Bayesian networks, Hidden Markov Models, and advanced neural networks), unsupervised learning (clustering, dimensionality reduction, and kernel methods), ensemble approaches, learning theory, and reinforcement learning. Students implement and analyze machine learning algorithms. Honor students enrolled in this course are held to more rigorous standards and expectations in assignments, participation, and examinations than students in CSCI 581. Students are also expected to perform preliminary work for the follow-up course, typically in the form of a literature review and proposal. 3 hours discussion. (022108)

Grade Basis: Graded**Repeatability:** You may take this course for a maximum of 3 units**Course Attributes:** Upper Division**CSCI 582 Bioinformatics****3 Units****Prerequisite:** CSCI 311 with a grade of C or higher; MATH 105, MATH 314, or MATH 350 (may be taken concurrently).**Typically Offered:** Spring only

An introduction to computational methods for Next Generation Sequencing data analysis. Topics include mapping sequenced reads back to a reference genome; approximate string matching; intro to biostatistics; probability distribution, hypothesis testing; identification of SNPs (single polymorphisms); analysis of RNA-seq data; mapping RNA-seq reads, identification of splice-junctions, analysis of gene expression; genome-wide associative analysis of methylation and gene expression. 3 hours discussion. (021619)

Grade Basis: Graded**Repeatability:** You may take this course for a maximum of 3 units**Course Attributes:** Upper Division

- CSCI 585 Robotics and Machine Intelligence** **3 Units**
Prerequisite: CSCI 211, EECE 237 both with a grade of C or higher.
Typically Offered: Spring only
 This course introduces students to the field of robotics by emphasizing the task of endowing machines with intelligence. Topics include various case studies of robot architectures and algorithms that facilitate embodying a robot with behaviors that are traditionally associated with human cognition (e.g., perception, reasoning, intelligent navigation, vision, learning, etc.). Students conduct research and experiments with robotics hardware and software. 2 hours activity, 2 hours lecture. (002361)
Grade Basis: Graded
Repeatability: You may take this course for a maximum of 3 units
Course Attributes: Upper Division
- CSCI 598 Adv Topic in Computer Science** **1-4 Units**
Typically Offered: Inquire at department
 This course is a special topic offered for 1.0-4.0 units. Exploration of selected topics in Computer Science. Consult semester schedules for specific listings. Standard letter grading only. 0 hours discussion. (020184)
Grade Basis: Graded
Repeatability: You may take this course more than once
Course Attributes: Upper Division
- CSCI 611 Applied Machine Learning** **3 Units**
Prerequisite: CSCI 311 and classified graduate standing.
Typically Offered: Spring only
 The course offers a practical exploration into machine learning and cutting-edge topics in neural networks, including modern techniques for deep learning. Students build deep learning models using sophisticated machine learning frameworks and scientific libraries. 3 hours lecture. (002395)
Grade Basis: Graduate Graded
Repeatability: You may take this course for a maximum of 3 units
Course Attributes: Graduate Division
- CSCI 612 Applied Computer Vision** **3 Units**
Prerequisite: CSCI 311 or equivalent with C or higher.
Typically Offered: Spring only
 Applied computer vision used in automation, robotics, physical security, surveillance, and inspection applications and systems. Topics covered include theory of computer vision and related algorithms for image capture and processing, filtering, thresholds, edge detection, shape analysis, shape detection, salient object detection, pattern matching, digital image enhancement, stereo ranging, and methods of sensor and information fusion. Focus is on real-time continuous image processing from cameras and video. Application using multi-core and co-processing parallel computing systems are covered as they relate to scaling of computer vision applications. 2 hours activity, 2 hours discussion. (022279)
Grade Basis: Graduate Graded
Repeatability: You may take this course for a maximum of 3 units
Course Attributes: Graduate Division; Laptop required
- CSCI 620 Web Technology** **3 Units**
Prerequisite: CINS 370, CSCI 311, and classified graduate standing.
Typically Offered: Fall only
 This course examines frameworks, libraries, languages, and tools for the development of full stack web applications that are progressive, responsive, and secure. Student propose, design, develop, test, and present a nontrivial full stack web application. 3 hours seminar. (002436)
Grade Basis: Graduate Graded
Repeatability: You may take this course for a maximum of 3 units
Course Attributes: Graduate Division
- CSCI 630 Software Design and Maintenance** **3 Units**
Prerequisite: CSCI 430 and classified graduate standing.
Typically Offered: Spring only
 Students conduct a study of designing and maintaining complex software. The course builds upon fundamental software engineering skills with an emphasis on: Object-Oriented software design patterns, anti-patterns, code review and refactoring, and tools for evaluating code quality. Students practice maintaining software by collaborating on a large-scale open source project using automated development operation (DevOps) tools. 3 hours discussion. (002394)
Grade Basis: Graduate Graded
Repeatability: You may take this course for a maximum of 3 units
Course Attributes: Graduate Division
- CSCI 640 Operating Systems** **3 Units**
Prerequisite: CSCI 440 and classified graduate standing.
Typically Offered: Fall only
 In-depth study of operating systems concepts including results from recent research. Topics may include processes, threads, virtual memory, file systems, distributed computing, scheduling, protection, and communication protocols. Students may be required to implement operating system projects. 3 hours seminar. (002430)
Grade Basis: Graduate Graded
Repeatability: You may take this course for a maximum of 3 units
Course Attributes: Graduate Division
- CSCI 650 Algorithms and Computability** **3 Units**
Prerequisite: CSCI 311 and classified graduate standing.
Typically Offered: Spring only
 This course presents algorithm design techniques (such as divide-and-conquer, greedy algorithms, dynamic programming, and others), mathematical and empirical analysis of algorithms, computability, Rice's theorem, P and NP classes, NP-completeness, and recent advances in algorithms. 3 hours seminar. (002417)
Grade Basis: Graduate Graded
Repeatability: You may take this course for a maximum of 3 units
Course Attributes: Graduate Division
- CSCI 651 Applied Graph Theory** **3 Units**
Prerequisite: CSCI 311 and classified graduate standing.
Typically Offered: Fall only
 This course covers foundational aspects of network science, the study of graph representations and the patterns they contain, along with tools and techniques for analyzing network data. Topics include random graph models, measures of structural importance, information spread in data networks, and methods for embedding graphs in real space. This is a project-based course. Students implement and apply graph algorithms on real-world network data. 3 hours lecture. (022206)
Grade Basis: Graduate Graded
Repeatability: You may take this course for a maximum of 3 units
Course Attributes: Graduate Division

CSCI 682 Topics in Artificial Intelligence 3 Units**Prerequisite:** Classified graduate standing.**Typically Offered:** Inquire at department

Further study of selected advanced topics in artificial intelligence as presented in recently published journals; possible emphasis on research interests and/or projects of faculty in the department. Consult the Graduate Coordinator to determine how many units may be counted toward your major. 3 hours lecture. (002402)

Grade Basis: Graduate Graded**Repeatability:** You may take this course for a maximum of 12 units**Course Attributes:** Graduate Division**CSCI 689 Internship 1-3 Units****Typically Offered:** Fall and spring

0 hours supervision. (020142)

Grade Basis: Report in Progress: CR/NC**Repeatability:** You may take this course for a maximum of 3 units**Course Attributes:** Graduate Division**CSCI 693 Research Methods in Computer Science 3 Units****Prerequisite:** Candidate status.**Typically Offered:** Spring only

This course interweaves three distinct themes (investigation, experimentation, and technical writing), that culminate in a comprehensive research project, presentation, and oral defense.

First, the students are immersed into the research process within Computer Science. This includes an understanding of the role, ethics, and responsibility of researchers in Computer Science. The second focus is on rigorous design of experiments for the purpose of testing research hypothesis, simulations, and models, and interpreting the results of those experiments. Finally, proficiency in communication of scientific ideas and findings will be addressed, from intensive reading, critiques, technical writing and oral presentations. 3 hours discussion. (020616)

Grade Basis: Graduate Graded**Repeatability:** You may take this course for a maximum of 3 units**Course Attributes:** Graduate Division**CSCI 697 Independent Study 1-6 Units****Prerequisite:** Classified graduate standing, faculty permission.**Typically Offered:** Fall and spring

This course is an independent study offered for 1.0-6.0 units. You must register directly with a supervising faculty member. Independent study and investigation of special problems in student's area of concentration. Both registration and study plan must have approval of the instructor and the student's graduate advisory committee chair. 9 hours supervision. (002451)

Grade Basis: Credit/No Credit**Repeatability:** You may take this course for a maximum of 6 units**Course Attributes:** Graduate Division**CSCI 698 Seminar in Advanced Topics 3 Units****Typically Offered:** Inquire at department

This course is a seminar offered for 1.0-3.0 units. Typical subjects in past semesters have included microprogramming theory, operating system development, software engineering principles, data communications, analysis of algorithms, and program optimization. Consult the Class Schedule for listing and prerequisites. 2 hours activity, 2 hours discussion. (002446)

Grade Basis: Graduate Graded**Repeatability:** You may take this course for a maximum of 3 units**Course Attributes:** Graduate Division**CSCI 699P Master's Project 3 Units****Prerequisite:** Candidate status.**Typically Offered:** Fall and spring

You must register directly with a supervising faculty member.

Independent study and investigation of special problems in student's area of concentration. Both registration and study plan must have approval of the instructor and the student's graduate advisory committee chair. Master's Project courses earn a Credit grade upon completion. 9 hours supervision. (002461)

Grade Basis: Report in Progress: CR/NC**Repeatability:** You may take this course for a maximum of 3 units**Course Attributes:** Graduate Division**CSCI 699T Master's Thesis 1-6 Units****Prerequisite:** Candidate status.**Typically Offered:** Fall and spring

This course is offered for 1.0-6.0 units. You must register directly with a supervising faculty member. Independent study and investigation of special problems in student's area of concentration. Both registration and study plan must have approval of the instructor and the student's graduate advisory committee chair. Master's Thesis courses earn a Credit grade upon completion. 9 hours supervision. (002453)

Grade Basis: Report in Progress: CR/NC**Repeatability:** You may take this course for a maximum of 6 units**Course Attributes:** Graduate Division

Computer Science Education

CSED 500 Computational Thinking 3 Units**Typically Offered:** Summer session only

This course explores broad concepts and applications of Computer Science including Human-Computer Interaction, problem solving, web design, programming, computing and data analysis, and robotics. The course introduces programming in a graphical, block-based development environment. Synchronous online activity; tablet, laptop, or desktop computer is required. 3 hours lecture. (022210)

Grade Basis: Graded**Repeatability:** You may take this course for a maximum of 6 units**Course Attributes:** Upper Division; Laptop required**CSED 501 Computing Practice and Programming 3 Units****Typically Offered:** Summer session only

In a broad introduction to Computer Science, this course emphasizes problem solving by collaboratively designing, developing, and evaluating algorithms. The class explores creative development, abstraction, data representation, computer systems and networks, and impacts of computing while learning the fundamentals of high-level programming in Python. Synchronous online discussion and laboratory; laptop or desktop computer is required. 3 hours lecture. (022211)

Grade Basis: Graded**Repeatability:** You may take this course for a maximum of 6 units**Course Attributes:** Upper Division; Laptop required

CSED 510 Technology for Computer Science Education 2 Units**Prerequisite:** CSED 500, CSED 501 or CSCI 111.**Typically Offered:** Fall only

Hardware and software technologies evolve rapidly. This course provides an overview of components and integrated systems of computers and networking. Students complete a supervised project to plan and integrate educational technologies for Computer Science classrooms.

The project explores technology for supporting evidence-based pedagogy to foster interactive, creative, and inclusive Computer Science education. Asynchronous online lecture and supervised project. 6 hours supervision. (022212)

Grade Basis: Graded**Repeatability:** You may take this course for a maximum of 2 units**Course Attributes:** Upper Division; Laptop required**CSED 511 Computing in Society 2 Units****Prerequisite:** CSED 500, CSED 501, or CSCI 111.**Typically Offered:** Spring only

Computers are ubiquitous and influential in shaping 21st century society. This course discusses the impacts of computers on individuals and on society. It also addresses issues of inclusion and equity in Computer Science pedagogy and relates contemporary social issues to the discipline. Students complete a supervised project to develop educational materials for Computer Science classrooms that contextualize computing in society. 6 hours supervision. (022280)

Grade Basis: Graded**Repeatability:** You may take this course for a maximum of 2 units**Course Attributes:** Upper Division**CSED 590 Software Design, Data Structures, and Algorithms 4 Units****Prerequisite:** CSCI 111 or CSED 501.**Typically Offered:** Summer session only

This course explores the design and construction of software applications by adopting the Agile software development process. Students practice the fundamentals Object-Oriented Programming with the Java programming language. Concepts include primitive types and operations, objects and classes, boolean expressions, decisions, iteration, single- and multi-dimensional arrays, inheritance, recursion, sorting, and searching. Projects involve software engineering practices and tools, including professional integrated development environments (IDE), to create real software applications. 4 hours lecture. (022284)

Grade Basis: Graded**Repeatability:** You may take this course for a maximum of 4 units**Course Attributes:** Upper Division; Laptop required

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Associate Professor

Doctor of Philosophy Univ Of Colorado At Boulder

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