Fall 2020 Course Descriptions as of 04/05/2020 08:11 PM

Information in Browse Course Catalog is subject to change. Information is term specific. Please refer to the appropriate term when searching for course content. Key to Course Descriptions may be found at: **http://rcs.registrar.arizona.edu/course_descriptions_key**.

Computer Science Main (CSC)

CSC 101: Introduction to Computer Science (3 units)
Description: This course introduces students to some of the big ideas in computer science. It will excite students about the application of computer science to various disciplines, and show the social impact possible through the use of technology in developing regions, politics, medicine, and other fields.
Grading basis: Regular Grades
Career: Undergraduate
Flat Fee: $40
Course Components: Lecture   Required
Course typically offered:
Main Campus: Fall, Spring

Enrollment requirement: Enrollment in this course is not open to Computer Science majors.

CSC 110: Introduction to Computer Programming I (4 units)
Description: An introduction to programming with an emphasis on solving problems drawn from a variety of domains. Topics include basic control and data structures, problem solving strategies, and software development tools and techniques.
Grading basis: Regular Grades
Career: Undergraduate
Flat Fee: $40
Course Components: Lecture   Required
Course typically offered:
Main Campus: Fall, Spring, Summer

Enrollment requirement: PPL 60+ or SAT I MSS 640+ or ACT MATH 26+ or (C or higher in CSC 101 or MATH 112) or one courses from MATH 113, 116, 120R, 122A, 122B, or 125. Test scores expire after 2 years.

CSC 120: Introduction to Computer Programming II (4 units)
Description: Provides a continuing introduction to programming with an emphasis on problem-solving. It considers problems drawn from a variety of domains (including Computer Science) and emphasizes both the broader applicability of the relevant data structures and programming concepts, as well as the implementation of those structures and concepts in software. Topics include arrays, lists, stacks, queues, trees, searching and sorting, and exceptions.
Grading basis: Regular Grades
Career: Undergraduate
Flat Fee: $40
Course Components: Lecture   Required
Course typically offered:
Main Campus: Fall, Spring, Summer

Enrollment requirement: C or higher in (CSC 110 or CSC 127A or ISTA 130 or ECE 175) or prior programming experience with Python or comparable programming language with department approval.

CSC 199: Independent Study (1 - 3 units)
Description: Qualified students working on an individual basis with professors who have agreed to supervise such work.
Grading basis: Alternative Grading: S, P, F
Career: Undergraduate
Course Components: Independent Study   Required
Repeatable: Course can be repeated a maximum of 99 times.
Course typically offered:
Main Campus: Fall, Spring

CSC 199H: Honors Independent Study (1 - 3 units)
Description: Qualified students working on an individual basis with professors who have agreed to supervise such work.
Grading basis: Regular Grades
Career: Undergraduate
Course Components: Independent Study   Required
Repeatable: Course can be repeated a maximum of 99 times.
Course typically offered:
Main Campus: Fall, Spring

Enrollment requirement: Student must be active in the Honors College.
Honors Course: Honors Course
Honors Course: Honors Course

-SA represents a Student Abroad & Student Exchange offering
-CC represents a Correspondence Course offering
May Be Offered Departments may offer this component in some semesters. See the Schedule of Classes for term-specific offerings.

CSC 210: Software Development (4 units)
Description: An introduction to the development of large- scale software. Topics include modularization, design patterns, documentation, unit testing, source code control, build systems, debuggers, and performance tuning; all of the tools necessary for developing software as opposed to writing small programs.
Grading basis: Regular Grades
Career: Undergraduate
Flat Fee: $40
Course Components: Lecture   Required
Course typically offered:
Main Campus: Fall, Spring, Summer

Enrollment requirement: C or higher in CSC 120.

CSC 245: Introduction to Discrete Structures (3 units)
Description: An introduction to mathematical concepts for Computer Science. Topics include first-order logic and logical arguments, proof techniques with an emphasis on mathematical induction, sets, relations and functions, properties of integers, counting methods, probability, and recurrences. Weekly laboratory.
Grading basis: Regular Grades
Career: Undergraduate
Flat Fee: $15
Course Components: Lecture   Required
Course typically offered:
Main Campus: Fall, Spring, Summer

Enrollment requirement: Student must have earned a C grade or higher in (CSC 120 or CSC 127B or CSC 227).

CSC 250: Essential Computing for the Sciences (3 units)
Description: This course teaches essential computing skills for students in scientific disciplines. No prior background in programming is required. The content focuses on three computational skills: (i) basic programming in a scripting language such as Python, and knowledge of its supported data structures; (ii) facility with the UNIX operating system environment, including file structure, regular expressions, and job control; (iii) essential database skills, including database accession and interfacing through the SQL query language.
Grading basis: Regular Grades
Career: Undergraduate
Flat Fee: $35
Course Components: Lecture   Required
Course typically offered:
Main Campus: Spring

Enrollment requirement: Enrollment in this course is not open to Computer Science majors.

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CSC 252: Computer Organization (3 units)
Description: Basic machine organization; elementary hardware concepts; CPU internals.
Machine operations and instructions; assembly language concepts and programming.
Grading basis: Regular Grades
Career: Undergraduate
Course Components:　　Discussion　　　　May Be Offered
　　　　　　　　　　　　　Lecture　　　　　　Required
Course typically offered:
Main Campus: Fall, Spring

Enrollment requirement: CSC 210 or CSC 127B.

CSC 296B: Seminar in Bioinformatics (1 unit)
Description: This seminar course provides an overview of and introduction to the field of
bioinformatics. Talks by faculty who do research in bioinformatics and computational biology, as
well as by scientists from the biotechnology industry, give a sense of the current directions in
the field.
Grading basis: Alternative Grading: S, P, F
Career: Undergraduate
Course Components:　　Seminar　　　　　　Required
Repeatable: Course can be repeated a maximum of 2 times.
Also offered as: ECOL 296B, MCB 296B
Course typically offered:
Main Campus: Fall

Home department: Ecology & Evolutionary Biology

CSC 299: Independent Study (1 - 4 units)
Description: Qualified students working on an individual basis with professors who have
agreed to supervise such work.
Grading basis: Alternative Grading: S, P, F
Career: Undergraduate
Course Components:　　Independent Study　　Required
Repeatable: Course can be repeated a maximum of 99 times.
Course typically offered:
Main Campus: Fall, Spring, Summer

CSC 299H: Honors Independent Study (1 - 3 units)
Description: Qualified students working on an individual basis with professors who have agreed to supervise such work.
Grading basis: Regular Grades
Career: Undergraduate
Course Components: Independent Study   Required
Repeatable: Course can be repeated a maximum of 99 times.
Course typically offered:
Main Campus: Fall, Spring

Enrollment requirement: Student must be active in the Honors College.
Honors Course: Honors Course
Honors Course: Honors Course

CSC 317: Mobile Application Programming (3 units)
Description: Students will learn how to develop applications for mobile devices. The course will cover the necessary programming language(s), development environment, and a number of platform-specific APIs commonly used in mobile applications such as maps, location services, notifications, camera, and local storage. Other mobile-specific software development topics will be considered such as programming with limited computational and battery resources, client/server architecture, and cloud synchronization.
Grading basis: Regular Grades
Career: Undergraduate
Course Components: Lecture   Required
Course typically offered:
Main Campus: Fall, Spring

Enrollment requirement: CSC 210, or equivalent prior software development experience. Speak with the instructor or a computer science academic advisor to determine if your background will suffice.

CSC 335: Object-Oriented Programming and Design (3 units)
Description: Fundamentals of object-oriented software development. Includes design principles, inheritance, polymorphism, Unified Modeling Language (UML), testing, event-driven programming with graphical user interfaces, applications of design patterns, and use of existing frameworks. Weekly laboratory.
Grading basis: Regular Grades
Career: Undergraduate
Course Components: Lecture   Required
Equivalent to: CSC 330, CSCV 335
Course typically offered:
Main Campus: Fall, Spring

Enrollment requirement: CSC 210 or CSC 127B.

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May Be Offered Departments may offer this component in some semesters. See the Schedule of Classes for term-specific offerings.

CSC 337: Web Programming (3 units)
Description: Introduction to the techniques and technologies for developing dynamic web sites. Topics include a web server, PHP as the server-side scripting language, the MySQL database, JavaScript and AJAX for enriching web services, and page layout with HTML and CSS. Security concerns will be considered with details for prevention of such vulnerabilities in web applications. This course includes a team project to deploy a dynamic website. Weekly laboratory.
Grading basis: Regular Grades
Career: Undergraduate
Flat Fee: $35
Course Components: Lecture   Required
Course typically offered:
Main Campus: Fall, Spring

Enrollment requirement: CSC 110 or CSC 127A or CSC 227 or ISTA 130 or ECE 175

CSC 343: Human Computer Interaction (3 units)
Description: The course is a implementation-based introduction to basic concepts of human-computer interaction. Students will learn principles and skills for designing, programming, and evaluating interactive systems and demonstrate these skills through coursework. Topics include: system architecture, algorithms, data structures, verification, and software engineering techniques for implementing and managing interactive interfaces; methods of design and evaluation; and capabilities and limits of both computing devices and humans and their effect on design and implementation.
Grading basis: Regular Grades
Career: Undergraduate
Course Components: Lecture   Required
Course typically offered:
Main Campus: Fall, Spring

Enrollment requirement: CSC 210 and (CSC 245 or Math 243)

CSC 345: Analysis of Discrete Structures (3 units)
Description: Introduction to and analysis of algorithms and characteristics of discrete structures. Course topics include algorithm analysis techniques, recurrence relations, structural induction, hierarchical structures, graphs, hashing, and sorting.
Grading basis: Regular Grades
Career: Undergraduate
Course Components: Lecture   Required
Equivalent to: CSC 346, CSCV 345
Course typically offered:
Main Campus: Fall, Spring

Enrollment requirement: (CSC 127B or CSC 210) and (CSC 245 or MATH 243 or MATH 323).

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CSC 346: Cloud Computing (3 units)
Description: This course focuses on cloud programming, with an emphasis on using the cloud to solve Big Data problems. The course will not only look at how distributed systems, databases, networks, etc. are used to implement cloud computing platforms and cloud applications, but also the impact of the infinite scalability and pay-as-you-go on the platforms and applications.
Grading basis: Regular Grades
Career: Undergraduate
Flat Fee: $35
Course Components: Lecture   Required
Course typically offered:
Main Campus: Fall

Recommendations and additional information: CSC 227, or CSC 127A and CSC 127B, or equivalent.
Enrollment requirement: CSC 120 or CSC 127B or CSC 227

CSC 350: Fundamentals of Computer Science Theory (3 units)
Description: This course introduces the fundamentals of computer science theory, by surveying key concepts from (a) discrete mathematics, (b) data structures and algorithms, and (c) automata and formal languages, that form the foundation of theoretical computer science. The content is designed to provide in one course a broad survey of the essentials of computer science theory for non-majors. This course is not available for credit by computer science pre-majors or majors.
Grading basis: Regular Grades
Career: Undergraduate
Flat Fee: $35
Course Components: Discussion   May Be Offered
                          Lecture   Required
Course typically offered:
Main Campus: Fall

Recommendations and additional information: MATH 112.
Enrollment requirement: Grade of C or better in CSC 120. Not available for Computer Science pre-majors and majors.

CSC 352: Systems Programming and Unix (3 units)
Description: Programming in C, including single and multi-dimensional arrays, lists, stacks, queues, trees, and bit manipulation. Unix topics, including debuggers, makefiles, shell programming, and other topics that support systems programming.
Grading basis: Regular Grades
Career: Undergraduate
Course Components: Laboratory   May Be Offered
                         Lecture   Required
Equivalent to: CSCV 352
Course typically offered:
Main Campus: Fall, Spring

Enrollment requirement: CSC 210 or CSC 127B.

CSC 372: Comparative Programming Languages (3 units)
Description: Introduction to several major high-level programming languages and their characteristics. Programming projects are required in at least three languages.
Grading basis: Regular Grades
Career: Undergraduate
Course Components: Discussion   May Be Offered
                         Lecture   Required
Equivalent to: CSC 327, CSCV 372, MIS 327, MIS 372
Course typically offered:
Main Campus: Spring

Enrollment requirement: CSC 210 or 127B.

CSC 382: Software Development in C++ (3 units)
Description: This course will build upon students' knowledge of C to become proficient at programming in C++. Topics include testing, classes, templates, inheritance, operator overloading, object-oriented design, the Standard Template Library (STL), and event-driven programming with graphical user interfaces. This course also examines features of the newer versions of C++.- The course includes a large team project at the end of the semester. 3 Units.
Grading basis: Regular Grades
Career: Undergraduate
Course Components: Lecture   Required
Course typically offered:
Main Campus: Fall, Spring

Enrollment requirement: CSC 352 or ECE 275

CSC 391: Preceptorship (1 - 3 units)
Description: Specialized work on an individual basis, consisting of instruction and practice in actual service in a department, program, or discipline. Teaching formats may include seminars, in-depth studies, laboratory work and patient study.
Grading basis: Alternative Grading: S, P, F
Career: Undergraduate
Course Components: Independent Study   Required
Repeatable: Course can be repeated a maximum of 99 times.
Course typically offered:
Main Campus: Fall, Spring, Summer

CSC 392: Directed Research (1 - 3 units)
Description: Individual or small group research under the guidance of faculty.
Grading basis: Regular Grades
Career: Undergraduate
Course Components: Independent Study   Required
Repeatable: Course can be repeated for a maximum of 6 units.
Course typically offered:
Main Campus: Fall, Spring

CSC 399: Independent Study (1 - 3 units)
Description: Qualified students working on an individual basis with professors who have agreed to supervise such work.
Grading basis: Alternative Grading: S, P, F
Career: Undergraduate
Course Components: Independent Study   Required
Repeatable: Course can be repeated a maximum of 99 times.
Course typically offered:
Main Campus: Fall, Spring

CSC 399H: Honors Independent Study (1 - 3 units)
Description: Qualified students working on an individual basis with professors who have agreed to supervise such work.
Grading basis: Regular Grades
Career: Undergraduate
Course Components: Independent Study   Required
Repeatable: Course can be repeated a maximum of 99 times.
Course typically offered:
Main Campus: Fall, Spring

Enrollment requirement: Student must be active in the Honors College.
Honors Course: Honors Course
Honors Course: Honors Course

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CSC 401A: Symbolic Logic (3 units)
Description: Intermediate propositional logic and quantificational theory, natural deduction, axiom systems, elementary metatheorems, introduction to notions of modal logic, selected topics in philosophy of logic. Credit allowed for only one of these courses: PHIL 401A, PHIL 402.
Grading basis: Regular Grades
Career: Undergraduate
Course Components: Lecture   Required
Equivalent to: CSC 401A, MATH 401A
Also offered as: MATH 401A, PHIL 401A
Co-convened with:
Course typically offered:
Main Campus: Fall

Home department: Philosophy

CSC 401B: Symbolic Logic (3 units)
Description: Advanced propositional logic and quantification theory; metatheorems on consistency, independence, and completeness; set theory, number theory, and modal theory; recursive function theory and Goedel's incompleteness theorem.
Grading basis: Regular Grades
Career: Undergraduate
Course Components: Lecture   Required
Equivalent to: CSC 401B, MATH 401B
Also offered as: MATH 401B, PHIL 401B
Co-convened with:
Course typically offered:
Main Campus: Spring

Home department: Philosophy

CSC 422: Introduction to Parallel and Distributed Programming (3 units)
Description: Concepts and applications of parallel and distributed programs. Process interaction using shared variables and message passing; parallel computing; development of correct programs; general problem solving techniques; scientific computing; distributed systems. Programming assignments on multiple processor machines.
Grading basis: Regular Grades
Career: Undergraduate
Course Components: Discussion   May Be Offered
                        Lecture   Required
Equivalent to: CSCV 422
Course typically offered:
Main Campus: Spring

Enrollment requirement: CSC 252, CSC 345, CSC 352.

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CSC 425: Computer Networking (3 units)
Description: Theory and practice of computer networks, emphasizing the principles underlying the design of network software and the role of the communications system in distributed computing. Topics include routing, flow and congestion control, end-to-end protocols, and multicast.
Grading basis: Regular Grades
Career: Undergraduate
Course Components: Discussion   May Be Offered
                          Lecture   Required
Course typically offered:
Main Campus: Spring

Enrollment requirement: CSC 252, and CSC 352.

CSC 433: Computer Graphics (3 units)
Description: Theory and practice of computer graphics: basic graphics programming, 2D and 3D transformations, clipping, 2D and 3D viewing, hierarchical modeling, hidden surface removal, lighting and shading, color, ray-tracing, radiosity, curve and surface modeling, and animation.
Grading basis: Regular Grades
Career: Undergraduate
Course Components: Discussion   May Be Offered
                          Lecture   Required
Co-convened with: CSC 533
Course typically offered:
Main Campus: Spring

Enrollment requirement: Major: COSC. CSC 252, CSC 335, CSC 345, CSC 352, and (MATH 215 or MATH 313).

CSC 436: Software Engineering (3 units)
Description: Introduces fundamental software engineering techniques for developing correct, efficient, reliable, maintainable, and evolvable software for large software projects. The class project gives an experience in using evolutionary software development processes for developing a high-quality, evolvable software product that addresses emerging customer requirements.
Grading basis: Regular Grades
Career: Undergraduate

Course Components:	Discussion	May Be Offered
	Lecture	Required

Equivalent to: CSC 435
Co-convened with: CSC 536
Course typically offered:
Main Campus: Fall

Enrollment requirement: CSC 252, CSC 335, CSC 345, and CSC 352.
Student Engagement Activity: Professional Development
Student Engagement Competency: Innovation and Creativity

CSC 437: Geometric Algorithms (3 units)
Description: The study of algorithms for geometric objects, using a computational geometry approach, with an emphasis on applications for graphics, VLSI, GIS, robotics, and sensor networks. Topics may include the representation and overlaying of maps, finding nearest neighbors, solving linear programming problems, and searching geometric databases.
Grading basis: Regular Grades
Career: Undergraduate

Course Components:	Discussion	May Be Offered
	Lecture	Required

Co-convened with: CSC 537
Course typically offered:
Main Campus: Fall

Recommendations and additional information: CSC 345.
Enrollment requirement: Major: COSC and CSC 345.
Writing Emphasis: Writing Emphasis Course

CSC 438: Computational Linguistics (3 units)
Description: Fundamentals of formal language theory; syntactic and semantic processing; the place of world knowledge in natural language processing.
Grading basis: Regular Grades
Career: Undergraduate
Course Components: Lecture   Required
Equivalent to: CSC 438, PSY 438
Also offered as: LING 438, PSY 438
Co-convened with: CSC 538
Course typically offered:
Main Campus: Fall

Recommendations and additional information: LING 388 or a course in one of the following: formal languages, syntax, data structures, or compilers.
Home department: Linguistics

CSC 439: Statistical Natural Language Processing (3 units)
Description: This course introduces the key concepts underlying statistical natural language processing. Students will learn a variety of techniques for the computational modeling of natural language, including: n-gram models, smoothing, Hidden Markov models, Bayesian Inference, Expectation Maximization, Viterbi, Inside-Outside Algorithm for Probabilistic Context-Free Grammars, and higher-order language models.
Grading basis: Regular Grades
Career: Undergraduate
Course Components: Lecture   Required
Equivalent to: CSC 439
Also offered as: ISTA 439, LING 439
Co-convened with: CSC 539
Course typically offered:
Main Campus: Fall

Recommendations and additional information: LING 388, LING 438.
Home department: Linguistics

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May Be Offered Departments may offer this component in some semesters. See the Schedule of Classes for term-specific offerings.

CSC 444: Data Visualization (3 units)
Description: This course will present the fundamentals of data visualization, the art and science of using a computer to generate visual depictions of data. The course will present the foundations of graphic design, perceptual psychology and cognitive science, as well as the algorithmic basis for many for the visualization techniques. While statistical techniques may determine correlations among the data, visualization helps us frame what questions to ask.The course is targeted at students looking for effective ways of understanding data from their own fields, as well as students interested in learning the fundamentals that will enable them to build and improve the state of the art. The successful student will learn to design, critique and improve data visualizations.
Grading basis: Regular Grades
Career: Undergraduate
Course Components: Lecture   Required
Course typically offered:
Main Campus: Spring

Enrollment requirement: Major: COSC, CSC 345, and CSC 335.

CSC 445: Algorithms (3 units)
Description: Introduction to the design and analysis of algorithms: basic analysis techniques (asymptotics, sums, recurrences); basic design techniques (divide and conquer, dynamic programming, greedy, amortization); acquiring an algorithm repertoire (sorting, median finding, strong components, spanning trees, shortest paths, maximum flow, string matching); and handling intractability (approximation algorithms, branch and bound).
Grading basis: Regular Grades
Career: Undergraduate
Course Components: Discussion   May Be Offered
                           Lecture   Required
Equivalent to: CSCV 445
Course typically offered:
Main Campus: Fall, Spring

Enrollment requirement: CSC 345.
Writing Emphasis: Writing Emphasis Course

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-CC represents a Correspondence Course offering
May Be Offered Departments may offer this component in some semesters. See the Schedule of Classes for term-specific offerings.

CSC 447: Green Computing (3 units)
Description: This course covers fundamental principles of energy management faced by designers of hardware, operating systems, and data centers. We will explore basic energy management option in individual components such as CPUs, network interfaces, hard drives, memory. We will further present the energy management policies at the operating system level that consider performance vs. energy saving tradeoffs. Finally we will consider large scale data centers where energy management is done at multiple layers from individual components in the system to shutting down entries subset of machines. We will also discuss energy generation and delivery and well as cooling issues in large data centers. In addition to the assignments listed for undergraduates,
Grading basis: Regular Grades
Career: Undergraduate
Course Components: Lecture   Required
Co-convened with: CSC 547
Course typically offered:
Main Campus: Spring

Enrollment requirement: Major: COSC, CSC 252 and CSC 352.

CSC 450: Algorithms in Bioinformatics (3 units)
Description: This course introduces fundamental results in discrete algorithms for combinatorial problems in bioinformatics and computational biology. The emphasis is on realistic models of computational problems that arise in the analysis of biological data, and practical algorithms for their solution. The content has depth in the area of biological sequence analysis, and breadth in areas such as phylogeny construction, protein structure prediction, and genome rearrangement analysis. Grades are based on homeworks, exams, programming projects, and a class presentation.
Grading basis: Regular Grades
Career: Undergraduate
Course Components: Lecture   Required
Co-convened with: CSC 550
Course typically offered:
Main Campus: Fall

Recommendations and additional information: For both computer science and non-computer science majors, mathematical maturity will be helpful.
Enrollment requirement: CSC 345

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-CC represents a Correspondence Course offering
May Be Offered Departments may offer this component in some semesters. See the Schedule of Classes for term-specific offerings.

CSC 452: Principles of Operating Systems (3 units)
Description: Concepts of modern operating systems; concurrent processes; process synchronization and communication; resource allocation; kernels; deadlock; memory management; file systems.
Grading basis: Regular Grades
Career: Undergraduate
Course Components: Lecture Required
Equivalent to: CSCV 452
Course typically offered:
Main Campus: Fall, Spring

Enrollment requirement: CSC 252, CSC 345, and CSC 352.

CSC 453: Compilers and Systems Software (3 units)
Description: Basic concepts of compilation and related systems software. Topics include lexical analysis, parsing, semantic analysis, code generation; assemblers, loaders, linkers; debuggers.
Grading basis: Regular Grades
Career: Undergraduate
Course Components: Lecture Required
Equivalent to: CSCV 453
Course typically offered:
Main Campus: Spring

Recommendations and additional information: CSC 372 recommended.
Enrollment requirement: Major: COSC, CSC 252, CSC 345, and CSC 352.

CSC 455: Philosophy and Artificial Intelligence (3 units)
Description: Interdisciplinary problems lying at the interface of philosophy and artificial intelligence.
Grading basis: Regular Grades
Career: Undergraduate
Course Components: Lecture Required
Equivalent to: CSC 455, PSY 455
Also offered as: PHIL 455
Co-convened with:
Course typically offered:
Main Campus: Fall, Spring

Home department: Philosophy

CSC 460: Database Design (3 units)
Description: Functions of a database system. Data modeling and logical database design. Query languages and query optimization. Efficient data storage and access. Database access through standalone and web applications.
Grading basis: Regular Grades
Career: Undergraduate
Course Components: Discussion   May Be Offered
                                      Lecture   Required
Equivalent to: CSCV 460
Course typically offered:
Main Campus: Fall, Spring

Enrollment requirement: CSC 335, and CSC 345.

CSC 466: Computer Security (3 units)
Description: This is an introductory course covering the fundamentals of computer security. In particular, the course will cover basic concepts of computer security such as threat models and security policies, and will show how these concepts apply to specific areas such as communication security, software security, operating systems security, network security, web security, and hardware-based security.
Grading basis: Regular Grades
Career: Undergraduate
Course Components: Lecture   Required
Co-convened with: CSC 566
Course typically offered:
Main Campus: Fall, Spring

Enrollment requirement: CSC 252, and CSC 352.

CSC 473: Automata, Grammars and Languages (3 units)
Description: Introduction to models of computation (finite automata, pushdown automata, Turing machines), representations of languages (regular expressions, context-free grammars), and the basic hierarchy of languages (regular, context-free, decidable, and undecidable languages).
Grading basis: Regular Grades
Career: Undergraduate
Course Components: Discussion   May Be Offered
                                      Lecture   Required
Equivalent to: CSCV 473, MATH 473
Course typically offered:
Main Campus: Spring

Enrollment requirement: Major: COSC and CSC 345.
Writing Emphasis: Writing Emphasis Course

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May Be Offered Departments may offer this component in some semesters. See the Schedule of Classes for term-specific offerings.

CSC 474A: Computer-Aided Logic Design (3 units)
Description: Tabular minimization of single and multiple output Boolean functions, NMOS and CMOS realizations, synthesis of sequential circuits, RTL description, laboratory exercises.
Grading basis: Regular Grades
Career: Undergraduate
Course Components: Lecture   Required
Equivalent to: CSC 474A
Also offered as: ECE 474A
Co-convened with: CSC 574A
Course typically offered:
Main Campus: Fall

Recommendations and additional information: ECE 274.
Home department: Electrical & Computer Engr
Enrollment requirement: Adv Stdg: Engineering.

CSC 477: Introduction to Computer Vision (3 units)
Description: Overview of algorithms for analyzing image data. Topics include image formation, physics-based vision, linear filtering, edge detection, multiple view geometry, segmentation, tracking, and recognition.
Grading basis: Regular Grades
Career: Undergraduate
Course Components: Discussion   May Be Offered
                         Lecture   Required
Co-convened with: CSC 577
Course typically offered:
Main Campus: Fall

Recommendations and additional information: Knowledge of probability and CSC 433 (or computer graphics) helpful.
Enrollment requirement: CSC 252, CSC 335, CSC 345, CSC 352, and (MATH 215 or MATH 313).

CSC 483: Text Retrieval and Web Search (3 units)
Description: Most of the web data today consists of unstructured text. Of course, the fact that this data exists is irrelevant, unless it is made available such that users can quickly find information that is relevant for their needs. This course will cover the fundamental knowledge necessary to build these systems, such as web crawling, index construction and compression, Boolean, vector-based, and probabilistic retrieval models, text classification and clustering, link analysis algorithms such as PageRank, and computational advertising. The students will also complete one programming project, in which they will construct one complex application that combines multiple algorithms into a system that solves real-world problems.
Grading basis: Regular Grades
Career: Undergraduate
Course Components: Lecture   Required
Co-convened with:
Course typically offered:
Main Campus: Fall

Recommendations and additional information: Grade of C or better in CSC 345.
Enrollment requirement: Major: COSC. CSC 345.

CSC 492: Directed Research (1 - 3 units)
Description: Individual or small group research under the guidance of faculty.
Grading basis: Regular Grades
Career: Undergraduate
Course Components: Independent Study   Required
Repeatable: Course can be repeated for a maximum of 6 units.
Course typically offered:
Main Campus: Fall, Spring

CSC 493: Internship (1 - 3 units)
Description: Specialized work on an individual basis, consisting of training and practice in actual service in a technical, business, or governmental establishment. Such work must be approved and supervised by a Computer Science faculty member. Available to Computer Science majors. May be repeated: Between C SC 293 and 493, a total of 6 units of internship may be earned.
Grading basis: Alternative Grading: S, P, F
Career: Undergraduate
Course Components: Independent Study   Required
Repeatable: Course can be repeated a maximum of 99 times.
Course typically offered:
Main Campus: Fall, Spring, Summer

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May Be Offered Departments may offer this component in some semesters. See the Schedule of Classes for term-specific offerings.

CSC 498H: Honors Thesis (1 - 3 units)
Description: An honors thesis is required of all the students graduating with honors. Students ordinarily sign up for this course as a two-semester sequence. The first semester the student performs research under the supervision of a faculty member; the second semester the student writes an honors thesis.
Grading basis: Regular Grades
Career: Undergraduate
Course Components: Independent Study   Required
Repeatable: Course can be repeated for a maximum of 6 units.
Equivalent to: CSCV 498H
Course typically offered:
Main Campus: Fall, Spring

Enrollment requirement: Student must be active in the Honors College.
Honors Course: Honors Course
Honors Course: Honors Course
Writing Emphasis: Writing Emphasis Course

CSC 499: Independent Study (1 - 4 units)
Description: Qualified students working on an individual basis with professors who have agreed to supervise such work.
Grading basis: Alternative Grading: S, P, F
Career: Undergraduate
Course Components: Independent Study   Required
Repeatable: Course can be repeated a maximum of 99 times.
Course typically offered:
Main Campus: Fall, Spring

CSC 499H: Honors Independent Study (1 - 4 units)
Description: Qualified students working on an individual basis with professors who have agreed to supervise such work.
Grading basis: Regular Grades
Career: Undergraduate
Course Components: Independent Study   Required
Repeatable: Course can be repeated a maximum of 99 times.
Course typically offered:
Main Campus: Fall, Spring

Enrollment requirement: Student must be active in the Honors College.
Honors Course: Honors Course
Honors Course: Honors Course

CSC 501A: Symbolic Logic (3 units)
Description: Intermediate propositional logic and quantificational theory, natural deduction, axiom systems, elementary metatheorems, introduction to notions of modal logic, selected topics in philosophy of logic. Graduate-level requirements include an in-depth research project on a central theme or topic of the course. Courses for which students receive the grade of P (Pass) do not satisfy requirements for the M.A. or Ph.D. or minor in philosophy.
Grading basis: Student Option ABCDE/PF
Career: Graduate
Course Components: Lecture   Required
Equivalent to: CSC 501A, MATH 501A
Also offered as: MATH 501A, PHIL 501A
Co-convened with: CSC 401A
Course typically offered:
Main Campus: Fall

Home department: Philosophy

CSC 501B: Symbolic Logic (3 units)
Description: Advanced propositional logic and quantification theory; metatheorems on consistency, independence, and completeness; set theory, number theory, and modal theory; recursive function theory and Goedel's incompleteness theorem. Graduate-level requirements include an in-depth research project on a central theme or topic of the course. Courses for which students receive the grade of P (Pass) do not satisfy requirements for the M.A. or Ph.D. or minor in philosophy.
Grading basis: Student Option ABCDE/PF
Career: Graduate
Course Components: Lecture   Required
Equivalent to: CSC 501B, MATH 501B
Also offered as: MATH 501B, PHIL 501B
Co-convened with: CSC 401B
Course typically offered:
Main Campus: Spring

Home department: Philosophy

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CSC 502: Mathematical Logic (3 units)
Description: [Taught Fall semester in even-numbered years] Sentential calculus, predicate calculus; consistency, independence, completeness, and the decision problem. Designed to be of interest to majors in mathematics or philosophy. Graduate-level requirements include more extensive problem sets or advanced projects.
Grading basis: Regular Grades
Career: Graduate
Course Components: Lecture   Required
Equivalent to: CSC 502, PHIL 502
Also offered as: MATH 502, PHIL 502
Co-convened with:
Course typically offered:
Main Campus: Fall (even years only)

Home department: Mathematics

CSC 520: Principles of Programming Languages (3 units)
Description: Important programming language concepts, including types, control and data abstraction, denotational semantics, declarative and object-oriented languages, implementation issues.
Grading basis: Regular Grades
Career: Graduate
Course Components: Lecture   Required
Course typically offered:
Main Campus: Spring

Recommendations and additional information: CSC 453.

CSC 522: Parallel and Distributed Computing (3 units)
Description: Basic concepts and semantics of concurrent programs. Synchronization methods and programming techniques: locks, semaphores, monitors, message passing, programming paradigms. High performance computing: hardware, applications, programming tools and techniques, parallelizing compilers, performance tuning. Distributed computing: RPC and rendezvous, distributed systems, decentralized control algorithms.
Grading basis: Regular Grades
Career: Graduate
Course Components: Lecture   Required
Course typically offered:
Main Campus: Fall

Recommendations and additional information: CSC 422.

CSC 525: Principles of Computer Networking (3 units)
Description: Intensive course in theory and practice of computer networks, emphasizing the underlying the design of network software and the role of the communications system in distributed computing. Topics include wireless and mobile networking, resource management, routing, flow and congestion control, multicast and data representation, and RPC.
Grading basis: Regular Grades
Career: Graduate
Course Components: Lecture   Required
Course typically offered:
Main Campus: Fall

Recommendations and additional information: CSC 425.

CSC 533: Computer Graphics (3 units)
Description: Theory and practice of computer graphics: basic graphics programming, 2D and 3D transformations, clipping, 2D and 3D viewing, hierarchical modeling, hidden surface removal, lighting and shading, color, ray-tracing, radiosity, curve and surface modeling, and animation. Graduate-level requirements include more extensive and challenging programming assignments.
Grading basis: Regular Grades
Career: Graduate
Course Components: Lecture   Required
Co-convened with: CSC 433
Course typically offered:
Main Campus: Spring

CSC 535: Probabilistic Graphical Models (3 units)
Description: Probabilistic graphical modeling and inference is a powerful modern approach to representing the combined statistics of data and models, reasoning about the world in the face of uncertainty, and learning about it from data. It cleanly separates the notions of representation, reasoning, and learning. It provides a principled framework for combining multiple source of information such as prior knowledge about the world with evidence about a particular case in observed data. This course will provide a solid introduction to the methodology and associated techniques, and show how they are applied in diverse domains ranging from computer vision to molecular biology to astronomy.
Grading basis: Regular Grades
Career: Graduate
Course Components: Lecture   Required
Course typically offered:
Main Campus: Spring

Recommendations and additional information: MATH 223 and MATH 313 or equivalent math background. MATH 464 or alternative course that covers basic discrete and continuous probability. CSC 445 or equivalent preparation in algorithms, data structures, and programming.
Enrollment requirement: Graduate major or minor: CSC.

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CSC 536: Software Engineering (3 units)
Description: Introduces fundamental software engineering techniques for developing correct, efficient, reliable, maintainable, and evolvable software for large software projects. The class project gives an experience in using evolutionary software development processes for developing a high-quality, evolvable software product that addresses emerging customer requirements. Graduate-level requirements include extra reading assignments on advanced topics and home assignments on these readings.
Grading basis: Regular Grades
Career: Graduate
Course Components: Lecture   Required
Co-convened with: CSC 436
Course typically offered:
Main Campus: Spring

CSC 537: Geometric Algorithms (3 units)
Description: The study of algorithms for geometric objects, using a computational geometry approach, with an emphasis on applications for graphics, VLSI, GIS, robotics, and sensor networks. Topics may include the representation and overlaying of maps, finding nearest neighbors, solving linear programming problems, and searching geometric databases. Graduate-level requirements include reading a paper in the field of computational geometry or related literature and discussing this paper with the instructor.
Grading basis: Regular Grades
Career: Graduate
Course Components: Lecture   Required
Co-convened with: CSC 437
Course typically offered:
Main Campus: Spring

CSC 538: Computational Linguistics (3 units)
Description: Fundamentals of formal language theory; syntactic and semantic processing; the place of world knowledge in natural language processing. Graduate-level requirements include a greater number of assignments and a higher level of performance.
Grading basis: Regular Grades
Career: Graduate
Course Components: Laboratory   May Be Offered
                         Lecture   Required
Equivalent to: CSC 538, PSY 538
Also offered as: LING 538, PSY 538
Co-convened with: CSC 438
Course typically offered:
Main Campus: Fall

Home department: Linguistics

CSC 539: Statistical Natural Language Processing (3 units)
Description: This course introduces the key concepts underlying statistical natural language processing. Students will learn a variety of techniques for the computational modeling of natural language, including: n-gram models, smoothing, Hidden Markov models, Bayesian Inference, Expectation Maximization, Viterbi, Inside-Outside Algorithm for Probabilistic Context-Free Grammars, and higher-order language models. Graduate-level requirements include assignments of greater scope than undergraduate assignments. In addition to being more in-depth, graduate assignments are typically longer and additional readings are required.
Grading basis: Regular Grades
Career: Graduate
Course Components: Lecture   Required
Equivalent to: CSC 539
Also offered as: INFO 539, LING 539
Co-convened with: LING 439
Course typically offered:
Main Campus: Fall

Recommendations and additional information: LING 538.
Home department: Linguistics

CSC 543: Theory of Graphs and Networks (3 units)
Description: [Taught Fall semester in even-numbered years] Undirected and directed graphs, connectivity, circuits, trees, partitions, planarity, coloring problems, matrix methods, applications in diverse disciplines. Graduate-level requirements include more extensive problem sets or advanced projects.
Grading basis: Regular Grades
Career: Graduate
Course Components: Lecture   Required
Equivalent to: CSC 543
Also offered as: MATH 543
Co-convened with: MATH 443
Course typically offered:
Main Campus: Fall (even years only)

Home department: Mathematics

CSC 544: Advanced Data Visualization (3 units)
Description: Data visualization is a research area that focuses on the use of visualization techniques to help people understand and analyze data. Visualization allows us to perceive relationships, patterns, and trends. While statistical techniques may determine correlations among the data, visualization helps us frame what questions to ask. Providing efficient and effective data visualization is a difficult challenge in many real world examples. One challenge lies in developing algorithmically efficient methods to visualize large and complex data sets. Another challenge is to develop effective visualizations that make the underlying patterns and trends easy to see. Even tougher is the challenge of providing interactive access, analysis, and filtering. All of these tasks become still more difficult with the size of the data sets arising in modern applications.This course will explore current research problems in visualizing large and complex data such as social networks with hundreds of thousands of participants and millions of relationships. Modeling such data and developing effective visualization tools is a challenging theoretical and practical task. This course will focus on classical as well as modern methods through projects that utilize real world large datasets from Netflix, IMDB, DBLP, and the Tree of Life.
Grading basis: Regular Grades
Career: Graduate
Course Components: Lecture   Required
Course typically offered:
Main Campus: Fall

CSC 545: Design and Analysis of Algorithms (3 units)
Description: Time, space complexity, recurrences, algorithm design techniques, lower bounds; graph, matrix, set algorithms; sorting, fast Fourier transform, arithmetic complexity, intractable problems.
Grading basis: Regular Grades
Career: Graduate
Course Components: Lecture   Required
Course typically offered:
Main Campus: Fall

Recommendations and additional information: CSC 445, CSC 473, MATH 362.

CSC 547: Green Computing (3 units)
Description: This course covers fundamental principles of energy management faced by designers of hardware, operating systems, and data centers. We will explore basic energy management option in individual components such as CPUs, network interfaces, hard drives, memory. We will further present the energy management policies at the operating system level that consider performance vs. energy saving tradeoffs. Finally we will consider large scale data centers where energy management is done at multiple layers from individual components in the system to shutting down entries subset of machines. We will also discuss energy generation and delivery and well as cooling issues in large data centers. In addition to the assignments listed for undergraduates, Graduate-level requirements include a detailed review of the three recent conference publications dealing with energy efficiency.
Grading basis: Regular Grades
Career: Graduate
Course Components: Lecture   Required
Co-convened with: CSC 447
Course typically offered:
Main Campus: Spring

Recommendations and additional information: CSC 452 or equivalent course in operating systems.

CSC 550: Algorithms in Bioinformatics (3 units)
Description: This course introduces fundamental results in discrete algorithms for combinatorial problems in bioinformatics and computational biology. The emphasis is on realistic models of computational problems that arise in the analysis of biological data, and practical algorithms for their solution. The content has depth in the area of biological sequence analysis, and breadth in areas such as phylogeny construction, protein structure prediction, and genome rearrangement analysis. Grades are based on homeworks, exams, programming projects, and a class presentation.
Grading basis: Regular Grades
Career: Graduate
Course Components: Lecture   Required
Co-convened with: CSC 450
Course typically offered:
Main Campus: Spring

Recommendations and additional information: CSC 545. For both computer science and non-computer science majors, mathematical maturity will be helpful.

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CSC 552: **Advanced Operating Systems** (3 units)
Description: Operating system design, implementation and modeling; deadlock and memory management models; protection mechanisms; operating systems for parallel and distributed systems.
Grading basis: Regular Grades
Career: Graduate
Course Components: Lecture   Required
Course typically offered:
Main Campus: Fall

Recommendations and additional information: CSC 452.

CSC 553: **Principles of Compilation** (3 units)
Description: Detailed study of advanced compilation: translator writing systems, attribute grammars, flow analysis, optimization, register allocation, code generation, compiling for modern architectures.
Grading basis: Regular Grades
Career: Graduate
Course Components: Lecture   Required
Course typically offered:
Main Campus: Spring

Recommendations and additional information: CSC 453, CSC 473.

CSC 555: **Philosophy and Artificial Intelligence** (3 units)
Description: Interdisciplinary problems lying at the interface of philosophy and artificial intelligence. Courses for which students receive the grade of P (Pass) do not satisfy requirements for the M.A. or Ph.D. or minor in philosophy. Graduate-level requirements include an in-depth research paper on a central theme or topic of the course.
Grading basis: Student Option ABCDE/PF
Career: Graduate
Course Components: Lecture   Required
Equivalent to: COGS 555, CSC 555, PSY 555
Also offered as: COGS 555, PHIL 555
Co-convened with:
Course typically offered:
Main Campus: Fall, Spring

Home department: Philosophy

CSC 560: Database Systems Implementation (3 units)
Description: Emphasis on DBMS architecture and implementation issues such as storage structures, multidimensional index structures, query optimization, concurrency control and recovery, and parallel database systems.
Grading basis: Regular Grades
Career: Graduate
Course Components: Lecture   Required
Course typically offered:
Main Campus: Spring

Recommendations and additional information: CSC 460.

CSC 566: Computer Security (3 units)
Description: This is an introductory course covering the fundamentals of computer security. In particular, the course will cover basic concepts of computer security such as threat models and security policies, and will show how these concepts apply to specific areas such as communication security, software security, operating systems security, network security, web security, and hardware-based security. Graduate-level requirements include an additional project/essay/in-class presentation.
Grading basis: Regular Grades
Career: Graduate
Course Components: Lecture   Required
Co-convened with: CSC 466
Course typically offered:
Main Campus: Fall

Recommendations and additional information: CSC 352 or similar course in systems programming.

CSC 573: Theory of Computation (3 units)
Description: Chomsky hierarchy, undecidability; general recursive functions; recursion theory; computational complexity theory, NP-complete and provably intractable problems.
Grading basis: Regular Grades
Career: Graduate
Course Components: Lecture   Required
Equivalent to: MATH 573
Also offered as: MATH 573
Course typically offered:
Main Campus: Spring

Recommendations and additional information: CSC 473.

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CSC 574A: Computer-Aided Logic Design (3 units)
Description: Tabular minimization of single and multiple output Boolean functions, NMOS and CMOS realizations, synthesis of sequential circuits, RTL description, laboratory exercises. Graduate-level requirements include additional homework and term projects.
Grading basis: Regular Grades
Career: Graduate
Course Components: Lecture   Required
Equivalent to: CSC 574A
Also offered as: ECE 574A
Co-convened with: CSC 474A
Course typically offered:
Main Campus: Fall

Home department: Electrical & Computer Engr

CSC 575A: Numerical Analysis (3 units)
Description: Error analysis, solution of linear systems and nonlinear equations, eigenvalue interpolation and approximation, numerical integration, initial and boundary value problems for ordinary differential equations, optimization.
Grading basis: Regular Grades
Career: Graduate
Course Components: Lecture   Required
Equivalent to: CSC 575A
Also offered as: MATH 575A
Co-convened with:
Course typically offered:
Main Campus: Fall

Recommendations and additional information: MATH 475B or MATH 456.
Home department: Mathematics

CSC 575B: Numerical Analysis (3 units)
Description: Error analysis, solution of linear systems and nonlinear equations, eigenvalue interpolation and approximation, numerical integration, initial and boundary value problems for ordinary differential equations, optimization.
Grading basis: Regular Grades
Career: Graduate
Course Components: Lecture   Required
Equivalent to: CSC 575B
Also offered as: MATH 575B
Co-convened with:
Course typically offered:
Main Campus: Spring

Recommendations and additional information: MATH 575A.
Home department: Mathematics

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CSC 576: Computer Architecture (3 units)
Description: Design of computers, including instruction set design, processor implementation, pipelining, memory hierarchy, vector processors, and parallel architectures. Emphasis on hardware and software tradeoffs.
Grading basis: Regular Grades
Career: Graduate
Course Components: Lecture   Required
Course typically offered:
Main Campus: Spring

Recommendations and additional information: CSC 452, ECE 369.

CSC 577: Introduction to Computer Vision (3 units)
Description: Overview of algorithms for analyzing image data. Topics include image formation, physics-based vision, linear filtering, edge detection, multiple view geometry, segmentation, tracking, and recognition. Graduate-level requirements include additional challenging assignments or a research oriented project and participate in the weekly vision group meeting.
Grading basis: Regular Grades
Career: Graduate
Course Components: Lecture   Required
Equivalent to: COGS 577
Also offered as: COGS 577
Co-convened with: CSC 477
Course typically offered:
Main Campus: Fall

CSC 580: Principles of Machine Learning (3 units)
Description: Students will learn why machine learning is a fundamentally different way of writing computer programs, and why this approach is often a uniquely attractive way of solving practical problems. Machine learning is all about automatic ways for computers to find patterns in datasets; students will learn both advantages and unique risks that this approach offers. They will learn the fundamental computational methods, algorithms, and perspectives which underlie current machine learning methods, and how to derive and implement many of them.Students will learn the fundamentals of unsupervised and supervised machine learning methods, the computational and quality tradeoffs between different methods, and how to adapt existing methods to fit their own research needs.
Grading basis: Regular Grades
Career: Graduate
Course Components: Lecture   Required
Course typically offered:
Main Campus: Fall, Spring

Recommendations and additional information: Strong background in linear algebra and calculus is necessary. Good amount of programming experience is needed: a significant amount of programming maturity is expected. Some probability theory and statistics will be helpful, but not strictly necessary.
Enrollment requirement: Graduate major or minor: CSC.

CSC 581: Advanced Computational Linguistics (3 units)
Description: This course provides a hands-on project-based approach to particular problems and issues in computational linguistics.
Grading basis: Regular Grades
Career: Graduate
Course Components: Lecture   Required
Equivalent to: CSC 581
Also offered as: LING 581
Course typically offered:
Main Campus: Spring

Recommendations and additional information: LING 538.
Home department: Linguistics

CSC 583: Text Retrieval and Web Search (3 units)
Description: Most of the web data today consists of unstructured text. Of course, the fact that this data exists is irrelevant, unless it is made available such that users can quickly find information that is relevant for their needs. This course will cover the fundamental knowledge necessary to build these systems, such as web crawling, index construction and compression, Boolean, vector-based, and probabilistic retrieval models, text classification and clustering, link analysis algorithms such as PageRank, and computational advertising. The students will also complete one programming project, in which they will construct one complex application that combines multiple algorithms into a system that solves real-world problems.
Grading basis: Regular Grades
Career: Graduate
Course Components: Lecture   Required
Co-convened with: CSC 483
Course typically offered:
Main Campus: Fall

Recommendations and additional information: MATH 129.
Enrollment requirement: Graduate major or minor: CSC.

CSC 585: Algorithms for Natural Language Processing (3 units)
Description: This course covers important algorithms useful for natural language processing (NLP), including distributional similarity algorithms such as word embeddings, recurrent and recursive neural networks (NN), probabilistic graphical models useful for sequence prediction, and parsing algorithms such as shift-reduce. This course will focus on the algorithms that underlie NLP, rather than the application of NLP to various problem domains.
Grading basis: Regular Grades
Career: Graduate
Course Components: Lecture   Required
Course typically offered:
Main Campus: Fall, Spring

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CSC 588: Machine Learning Theory (3 units)
Description: Students will learn how and when machine learning is possible/impossible as well as various algorithms with theoretical guarantees under minimal assumptions. Specifically, the course offers formulation of learning environments (e.g., stochastic and adversarial worlds with possibly limited feedback), fundamental limits of learning in these environments, various algorithms concerning sample efficiency, computational efficiency, and generality. Throughout, students will not only learn fundamental tools upholding the current understanding of machine learning systems in the research community but also develop skills of adapting these techniques to their own research needs such as developing new algorithms for large-scale, data-driven applications.
Grading basis: Regular Grades
Career: Graduate
Course Components: Lecture   Required
Course typically offered:
Main Campus: Fall, Spring

Recommendations and additional information: Students must have strong familiarity with:- Linear Algebra- Multivariate Calculus- Basic probability theory- Basic programming
Field trip: None
Enrollment requirement: Graduate major or minor: CSC.

CSC 593: Internship (1 - 6 units)
Description: Specialized work on an individual basis, consisting of training and practice in actual service in a technical, business, or governmental establishment.
Grading basis: Alternative Grading: S, P, F
Career: Graduate
Course Components: Independent Study   Required
Course typically offered:
Main Campus: Fall, Spring, Summer

CSC 599: Independent Study (1 - 4 units)
Description: Qualified students working on an individual basis with professors who have agreed to supervise such work. Graduate students doing independent work which cannot be classified as actual research will register for credit under course number 599, 699, or 799.
Grading basis: Alternative Grading: S, P, F
Career: Graduate
Course Components: Independent Study   Required
Repeatable: Course can be repeated a maximum of 99 times.
Course typically offered:
Main Campus: Fall, Spring

CSC 695A: Graduate Colloquium (1 unit)
Description: Presentation of current research topics in Computer Science.
Grading basis: Alternative Grading: S, P, F
Career: Graduate
Course Components: Colloquium   Required
Repeatable: Course can be repeated for a maximum of 7 units.
Course typically offered:
Main Campus: Fall, Spring

CSC 695C: Advanced Topic: Doctoral Colloquium (3 units)
Description: Designed to develop skills in the major professional forms: presentation, journal papers, theses, and dissertations. Students will be required to make one presentation in the colloquium setting. This course will be taken four out of the first five semesters in the doctoral program.
Grading basis: Alternative Grading: S, P, F
Career: Graduate
Course Components: Colloquium   Required
Repeatable: Course can be repeated a maximum of 4 times.
Course typically offered:
Main Campus: Fall, Spring

CSC 696A: Advanced Topics in Programming Languages and Compilers (3 units)
Description: The goal of this graduate seminar course is to learn more about research in the general field of programming languages and compilers. In this course, we will read and review research papers on programming languages and compilers. We will also learn how to do research in computer science by reading, evaluating, presenting, and conducting a research project in programming languages and compilers. Specific topics to be determined by current literature and faculty and student interest.
Grading basis: Regular Grades
Career: Graduate
Course Components: Seminar   Required
Repeatable: Course can be repeated a maximum of 99 times.
Course typically offered:
Main Campus: Fall, Spring

Field trip: None
Enrollment requirement: Graduate major or minor: CSC.

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CSC 696B: Advanced Topics in Parallel, Distributed, and High-Performance Computing (3 units)
Description: The goal of this graduate seminar course is to learn more about research in the general field of parallel, distributed, and high-performance computing.   In this course, we will read and review research papers on parallel, distributed, and high-performance computing. We will also learn how to do research in computer science by reading, evaluating, presenting, and conducting a research project in parallel, distributed, or high-performance computing. Specific topics to be determined by current literature and faculty and student interest.
Grading basis: Regular Grades
Career: Graduate
Course Components: Seminar   Required
Repeatable: Course can be repeated a maximum of 99 times.
Course typically offered:
Main Campus: Fall, Spring

Field trip: None
Enrollment requirement: Graduate major or minor: CSC.

CSC 696C: Advanced Topics in Computer Science (3 units)
Description: This is a research-oriented seminar course addressing selected advanced current topics in computer science. The specific computer science domain will be selected based on current literature as well as faculty and student interests. Exemplar domains include computer architecture, cyber-physical systems, domain-specific applications, education, embedded & real-time systems, formal verification, operations research, robotics, software engineering, ubiquitous computing, and web technologies.
Grading basis: Regular Grades
Career: Graduate
Course Components: Seminar   Required
Repeatable: Course can be repeated a maximum of 99 times.
Course typically offered:
Main Campus: Fall, Spring

Field trip: None
Enrollment requirement: Graduate major or minor: CSC.

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CSC 696D: Advanced Topics in Visualization and Graphics (3 units)
Description: This is a research-oriented seminar course addressing selected advanced current topics in visualization and graphics, broadly defined to include both the theory and applications. Exemplar domains include data visualization, computer graphics, computational geometry, visual analytics, data analysis, imaging, visual interfaces, geometric modeling, perception & cognition, computer-aided geometric design, display technologies, and virtual & augmented reality. Within a domain, topics will be selected based on current literature as well as faculty and student interests.
Grading basis: Regular Grades
Career: Graduate
Course Components: Seminar   Required
Repeatable: Course can be repeated a maximum of 99 times.
Course typically offered:
Main Campus: Fall, Spring

Field trip: None
Enrollment requirement: Graduate major or minor: CSC.

CSC 696E: Advanced Topics in Algorithms (3 units)
Description: The goal of this graduate seminar course is to learn more about research in the general field of algorithms. In this course, we will read and review research papers on algorithms. We will also learn how to do research in computer science by reading, evaluating, presenting, and conducting a research project in algorithms. Specific topics to be determined by current literature and faculty and student interest.
Grading basis: Regular Grades
Career: Graduate
Course Components: Seminar   Required
Repeatable: Course can be repeated a maximum of 99 times.
Course typically offered:
Main Campus: Fall, Spring

Field trip: None
Enrollment requirement: Graduate major or minor: CSC.

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-CC represents a Correspondence Course offering
May Be Offered Departments may offer this component in some semesters. See the Schedule of Classes for term-specific offerings.

CSC 696F: Advanced Topics in Computer Systems (3 units)
Description: The goal of this graduate seminar course is to learn more about research in the general field of computer systems. In this course, we will read and review research papers on computer systems. We will also learn how to do research in computer science by reading, evaluating, presenting, and conducting a research project in computer systems. Specific topics to be determined by current literature and faculty and student interest.
Grading basis: Regular Grades
Career: Graduate
Course Components: Seminar   Required
Repeatable: Course can be repeated a maximum of 99 times.
Course typically offered:
Main Campus: Fall, Spring

Field trip: None
Enrollment requirement: Graduate major or minor: CSC.

CSC 696G: Topics in Computational Linguistics (3 units)
Description: The development and exchange of scholarly information, usually in a small group setting with an in depth investigation of computational linguistics theory and application. The scope of work shall consist of research by course registrants, with the exchange of the results of such research through discussion, reports, and/or papers.
Grading basis: Regular Grades
Career: Graduate
Course Components: Seminar   Required
Repeatable: Course can be repeated for a maximum of 18 units.
Equivalent to: CSC 696G
Also offered as: LING 696G
Course typically offered:
Main Campus: Fall, Spring

Home department: Linguistics

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CSC 696H: Advanced Topics in Artificial Intelligence (3 units)
Description: The goal of this graduate seminar course is to learn more about research in the general field of artificial intelligence. In this course, we will read and review research papers on artificial intelligence. We will also learn how to do research in computer science by reading, evaluating, presenting, and conducting a research project in artificial intelligence. Specific topics to be determined by current literature and faculty and student interest.
Grading basis: Regular Grades
Career: Graduate
Course Components: Seminar   Required
Repeatable: Course can be repeated a maximum of 99 times.
Course typically offered:
Main Campus: Fall, Spring

Field trip: None
Enrollment requirement: Graduate major or minor: CSC.

CSC 696I: Advanced Topics in Security (3 units)
Description: The goal of this graduate seminar course is to learn more about research in the general field of computer security. In this course, we will read and review research papers on computer security. We will also learn how to do research in computer science by reading, evaluating, presenting, and conducting a research project in computer security. Specific topics to be determined by current literature and faculty and student interest.
Grading basis: Regular Grades
Career: Graduate
Course Components: Seminar   Required
Repeatable: Course can be repeated a maximum of 99 times.
Course typically offered:
Main Campus: Fall, Spring

Field trip: None
Enrollment requirement: Graduate major or minor: CSC.

CSC 699: Independent Study (1 - 4 units)
Description: Qualified students working on an individual basis with professors who have agreed to supervise such work. Graduate students doing independent work which cannot be classified as actual research will register for credit under course number 599, 699, or 799.
Grading basis: Alternative Grading: S, P, F
Career: Graduate
Course Components: Independent Study   Required
Repeatable: Course can be repeated a maximum of 99 times.
Course typically offered:
Main Campus: Fall, Spring

-SA represents a Student Abroad & Student Exchange offering
-CC represents a Correspondence Course offering
May Be Offered Departments may offer this component in some semesters. See the Schedule of Classes for term-specific offerings.

CSC 799: Independent Study (1 - 4 units)
Description: Qualified students working on an individual basis with professors who have agreed to supervise such work. Graduate students doing independent work which cannot be classified as actual research will register for credit under course number 599, 699, or 799.
Grading basis: Alternative Grading: S, P, F
Career: Graduate
Course Components:　　Independent Study　　Required
Repeatable: Course can be repeated a maximum of 99 times.
Course typically offered:
Main Campus: Fall, Spring

CSC 900: Research (1 - 6 units)
Description: Individual research, not related to thesis or dissertation preparation, by graduate students.
Grading basis: Alternative Grading: S, P, F
Career: Graduate
Course Components:　　Independent Study　　Required
Repeatable: Course can be repeated a maximum of 99 times.
Course typically offered:
Main Campus: Fall, Spring

CSC 910: Thesis (1 - 6 units)
Description: Research for the master's thesis (whether library research, laboratory or field observation or research, artistic creation, or thesis writing). Maximum total credit permitted varies with the major department.
Grading basis: Alternative Grading: S, P, F
Career: Graduate
Course Components:　　Independent Study　　Required
Repeatable: Course can be repeated a maximum of 99 times.
Course typically offered:
Main Campus: Fall, Spring

CSC 920: Dissertation (1 - 9 units)
Description: Research for the doctoral dissertation (whether library research, laboratory or field observation or research, artistic creation, or dissertation writing).
Grading basis: Alternative Grading: S, P, F
Career: Graduate
Course Components:　　Independent Study　　Required
Repeatable: Course can be repeated a maximum of 99 times.
Course typically offered:
Main Campus: Fall, Spring

-SA represents a Student Abroad & Student Exchange offering
-CC represents a Correspondence Course offering
May Be Offered Departments may offer this component in some semesters. See the Schedule of Classes for term-specific offerings.