COMPUTER SCIENCES (COMP SCI)

COMP SCI 200 — PROGRAMMING I
3 credits.

Intended for students who have no prior programming experience. Students taking this course will be taught the process of incrementally developing small (200-500 lines) programs along with the fundamental Computer Science topics. These topics include: problem abstraction and decomposition, the edit-compile-run cycle, using variables of primitive and more complex data types, conditional and loop-based flow control, basic testing and debugging techniques, how to define and call functions (methods), and IO processing techniques. This course also teaches and reinforces good programming practices including the use of a consistent style, and meaningful documentation.

Requisites: Satisfied Quantitative Reasoning (QR) A requirement
Course Designation: Gen Ed - Quantitative Reasoning Part B
Breadth - Natural Science
Level - Elementary
L&S Credit - Counts as Liberal Arts and Science credit in L&S
Repeatable for Credit: No

COMP SCI 202 — INTRODUCTION TO COMPUTATION
3 credits.

An introduction to the principles that form the foundation of computer science. Suitable for students with a general background who wish to study the key principles of computer science rather than just computer programming. MATH 118 does not fulfill the prerequisite

Requisites: MATH 095 or placement into MATH 101.
Course Designation: Gen Ed - Quantitative Reasoning Part A
Breadth - Natural Science
Level - Elementary
L&S Credit - Counts as Liberal Arts and Science credit in L&S
Repeatable for Credit: No
Last Taught: Fall 2016

COMP SCI/MATH 240 — INTRODUCTION TO DISCRETE MATHEMATICS
3 credits.

Basic concepts of logic, sets, partial order and other relations, and functions. Basic concepts of mathematics (definitions, proofs, sets, functions, and relations) with a focus on discrete structures: integers, bits, strings, trees, and graphs. Propositional logic, Boolean algebra, and predicate logic. Mathematical induction and recursion. Invariants and algorithmic correctness. Recurrences and asymptotic growth analysis.

Requisites: May not receive credit for both COMP SCI 270 and COMP SCI 570.
Course Designation: Gen Ed - Quantitative Reasoning Part A
Breadth - Natural Science
Level - Intermediate
L&S Credit - Counts as Liberal Arts and Science credit in L&S
Repeatable for Credit: No
Last Taught: Spring 2017

COMP SCI 250 — DIGITAL SOCIETY: THE IMPACT OF COMPUTERS AND COMPUTER TECHNOLOGY
3 credits.

Introduction to computers in the digital society; social changes they influence, and choices they present. Topics include: digital divide, role of computers in improving quality of life, electronic voting and governance, digital intellectual property rights, privacy, computers and the environment.

Requisites: Open to Fr
Course Designation: Level - Elementary
L&S Credit - Counts as Liberal Arts and Science credit in L&S
Repeatable for Credit: No
Last Taught: Fall 2011

COMP SCI/ECE 252 — INTRODUCTION TO COMPUTER ENGINEERING
2 credits.

Logic components built with transistors, rudimentary Boolean algebra, basic combinational logic design, basic synchronous sequential logic design, basic computer organization and design, introductory machine- and assembly-language programming.

Requisites: Open to Freshmen
Course Designation: Level - Elementary
L&S Credit - Counts as Liberal Arts and Science credit in L&S
Repeatable for Credit: No
Last Taught: Spring 2017

COMP SCI 270 — FUNDAMENTALS OF HUMAN-COMPUTER INTERACTION
3 credits.

User-centered software design including principles and methods for understanding user needs, designing and prototyping interface solutions, and evaluating their usability covered through lectures, hands-on in-class activities, and week-long assignments. Meets with COMP SCI 570.

Requisites: May not receive credit for both COMP SCI 270 and COMP SCI 570.
Course Designation: Level - Elementary
L&S Credit - Counts as Liberal Arts and Science credit in L&S
Repeatable for Credit: No
Last Taught: Spring 2017

COMP SCI 298 — DIRECTED STUDY IN COMPUTER SCIENCE
1-3 credits.

Undergraduate directed study in computer sciences.

Requisites: Open to Fr
Course Designation: Level - Elementary
L&S Credit - Counts as Liberal Arts and Science credit in L&S
Repeatable for Credit: Yes, unlimited number of completions
Last Taught: Spring 2017
COMP SCI 300 — PROGRAMMING II
3 credits.

Introduces students to Object-Oriented Programming using classes and objects to solve more complex problems. The course also introduces array-based and linked data structures: including lists, stacks, and queues. Programming assignments require writing and developing multi-class (file) programs using interfaces, generics, and exception handling to solve challenging real world problems. Topics reviewed include reading/writing data and objects from/to files and exception handling, and command line arguments. Topics introduced: object-oriented design; class vs. object; create and define interfaces and iterators; searching and sorting; abstract data types (List,Stack,Queue,PRIORITYQueue(HEAP),Binary Search Tree); generic interfaces (parametric polymorphism); how to design and write test methods and classes; array based vs. linked node implementations; introduction to complexity analysis; recursion.

Requisites: Satisfied Quantitative Reasoning (QR) A requirement and score of 3 on Computer Science A Advanced Placement (AP) Exam, COMP SCI 200, COMP SCI 301, COMP SCI 302, COMP SCI 310, or (COMP SCI/E C E/COMP SCI 252 and E C E 203)
Course Designation: Gen Ed - Quantitative Reasoning Part B
Breadth - Natural Science
Level - Intermediate
L&S Credit - Counts as Liberal Arts and Science credit in L&S
Repeatable for Credit: No

COMP SCI 301 — INTRODUCTION TO DATA PROGRAMMING
3 credits.

Instruction and experience in the use of a programming language for beginners. Program design, development of good programming style. No previous computing experience required. Recommended for non-CS and undecided majors. Satisfied Quantitative Reasoning (QR) A requirement.

Requisites: Not open to students who have completed CS 302.
Course Designation: Gen Ed - Quantitative Reasoning Part B
Breadth - Natural Science
Level - Elementary
L&S Credit - Counts as Liberal Arts and Science credit in L&S
Repeatable for Credit: No
Last Taught: Summer 2017

COMP SCI 302 — INTRODUCTION TO PROGRAMMING
3 credits.

Instruction and experience in the use of an object-oriented programming language. Program design; development of good programming style; preparation for other computer science courses.

Requisites: Satisfied Quantitative Reasoning (QR) A requirement
Course Designation: Gen Ed - Quantitative Reasoning Part B
Breadth - Natural Science
Level - Intermediate
L&S Credit - Counts as Liberal Arts and Science credit in L&S
Repeatable for Credit: No
Last Taught: Summer 2017

COMP SCI 304 — WES-CS GROUP MEETING
1 credit.

Small group meetings for Wisconsin Emerging Scholars - Computer Science (WES-CS) students. Meets for two hours each week in small groups to work together on problems related to the COMP SCI 302 course material. Open to Freshmen

Requisites: Concurrent registration in COMP SCI 302 membership in WES-CS.
Course Designation: Level - Elementary
Repeatable for Credit: No
Last Taught: Spring 2017

COMP SCI 310 — PROBLEM SOLVING USING COMPUTERS
3 credits.

Gives students an introduction to computer and analytical skills to use in their subsequent course work and professional development. Discusses several methods of using computers to solve problems, including elementary programming techniques, symbolic manipulation languages, and software packages. Techniques will be illustrated using sample problems drawn from elementary engineering. Emphasis is on introduction of algorithms with the use of specific tools to illustrate the methods.

Requisites: MATH 222
Course Designation: Level - Elementary
L&S Credit - Counts as Liberal Arts and Science credit in L&S
Repeatable for Credit: No
Last Taught: Spring 2017

COMP SCI/E C E 352 — DIGITAL SYSTEM FUNDAMENTALS
3 credits.

Logic components, Boolean algebra, combinational logic analysis and synthesis, synchronous and asynchronous sequential logic analysis and design, digital subsystems, computer organization and design.

Requisites: Comp Sci/ECE 252
Course Designation: Gen Ed - Quantitative Reasoning Part B
Breadth - Physical Sci. Counts toward the Natural Sci req
Level - Intermediate
L&S Credit - Counts as Liberal Arts and Science credit in L&S
Repeatable for Credit: No
Last Taught: Spring 2017

COMP SCI/E C E 354 — MACHINE ORGANIZATION AND PROGRAMMING
3 credits.

An introduction to computer organization using assembly and machine language. Number representation, computer arithmetic, instruction sets, I/O interrupts, and programming interrupts. Projects involve detailed study and use of a specific computer hardware and software system.

Requisites: COMP SCI 302 ECE/COMP SCI/E C E 252
Course Designation: Gen Ed - Quantitative Reasoning Part B
Breadth - Natural Science
Level - Intermediate
L&S Credit - Counts as Liberal Arts and Science credit in L&S
Repeatable for Credit: No
Last Taught: Spring 2017
COMP SCI 367 — INTRODUCTION TO DATA STRUCTURES
3 credits.

Study of data structures (including stacks, queues, trees, graphs, and hash tables) and their applications. Development, implementation, and analysis of efficient data structures and algorithms (including sorting and searching). Experience in use of an object-oriented programming language. Stds are strongly encouraged to take COMP SCI 367 within two semesters of having taken COMP SCI 302.

Requisites: COMP SCI 302 or cons inst.

Course Designation: Gen Ed - Quantitative Reasoning Part B
Breadth - Natural Science
Level - Intermediate
L&S Credit - Counts as Liberal Arts and Science credit in L&S
Repeatable for Credit: No
Last Taught: Summer 2017

COMP SCI 368 — LEARNING A PROGRAMMING LANGUAGE
1 credit.

For students interested in learning a particular programming language. Each 1-credit course focuses on a specific language offered at one of three levels: beginner, intermediate, and advanced.

Requisites: Students may not receive credit twice for the same language at the same level.

Course Designation: Level - Intermediate
L&S Credit - Counts as Liberal Arts and Science credit in L&S
Repeatable for Credit: Yes, unlimited number of completions
Last Taught: Summer 2017

COMP SCI 369 — WEB PROGRAMMING
3 credits.

Covers web application development end-to-end: languages and frameworks for client- and server-side programming, database access, and other topics. Involves hands-on programming assignments. Students attain a thorough understanding of and experience with writing web applications using tools popular in industry. Open to Fr

Requisites: COMP SCI 367 or substantial prog exper cons inst.

Course Designation: Breadth - Natural Science
Level - Elementary
L&S Credit - Counts as Liberal Arts and Science credit in L&S
Repeatable for Credit: No
Last Taught: Spring 2014

COMP SCI/INFO SYS 371 — TECHNOLOGY OF COMPUTER-BASED BUSINESS SYSTEMS
3 credits.

Overview of computers, their attendant technology, and the implications of this technology for large-scale, computer-based information systems. Topics include hardware, system software, program development, files and data communications.

Requisites: COMP SCI 302 or cons inst

Course Designation: Breadth - Social Science
Level - Intermediate
L&S Credit - Counts as Liberal Arts and Science credit in L&S
Repeatable for Credit: No
Last Taught: Spring 2017

COMP SCI 400 — PROGRAMMING III
3 credits.

The third course in our programming fundamentals sequence. It presumes that students understand and use functional and object-oriented design and abstract data types as needed. This course introduces balanced search trees, graphs, graph traversal algorithms, hash tables and sets, and complexity analysis and about classes of problems that require each data type. Students are required to design and implement using high quality professional code, a medium sized program, that demonstrates knowledge and use of latest language features, tools, and conventions. Additional topics introduced will include as needed for projects: inheritance and polymorphism, anonymous inner classes, lambda functions, performance analysis to discover and optimize critical code blocks. Students learn about industry standards for code development. Students will design and implement a medium size project with a more advanced user-interface design, such as a web or mobile application with a GUI and event- driven implementation; use of version-control software.

Requisites: COMP SCI 300

Course Designation: Breadth - Natural Science
Level - Intermediate
L&S Credit - Counts as Liberal Arts and Science credit in L&S
Repeatable for Credit: No

COMP SCI 402 — INTRODUCING COMPUTER SCIENCE TO K-12 STUDENTS
2 credits.

Work in teams to lead Computer Science clubs and workshops for K-12 students at sites in the Madison area. Design and lead activities to help K-12 students learn computational thinking and computer programming.

Requisites: Any course Computer Sciences (e.g., COMP SCI 202, COMP SCI 302, COMP SCI 310)

Course Designation: Level - Intermediate
L&S Credit - Counts as Liberal Arts and Science credit in L&S
Repeatable for Credit: No
Last Taught: Summer 2017

COMP SCI 407 — FOUNDATIONS OF MOBILE SYSTEMS AND APPLICATIONS
3 credits.

Design and implementation of applications, systems, and services for mobile platforms with (i) constraints, such as limited processing, memory, energy, interfaces, variable bandwidth, and high mobility, and (ii) features, such as touchscreens, cameras, electronic compasses, GPS, and accelerometers.

Requisites: COMP SCI 367 or equiv, or cons inst

Course Designation: Level - Intermediate
L&S Credit - Counts as Liberal Arts and Science credit in L&S
Repeatable for Credit: No
Last Taught: Spring 2017
COMP SCI 412 — INTRODUCTION TO NUMERICAL METHODS
3 credits.

Interpolation, solution of linear and nonlinear systems of equations, approximate integration and differentiation, numerical solution of ordinary differential equations. Credit will not be given for both COMP SCI 412 416

Requisites: MATH 222 either COMP SCI/MATH 240 or MATH 234, COMP SCI 302, or equiv, knowledge of matrix algebra.

Course Designation: Breadth - Natural Science
Level - Intermediate
L&S Credit - Counts as Liberal Arts and Science credit in L&S
Repeatable for Credit: No
Last Taught: Spring 2017

COMP SCI/I SY/E/MATH 425 — INTRODUCTION TO COMBINATORIAL OPTIMIZATION
3 credits.

This course focuses on optimization problems over discrete structures, such as shortest paths, spanning trees, flows, matchings, and the traveling salesman problem. We will investigate structural properties of these problems, and we will study both exact methods for their solution, and approximation algorithms.

Requisites: MATH 320 or 340 or 341 or 375

Course Designation: Breadth - Physical Science. Counts toward the Natural Science req
Level - Intermediate
L&S Credit - Counts as Liberal Arts and Science credit in L&S
Repeatable for Credit: No
Last Taught: Fall 2016

COMP SCI/E C E/MATH 435 — INTRODUCTION TO CRYPTOGRAPHY
3 credits.

Cryptography is the art and science of transmitting digital information in a secure manner. This course will provide an introduction to its technical aspects. Open to Fr

Requisites: MATH 320 or 340 or cons inst.

Course Designation: Level - Advanced
L&S Credit - Counts as Liberal Arts and Science credit in L&S
Repeatable for Credit: No
Last Taught: Spring 2017

COMP SCI/STAT 471 — INTRODUCTION TO COMPUTATIONAL STATISTICS
3 credits.

Classical statistical procedures arise where closed-form mathematical expressions are available for various inference summaries (e.g. linear regression; analysis of variance). A major emphasis of modern statistics is the development of inference principles in cases where both more complex data structures are involved and where more elaborate computations are required. Topics from numerical linear algebra, optimization, Monte Carlo (including Markov chain Monte Carlo), and graph theory are developed, especially as they relate to statistical inference (e.g., bootstrapping, permutation, Bayesian inference, EM algorithm, multivariate analysis).

Requisites: STAT/MATH 310 and STAT 333

Course Designation: Breadth - Natural Science
Level - Intermediate
L&S Credit - Counts as Liberal Arts and Science credit in L&S
Repeatable for Credit: No
Last Taught: Spring 2014

COMP SCI/MATH/STAT 475 — INTRODUCTION TO COMBINATORICS
3 credits.


Requisites: MATH 320, 340, 341 or 375

Course Designation: Breadth - Natural Science
Level - Advanced
L&S Credit - Counts as Liberal Arts and Science credit in L&S
Repeatable for Credit: No
Last Taught: Spring 2017

COMP SCI/E C E 506 — SOFTWARE ENGINEERING
3 credits.

Ideas and techniques for designing, developing, and modifying large software systems. Topics include software engineering processes; requirements and specifications; project team organization and management; software architectures; design patterns; testing and debugging; and cost and quality metrics and estimation. Students will work in large teams on a substantial programming project.

Requisites: COMPSCI 367 and at least one of COMPSCI 407, 536, 537, 545, 552, 559, 564, 570, or 679

Course Designation: Level - Advanced
L&S Credit - Counts as Liberal Arts and Science credit in L&S
Repeatable for Credit: No
Last Taught: Spring 2017
COMP SCI/MATH 513 — NUMERICAL LINEAR ALGEBRA
3 credits.

Direct and iterative solution of linear and nonlinear systems and of
eigenproblems. LU and symmetric LU factorization. Complexity, stability,
and conditioning. Nonlinear systems. Iterative methods for linear
systems. QR-factorization and least squares. Eigenproblems: local and
global methods.
Requisites: MATH 340 or equiv, COMP SCI 302 or equiv
Course Designation: Breadth - Natural Science
Level - Advanced
L&S Credit - Counts as Liberal Arts and Science credit in L&S
Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Spring 2016

COMP SCI/MATH 514 — NUMERICAL ANALYSIS
3 credits.

Polynomial forms, divided differences. Polynomial interpolation.
Polynomial approximation: uniform approximation and Chebyshev
polynomials, least-squares approximation and orthogonal polynomials.
Numerical differentiation and integration. Splines, B-splines and spline
Requisites: MATH 340 or equiv, COMP SCI 302 or equiv
Course Designation: Breadth - Natural Science
Level - Advanced
L&S Credit - Counts as Liberal Arts and Science credit in L&S
Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Fall 2016

COMP SCI 520 — INTRODUCTION TO THEORY OF COMPUTING
3 credits.

Basics about the notion, capabilities, and limitations of computation:
elements of finite automata and regular languages, computability theory,
and computational complexity theory. Additional topics include context-
free grammars and languages, and complexity-theoretic cryptography.
Requisites: COMP SCI/MATH 240 367, or cons inst
Course Designation: Breadth - Natural Science
Level - Advanced
L&S Credit - Counts as Liberal Arts and Science credit in L&S
Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Fall 2016

COMP SCI/E C I SY E 524 — INTRODUCTION TO OPTIMIZATION
3 credits.

Introduction to mathematical optimization from a modeling and solution perspective. Formulation of applications as discrete and continuous
optimization problems and equilibrium models. Survey and appropriate
usage of basic algorithms, data and software tools, including modeling
languages and subroutine libraries.
Requisites: COMP SCI 302 and MATH 320 or 340
Course Designation: Breadth - Natural Science
Level - Intermediate
L&S Credit - Counts as Liberal Arts and Science credit in L&S
Repeatable for Credit: No
Last Taught: Spring 2017

COMP SCI/I SY E/MATH/STAT 525 — LINEAR PROGRAMMING
METHODS
3 credits.

Real linear algebra over polyhedral cones; theorems of the alternative for
The simplex method and related methods for efficient computer solution.
Perturbation and sensitivity analysis. Applications and extensions, such
as game theory, linear economic models, and quadratic programming.
Requisites: MATH 320, 340, or 443
Course Designation: Breadth - Natural Science
Level - Advanced
L&S Credit - Counts as Liberal Arts and Science credit in L&S
Repeatable for Credit: No
Last Taught: Spring 2017

COMP SCI/I SY E 526 — ADVANCED LINEAR PROGRAMMING
3-4 credits.

Review of linear programming. Polynomial time methods for linear
programming. Quadratic programs and linear complementarity problems
and related solution techniques. Solution sets and their continuity
properties. Error bounds for linear inequalities and programs. Parallel
algorithms for linear and quadratic programs.
Requisites: COMP SCI/I SY E/MATH/STAT 525 or equiv, 302 or equiv, or
cons inst
Course Designation: L&S Credit - Counts as Liberal Arts and Science
credit in L&S
Repeatable for Credit: No
Last Taught: Fall 2015

COMP SCI/E C I SY E M E 532 — THEORY AND APPLICATIONS OF PATTERN
RECOGNITION
3 credits.

Pattern recognition systems and components; decision theories and
classification; discriminant functions; supervised and unsupervised
training; clustering; feature extraction and dimensional reduction;
sequential and hierarchical classification; applications of training, feature
extraction, and decision rules to engineering problems.
Requisites: ECE 331 or MATH/STAT 431 or cons inst
Course Designation: Breadth - Physical Sci. Counts toward the Natural Sci
req
Level - Advanced
L&S Credit - Counts as Liberal Arts and Science credit in L&S
Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Fall 2016

COMP SCI/E C I SY E 533 — IMAGE PROCESSING
3 credits.

Mathematical representation of continuous and digital images; models of
image degradation; picture enhancement, restoration, segmentation, and
coding; pattern recognition, tomography.
Requisites: ECE 330 or cons inst; MATH 320 or 340 or equiv
Course Designation: Breadth - Physical Sci. Counts toward the Natural Sci
req
Level - Advanced
L&S Credit - Counts as Liberal Arts and Science credit in L&S
Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Spring 2017
COMP SCI 534 — COMPUTATIONAL PHOTOGRAPHY
3 credits.
Study of sensing and computational techniques that enhance or extend the capabilities of digital photography by using methods from computer vision and computer graphics to create new visual representations. Algorithms for analyzing, improving, manipulating, combining, and synthesizing images.
Requisites: COMP SCI 367
Course Designation: Breadth - Natural Science
Level - Advanced
L&S Credit - Counts as Liberal Arts and Science credit in L&S
Repeatable for Credit: No
Last Taught: Fall 2016

COMP SCI 536 — INTRODUCTION TO PROGRAMMING LANGUAGES AND COMPILERS
3 credits.
Introduction to the theory and practice of compiler design. Comparison of features of several programming languages and their implications for implementation techniques. Several programming projects required.
Requisites: Comp Sci/ECE 354 COMP SCI 367
Course Designation: Breadth - Natural Science
Level - Advanced
L&S Credit - Counts as Liberal Arts and Science credit in L&S
Repeatable for Credit: No
Last Taught: Spring 2017

COMP SCI 537 — INTRODUCTION TO OPERATING SYSTEMS
4 credits.
Input-output hardware, interrupt handling, properties of magnetic tapes, discs and drums, associative memories and virtual address translation techniques. Batch processing, time sharing and real-time systems, scheduling resource allocation, modular software systems, performance measurement and system evaluation.
Requisites: COMP SCI/E C E/COMP SCI 354 and (COMP SCI 367 or COMP SCI 400)
Course Designation: Breadth - Natural Science
Level - Advanced
L&S Credit - Counts as Liberal Arts and Science credit in L&S
Repeatable for Credit: No
Last Taught: Summer 2017

COMP SCI 538 — INTRODUCTION TO THE THEORY AND DESIGN OF PROGRAMMING LANGUAGES
3 credits.
Design and theory of programming languages: procedural, object-oriented, functional and logic paradigms. Serial and concurrent programming. Execution models and formal specification techniques.
Requisites: Comp Sci/ECE 354 COMP SCI 367
Course Designation: L&S Credit - Counts as Liberal Arts and Science credit in L&S
Repeatable for Credit: No
Last Taught: Spring 2008

COMP SCI/E C E/M E 539 — INTRODUCTION TO ARTIFICIAL NEURAL NETWORK AND FUZZY SYSTEMS
3 credits.
Theory and applications of artificial neural networks and fuzzy logic: multi-layer perceptron, self-organization map, radial basis network, Hopfield network, recurrent network, fuzzy set theory, fuzzy logic control, adaptive fuzzy neural network, genetic algorithm, and evolution computing. Applications to control, pattern recognition, nonlinear system modeling, speech and image processing.
Requisites: COMP SCI 302, or COMP SCI 310, or knowledge of C programming lang
Course Designation: L&S Credit - Counts as Liberal Arts and Science credit in L&S
Repeatable for Credit: No
Last Taught: Spring 2016

COMP SCI 540 — INTRODUCTION TO ARTIFICIAL INTELLIGENCE
3 credits.
Principles of knowledge-based search techniques, automatic deduction, knowledge representation using predicate logic, machine learning, probabilistic reasoning. Applications in tasks such as problem solving, data mining, game playing, natural language understanding, computer vision, speech recognition, and robotics.
Requisites: COMP SCI 367
Course Designation: Breadth - Natural Science
Level - Advanced
L&S Credit - Counts as Liberal Arts and Science credit in L&S
Repeatable for Credit: No
Last Taught: Summer 2017

COMP SCI 545 — NATURAL LANGUAGE AND COMPUTING
3 credits.
The course covers basic techniques and tools in natural language processing: generative grammars, parsing, dictionary construction, semantic networks, generation of text from a knowledge base, natural language interfacing, and machine translation.
Requisites: COMP SCI 536 or 537 or 564 or cons inst
Course Designation: Breadth - Natural Science
Level - Advanced
L&S Credit - Counts as Liberal Arts and Science credit in L&S
Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Fall 2014

COMP SCI 547 — COMPUTER SYSTEMS MODELING FUNDAMENTALS
3 credits.
An introduction to basic tools and applications for modeling and analysis of computer systems. Fundamentals of network flow graphs, graph models of computation and stochastic models of computer system performance. Network delay analysis and capacity planning, reachability analysis for deadlock detection in distributed systems, Markov Chains, elementary queueing theory, basic concepts of queueing network models and associated analyses.
Requisites: Math 223, COMP SCI 367, COMP SCI/ECE 354
Course Designation: Breadth - Natural Science
Level - Advanced
L&S Credit - Counts as Liberal Arts and Science credit in L&S
Repeatable for Credit: No
Last Taught: Spring 2012
COMP SCI/ECE 552 — INTRODUCTION TO COMPUTER ARCHITECTURE
3 credits.

The design of computer systems and components. Processor design, instruction set design, and addressing; control structures and microprogramming; memory management, caches, and memory hierarchies; and interrupts and I/O structures.

Requisites: ECE/COMP SCI/ECE 352 Comp SCI/ECE 354
Course Designation: Breadth - Physical Sci. Counts toward the Natural Sci req
Level - Advanced
L&S Credit - Counts as Liberal Arts and Science credit in L&S
Repeatable for Credit: No
Last Taught: Spring 2017

COMP SCI/I SY E/M E 558 — INTRODUCTION TO COMPUTATIONAL GEOMETRY
3 credits.

Introduction to fundamental geometric computations and algorithms, and their use for solving engineering and scientific problems. Computer representations of simple geometric objects and paradigms for algorithm design. Applications from areas of engineering analysis, design and manufacturing, biology, statistics, and other sciences.

Requisites: COMP SCI 367 or equiv, Math 223 or equiv, or cons inst
Course Designation: L&S Credit - Counts as Liberal Arts and Science credit in L&S
Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Spring 2016

COMP SCI 559 — COMPUTER GRAPHICS
3 credits.


Requisites: MATH 320 or 340 COMP SCI 367
Course Designation: Level - Intermediate
L&S Credit - Counts as Liberal Arts and Science credit in L&S
Repeatable for Credit: No
Last Taught: Spring 2017

COMP SCI 564 — DATABASE MANAGEMENT SYSTEMS: DESIGN AND IMPLEMENTATION
4 credits.

What a database management system is; different data models currently used to structure the logical view of the database: relational, hierarchical, and network. Hands-on experience with relational and network-based database systems. Implementation techniques for database systems. File organization, query processing, concurrency control, rollback and recovery, integrity and consistency, and view implementation.

Requisites: COMP SCI/ECE 354 and (COMP SCI 367 or COMP SCI 400)
Course Designation: Breadth - Physical Sci. Counts toward the Natural Sci req
Level - Intermediate
L&S Credit - Counts as Liberal Arts and Science credit in L&S
Repeatable for Credit: No
Last Taught: Summer 2017

COMP SCI/BMI 567 — MEDICAL IMAGE ANALYSIS
3 credits.

Present introductory medical image processing and analysis techniques. Topics include medical imaging formats, segmentation, registration, image quantification, classification.

Requisites: CS 367 (or programming experience with some high-level programming language), MATH 221, and some familiarity with introductory concepts in probability and linear algebra or by consent of the instructor.
Course Designation: Breadth - Biological Sci. Counts toward the Natural Sci req
Level - Advanced
L&S Credit - Counts as Liberal Arts and Science credit in L&S
Repeatable for Credit: No
Last Taught: Spring 2017

COMP SCI 570 — INTRODUCTION TO HUMAN-COMPUTER INTERACTION
4 credits.

User-centered software design; (1) principles of and methods for understanding user needs, designing and prototyping interface solutions, and evaluating their usability, (2) their applications in designing web-based, mobile, and embodied interfaces through month long group projects. Meets with COMP SCI 270. May not receive credit for both COMP SCI 270 and COMP SCI 570.

Requisites: COMP SCI 202 or COMP SCI 302.
Course Designation: Level - Intermediate
L&S Credit - Counts as Liberal Arts and Science credit in L&S
Repeatable for Credit: No
Last Taught: Spring 2017

COMP SCI/BMI 576 — INTRODUCTION TO BIOINFORMATICS
3 credits.

Algorithms for computational problems in molecular biology. The course will study algorithms for problems such as: genome sequencing and mapping, pairwise and multiple sequence alignment, modeling sequence classes and features, phylogenetic tree construction, and gene-expression data analysis.

Requisites: COMP SCI 367, MATH 222
Course Designation: Breadth - Biological Sci. Counts toward the Natural Sci req
Level - Advanced
L&S Credit - Counts as Liberal Arts and Science credit in L&S
Repeatable for Credit: No
Last Taught: Fall 2016

COMP SCI 577 — INTRODUCTION TO ALGORITHMS
4 credits.

Basic paradigms for the design and analysis of efficient algorithms: greed, divide-and-conquer, dynamic programming, reductions, and the use of randomness. Computational intractability including typical NP-complete problems and ways to deal with them.

Requisites: COMP SCI/MATH/COMP SCI 240 and COMP SCI 367
Course Designation: Breadth - Natural Science
Level - Advanced
L&S Credit - Counts as Liberal Arts and Science credit in L&S
Repeatable for Credit: No
Last Taught: Summer 2017
COMP SCI 578 — CONTEST-LEVEL PROGRAMMING
1 credit.

Training in computer programming for competitions: assessing the coding difficulty and complexity of computational problems, recognizing the applicability of known algorithms, fast coding and testing, team work. COMP SCI 577 is suggested but not required
Requisites: COMP SCI 367 is required.
Course Designation: Level - Intermediate
L&S Credit - Counts as Liberal Arts and Science credit in L&S
Repeatable for Credit: Yes, unlimited number of completions
Last Taught: Fall 2014

COMP SCI/DS 579 579 — VIRTUAL REALITY
3 credits.

This course introduces students to the field of virtual reality and focuses on creating immersive, interactive virtual experiences. Survey topics include historical perspectives on virtual reality technology, computer graphics and 3D modeling, human perception and psychology, human computer interaction and user interface design. This course is designed for students with backgrounds in Computer Science, Engineering, Art, Architecture and Design. Students will work in interdisciplinary teams projects, culminating in a final event that will be showcased to the public. While not an official prerequisite, the class will be technologically motivated; therefore students should be comfortable learning new software. The class will utilize publicly available game design software which provides tools and services for the creation of interactive content. While not necessary, students may find it helpful to have taken classes in programming and computer graphics (such COMP SCI 559: Computer Graphics) or in 3D modeling (such as ART 429: 3D Digital Studio I or DS 242: Visual Communication II).
Requisites: Sophomore standing
Course Designation: Level - Intermediate
L&S Credit - Counts as Liberal Arts and Science credit in L&S
Repeatable for Credit: No
Last Taught: Fall 2016

COMP SCI/L IS 611 — USER EXPERIENCE DESIGN 1
3 credits.

Introduces students to the user experience design process, key stages involved in designing for user experience, and tasks, methods, and tools involved at each stage at an introductory level, including understanding and modeling users, needs, and context and performing basic design, prototyping, and formative evaluation.
Requisites: Course is only available to students admitted to the User Experience Design Capstone program
Course Designation: Level - Advanced
L&S Credit - Counts as Liberal Arts and Science credit in L&S
Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No

COMP SCI/L IS 612 — USER EXPERIENCE DESIGN 2
3 credits.

Students advance their understanding of the UX design process by learning and applying tools and techniques at an intermediate level, including conceptual and interaction design, more advanced methods for prototyping of design solutions, and iterative design based on user models and evaluation. Students apply skills learned in the course to develop and iteratively improve prototypes for a project.
Requisites: LIS/COMP SCI/L IS 611 and declared in the User Experience Design Capstone program
Course Designation: Level - Advanced
L&S Credit - Counts as Liberal Arts and Science credit in L&S
Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No

COMP SCI/L IS 613 — USER EXPERIENCE DESIGN 3
3 credits.

In this class students will hone their skills in assessment of digital user experience design including assessment of accessibility, information architecture, interactions, contribution to organizational goals, content workflows, trace data and advanced usability assessment. Students learn and apply core concepts of information architecture to improve digital design. Students gain understanding of how to find, analyze and interpret trace data to assess design. Students apply understanding of social aspects of digital media through exploration and application of participatory and value sensitive design approaches and analysis methods, broader stakeholder analysis and analysis that examine the fit between culture and task.
Requisites: LIS/COMP SCI/L IS 612 and declared in the User Experience Design Capstone program
Course Designation: Level - Advanced
L&S Credit - Counts as Liberal Arts and Science credit in L&S
Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No

COMP SCI/L IS 614 — USER EXPERIENCE DESIGN CAPSTONE
1 credit.

One credit capstone course applies a design studio critique approach to produce a learning environment of collaborative and interdisciplinary peer critique and learning, in addition to provide expert feedback and suggestions. Students will present and defend the latest iteration of the user experience design project they developed in earlier courses while learning about the professions associated with digital user experience design.
Requisites: LIS/COMP SCI/L IS 613 and declared in the User Experience Design capstone certificate program
Course Designation: Level - Advanced
L&S Credit - Counts as Liberal Arts and Science credit in L&S
Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
COMP SCI/I SY E 635 — TOOLS AND ENVIRONMENTS FOR OPTIMIZATION
3 credits.

Formulation and modeling of applications from computer sciences, operations research, business, science and engineering involving optimization and equilibrium models. Survey and appropriate usage of software tools for solving such problems, including modeling language use, automatic differentiation, subroutine libraries and web-based optimization tools and environments.

Requisites: Comp Sci302, MATH 340 or equiv
Course Designation: Breadth - Physical Sci. Counts toward the Natural Sci req
Level - Intermediate
L&S Credit - Counts as Liberal Arts and Science credit in L&S
Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Spring 2015

COMP SCI 638 — UNDERGRADUATE TOPICS IN COMPUTING
1-4 credits.

Requisites: Consent of instructor
Course Designation: Breadth - Natural Science
Level - Advanced
L&S Credit - Counts as Liberal Arts and Science credit in L&S
Repeatable for Credit: Yes, unlimited number of completions
Last Taught: Summer 2017

COMP SCI 640 — INTRODUCTION TO COMPUTER NETWORKS
3 credits.

Architecture of computer networks and network protocols, protocol layering, reliable transmission, congestion control, flow control, naming and addressing, unicast and multicast routing, network security, network performance widely used protocols such as Ethernet, wireless LANs, IP, TCP, and HTTP.

Requisites: COMP SCI 537
Course Designation: L&S Credit - Counts as Liberal Arts and Science credit in L&S
Repeatable for Credit: No
Last Taught: Spring 2017

COMP SCI 642 — INTRODUCTION TO INFORMATION SECURITY
3 credits.

Senior level undergraduate course covering various topics on information security. Covers a wide range of topics, such as cryptographic primitives, security protocols, system security, and emerging topics. Elementary knowledge of mathematical logic and discrete probability theory also required

Requisites: COMP SCI 537 or cons inst.
Course Designation: Level - Advanced
L&S Credit - Counts as Liberal Arts and Science credit in L&S
Repeatable for Credit: No
Last Taught: Spring 2016

COMP SCI 679 — COMPUTER GAME TECHNOLOGY
3 credits.

Survey of software technology important to computer games and other forms of interactive technology. Real-time image generation, managing complex geometric models, creating virtual characters, simulating physical phenomenon, networking technology for distributed virtual environments.

Requisites: COMP SCI 559
Course Designation: Level - Advanced
L&S Credit - Counts as Liberal Arts and Science credit in L&S
Repeatable for Credit: No
Last Taught: Fall 2012

COMP SCI 681 — SENIOR HONORS THESIS
3 credits.

Requisites: Honors cand and cons inst
Course Designation: Level - Advanced
L&S Credit - Counts as Liberal Arts and Science credit in L&S
Honors - Honors Only Courses (H)
Repeatable for Credit: Yes, unlimited number of completions
Last Taught: Summer 2017

COMP SCI 682 — SENIOR HONORS THESIS
3 credits.

Requisites: Honors cand and cons inst
Course Designation: Level - Advanced
L&S Credit - Counts as Liberal Arts and Science credit in L&S
Honors - Honors Only Courses (H)
Repeatable for Credit: Yes, unlimited number of completions
Last Taught: Summer 2017

COMP SCI 691 — SENIOR THESIS
2-3 credits.

Course Designation: Level - Advanced
L&S Credit - Counts as Liberal Arts and Science credit in L&S
Repeatable for Credit: Yes, unlimited number of completions
Last Taught: Spring 2016

COMP SCI 692 — SENIOR THESIS
2-3 credits.

Course Designation: Level - Advanced
L&S Credit - Counts as Liberal Arts and Science credit in L&S
Repeatable for Credit: Yes, unlimited number of completions
Last Taught: Spring 2014

COMP SCI 698 — DIRECTED STUDY
1-6 credits.

Requisites: Graded on a Cr/N basis; Jr or Sr st; requires cons inst
Course Designation: Level - Advanced
L&S Credit - Counts as Liberal Arts and Science credit in L&S
Repeatable for Credit: Yes, unlimited number of completions
Last Taught: Spring 2016
COMP SCI 699 — DIRECTED STUDY
1-6 credits.

Requires cons inst
Requisites: Graded on a lettered basis; Jr or Sr st.
Course Designation: Level - Advanced
L&S Credit - Counts as Liberal Arts and Science credit in L&S
Repeatable for Credit: Yes, unlimited number of completions
Last Taught: Summer 2017

COMP SCI 701 — CONSTRUCTION OF COMPILERS
3 credits.

Principles in the design of programming languages. Organization of translators and their relation to operating systems. Role of formal grammars in syntactic analysis. Design and implementation of a compiler. Methods of interaction with the translation process. Definition facilities and extensible languages.
Requisites: COMP SCI 536
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Fall 2016

COMP SCI 703 — ADVANCED TOPICS IN PROGRAMMING LANGUAGES AND COMPILERS
3 credits.

Advanced parsing techniques; automatic syntactic error correction; local and global code optimization; attribute grammars; programming language design issues (data and control abstractions, specification and verification of high-level languages).
Requisites: COMP SCI 701
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Spring 2017

COMP SCI 704 — PRINCIPLES OF PROGRAMMING LANGUAGES
3 credits.

Introduction to principles of advanced programming languages and programming-language theory. Topics include: lambda-calculus, functional languages, polymorphic functions, type inference, structural induction, lazy evaluation, operational semantics, denotational semantics, and axiomatic semantics.
Requisites: COMP SCI 536 or equiv, or cons inst
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Spring 2017

COMP SCI 706 — ANALYSIS OF SOFTWARE ARTIFACTS
3 credits.

Advanced course covering various analysis techniques used in software engineering. This course will cover techniques for analyzing various software artifacts. Some of the topics that will be covered are: model checking, testing, program analysis, requirements analysis, and safety analysis. A basic knowledge of mathematical logic is also required
Requisites: COMP SCI 536 or cons inst
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Fall 2016

COMP SCI/E C E 707 — MOBILE AND WIRELESS NETWORKING
3 credits.

Design and implementation of protocols, systems, and applications for mobile and wireless networking, particularly at the media access control, network, transport, and application layers. Focus is on the unique problems and challenges presented by the properties of wireless transmission, various device constraints such as limited battery power, and node mobility.
Requisites: COMP SCI 640 or ECE 537 or cons inst
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Fall 2016

COMP SCI 710 — COMPUTATIONAL COMPLEXITY
3 credits.

Study of the capabilities and limitations of efficient computation. Relationships between models representing capabilities such as parallelism, randomness, quantum effects, and non-uniformity; and models based on the notions of nondeterminism, alternation, and counting, which capture the complexity of important problems.
Requisites: COMP SCI 520
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Spring 2017

COMP SCI/MATH 714 — METHODS OF COMPUTATIONAL MATHEMATICS I
3 credits.

Requisites: COMP SCI 302, 412; MATH 322, 340, 521; or equiv; or cons inst
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Fall 2016
COMP SCI/MATH 715 — METHODS OF COMPUTATIONAL MATHEMATICS II
3 credits.
Introduction to spectral methods (Fourier, Chebyshev, Fast Fourier Transform), finite element methods (Galerkin methods, energy estimates and error analysis), and mesh-free methods (Monte-Carlo, smoothed-particle hydrodynamics) for solving partial differential equations. Applications from science and engineering.
Requisites: COMP SCI 302, 412; MATH 322, 340, 521, 714; or equiv; or cons inst
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Spring 2017

COMP SCI/I SY E 719 — STOCHASTIC PROGRAMMING
3 credits.
Stochastic programming is concerned with decision making in the presence of uncertainty, where the eventual outcome depends on a future random event. Topics include modeling uncertainty in optimization problems, risk measures, stochastic programming algorithms, approximation and sampling methods, and applications.
Requisites: COMP SCI/I SY E/MATH/STAT 525; MATH/STAT 431 or STAT 311; or cons inst
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Fall 2016

COMP SCI/I SY E 723 — DYNAMIC PROGRAMMING AND ASSOCIATED TOPICS
3 credits.
Requisites: COMP SCI/I SY E/MATH/STAT 525 or Ind Engr 623; MATH 521 or COMP SCI/I SY E/MATH/STAT 726; MATH/STAT 431 or equiv; comp programming; or cons inst
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Fall 2014

COMP SCI/I SY E/MATH/STAT 726 — NONLINEAR OPTIMIZATION I
3 credits.
Theory and algorithms for nonlinear optimization, focusing on unconstrained optimization. Line-search and trust-region methods; quasi-Newton methods; conjugate-gradient and limited-memory methods for large-scale problems; derivative-free optimization; algorithms for least-squares problems and nonlinear equations; gradient projection algorithms for bound-constrained problems; and simple penalty methods for nonlinearly constrained optimization.
Requisites: Familiarity with basic mathematical analysis and either MATH 443 or 320; or cons inst
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Fall 2016

COMP SCI/I SY E 727 — CONVEX ANALYSIS
3 credits.
Requisites: MATH 521 and MATH 340 or cons inst
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Fall 2016

COMP SCI/I SY E/MATH 728 — INTEGER OPTIMIZATION
3 credits.
Introduces optimization problems over integers, and surveys the theory behind the algorithms used in state-of-the-art methods for solving such problems. Special attention is given to the polyhedral formulations of these problems, and to their algebraic and geometric properties. Applicability of Integer Optimization is highlighted with applications in combinatorial optimization. Key topics include: formulations, relaxations, polyhedral theory, cutting planes, decomposition, enumeration.
Requisites: COMP SCI/MATH/STAT/I SY E/COMP SCI/MATH/STAT 525
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Spring 2017

COMP SCI/I SY E/MATH 730 — NONLINEAR OPTIMIZATION II
3 credits.
Requisites: COMP SCI/MATH/STAT/I SY E/COMP SCI/MATH/STAT 726
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Spring 2017
COMP SCI 731 — ADVANCED ARTIFICIAL INTELLIGENCE
3 credits.
Learning and hypothesis formation; knowledge acquisition; deductive and inductive inference systems; reasoning techniques involving time, nonmonotonic reasoning, spatial reasoning, truth maintenance systems; planning strategies.
Requisites: COMP SCI 540 or cons inst
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Spring 2011

COMP SCI 733 — COMPUTATIONAL METHODS FOR LARGE SPARSE SYSTEMS
3 credits.
Requisites: COMP SCI 367 ECE 334; or COMP SCI 367, 412 MATH 340; or cons inst
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Fall 2012

COMP SCI 736 — ADVANCED OPERATING SYSTEMS
3 credits.
Advanced topics in operating systems, including process communication, resource allocation, multiprocess and network operating systems, kernel philosophies, fault-tolerant systems, virtual machines, high-level language systems, verifiability and proof techniques.
Requisites: COMP SCI 537 or cons inst
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Spring 2017

COMP SCI 737 — COMPUTER SYSTEM PERFORMANCE EVALUATION AND MODELING
3 credits.
Statistical techniques of computer system performance evaluation and measurement. System selection and tuning strategies. Deterministic and probabilistic models of process scheduling and resource allocation. Analytic and simulation models of computer systems. Systematic study of system architectures.
Requisites: MATH 222, COMP SCI 537 or 736, or cons inst
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Fall 2008

COMP SCI 739 — DISTRIBUTED SYSTEMS
3 credits.
Basic concepts; distributed programming; distributed file systems; atomic actions; fault tolerance, transactions, program and data replication, recovery; distributed machine architectures; security and authentication; load balancing and process migration; distributed debugging; distributed performance measurement; distributed simulation techniques; distributed applications; correctness considerations and proof systems.
Requisites: COMP SCI 736 or cons inst
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Fall 2016

COMP SCI 740 — ADVANCED COMPUTER NETWORKS
3 credits.
Advanced topics in computer communications networks: congestion and flow control; routing; rate-based protocols; high speed interfaces and technologies: metropolitan area networks; fast packet switching technologies; advanced applications; network services: name service, authentication, resource location.
Requisites: COMP SCI 540
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Spring 2017

COMP SCI 744 — BIG DATA SYSTEMS
3 credits.
Issues in the design and implementation of big data processing systems, including: an overview of cluster architecture, key design goals (flexibility, performance and fault tolerance), popular execution frameworks, basic abstractions, and applications (e.g., batch analytics, stream processing, graph processing, and machine learning).
Requisites: Graduate or professional standing
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No

COMP SCI 747 — ADVANCED COMPUTER SYSTEMS ANALYSIS TECHNIQUES
3 credits.
A survey of advanced analytical modeling techniques for performance analysis of computer systems. Techniques covered include discrete-parameter (embedded) Markov Chains, M/G/1 queues, stochastic Petri nets, queueing networks, renewal theory, and sample path analysis. Application areas include high performance computer architectures, databases, and operating system resource allocation policies.
Requisites: COMP SCI 547 or cons inst
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Spring 2011
COMP SCI/ECE 750 — REAL-TIME COMPUTING SYSTEMS
3 credits.

Introduction to the unique issues in the design and analysis of computer systems for real-time applications. Hardware and software support for guaranteeing timeliness with and without failures. Resource management, time-constrained communication, scheduling and imprecise computations, real-time kernels and case studies.

Requisites: ECE/COMP SCI/ECE 552 COMP SCI 537 or cons inst
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Fall 2016

COMP SCI/ECE 752 — ADVANCED COMPUTER ARCHITECTURE I
3 credits.

Processor design, computer arithmetic, pipelining, multi-operation processors, vector processors, control units, precise interrupts, main memory, cache memories, instruction set design, stack machines, busses and I/O, protection and security.

Requisites: ECE, COMP SCI/ECE 552 COMP SCI 537
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Fall 2016

COMP SCI/ECE 755 — VLSI SYSTEMS DESIGN
3 credits.

Overview of MOS devices and circuits; introduction to integrated circuit fabrication; topological design of data flow and control; interactive graphics layout; circuit simulation; system timing; organizational and architectural considerations; alternative implementation approaches; design project.

Requisites: ECE 340, ECE/COMP SCI/ECE 352, ECE/COMP SCI/ECE 552
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Spring 2016

COMP SCI/ECE 756 — COMPUTER-AIDED DESIGN FOR VLSI
3 credits.

Broad introduction to computer-aided design tools for VLSI, emphasizing implementation algorithms and data structures. Topics covered: design styles, layout editors, symbolic compaction, module generators, placement and routing, automatic synthesis, design-rule checking, circuit extraction, simulation and verification.

Requisites: COMP SCI 367, good programming skills, Comp Sci/ECE 755 strongly recommended, Comp Sci/ECE 352
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Fall 2015

COMP SCI/ECE 757 — ADVANCED COMPUTER ARCHITECTURE II
3 credits.

Parallel algorithms, principles of parallelism detection and vectorizing compilers, interconnection networks, SIMD/MIMD machines, processor synchronization, data coherence, multis, dataflow machines, special purpose processors.

Requisites: Comp Sci, ECE 752
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Spring 2017

COMP SCI 758 — ADVANCED TOPICS IN COMPUTER ARCHITECTURE
3 credits.

Advanced topics in computer architecture that explore the implications to architecture of forthcoming evolutionary and revolutionary changes in application demands, software paradigms, and hardware implementation technologies.

Requisites: Comp Sci/ECE 752 757, or cons inst
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Fall 2016

COMP SCI/ECE M/A/E/P/M 759 — HIGH PERFORMANCE COMPUTING FOR APPLICATIONS IN ENGINEERING
3 credits.

An overview of hardware and software solutions that enable the use of advanced computing in tackling computationally intensive Engineering problems. Hands-on learning promoted through programming assignments that leverage emerging hardware architectures and use parallel computing programming languages.

Requisites: COMP SCI 302 or COMP SCI 368
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Fall 2015

COMP SCI 760 — MACHINE LEARNING
3 credits.


Requisites: COMP SCI 540
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Spring 2017
COMP SCI/ECE 761 — MATHEMATICAL FOUNDATIONS OF MACHINE LEARNING
3 credits.

Mathematical foundations of machine learning theory and algorithms. Probabilistic, algebraic, and geometric models and representations of data, mathematical analysis of state-of-the-art learning algorithms and optimization methods, and applications of machine learning. Students should have taken a course in statistics and a course in linear algebra (e.g., STAT 302 and MATH 341).

Requisites: Graduate or professional standing
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Spring 2017

COMP SCI 764 — TOPICS IN DATABASE MANAGEMENT SYSTEMS
3 credits.

Implementation of database management systems, the impact of new technology on database management systems, back-end database computers, distributed database management systems, concurrency control, and query execution in both distributed and centralized systems, implementation of multiple user views, roll-back and recovery mechanisms, database translation.

Requisites: COMP SCI 564, 537 536 or cons inst
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Fall 2016

COMP SCI 765 — DATA VISUALIZATION
3 credits.

Principles of the visual presentation of data. Survey of Information Visualization, Scientific Visualization, and Visual Analytics. Design and evaluation of visualizations and interactive exploration tools. Introduction to relevant foundations in visual design, human perception, and data analysis. Encodings, layout and interaction. Approaches to large data sets. Visualization of complex data types such as scalar fields, graphs, sets, texts, and multi-variate data. Use of 2D, 3D and motion in data presentations. Implementation issues.

Requisites: Graduate or professional standing
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Spring 2017

COMP SCI 766 — COMPUTER VISION
3 credits.

Fundamentals of image analysis and computer vision; image acquisition and geometry; image enhancement; recovery of physical scene characteristics; shape-from techniques; segmentation and perceptual organization; representation and description of two-dimensional objects; shape analysis; texture analysis; goal-directed and model-based systems; parallel algorithms and special-purpose architectures.

Requisites: COMP SCI 540
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Spring 2017

COMP SCI/BMI 767 — COMPUTATIONAL METHODS FOR MEDICAL IMAGE ANALYSIS
3 credits.

Study of computational techniques that facilitate automated analysis, manipulation, denoising, and improvement of large-scale and high resolution medical images. Design and implementation of methods from computer Vision and Machine Learning to efficiently process such image data to answer biologically and clinically meaningful scientific questions.

Requisites: COMP SCI 367 or an equivalent high level programming class, basic proficiency in Calculus and Linear Algebra
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Fall 2016

COMP SCI 769 — ADVANCED NATURAL LANGUAGE PROCESSING
3 credits.

Develop algorithms and mathematical models for natural language processing tasks, including text categorization, information retrieval, speech recognition, machine translation, and information extraction. Focus is on the state-of-the-art computational techniques as they are applied to natural language tasks.

Requisites: COMP SCI 540 or equiv
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Spring 2013

COMP SCI/ED PSYCH/PSYCH 770 — HUMAN-COMPUTER INTERACTION
3 credits.

Principles of human-computer interaction (HCI); human subjects research methods and procedures, qualitative and quantitative data analysis; and semester-long research project situated in critical domains of HCI, including applications in ubiquitous, affective, assistive, social, and embodied computing.

Requisites: Graduate or professional standing
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Fall 2016

COMP SCI/BMI 776 — ADVANCED BIOINFORMATICS
3 credits.

Advanced course covering computational problems in molecular biology. The course will study algorithms for problems such as: modeling sequence classes and features, phylogenetic tree construction, gene-expression data analysis, protein and RNA structure prediction, and whole-genome analysis and comparisons.

Requisites: BMI 576
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Spring 2017
COMP SCI 777 — COMPUTER ANIMATION
3 credits.
Survey of technical issues in the creation of moving and dynamic computer imagery. Principles of animation. Manual motion specification and keyframing. Procedural and simulation-based motion synthesis. Motion capture processing, editing and use. Animation systems. Modeling, rendering and video issues relating to animation. Image-based animation methods and warping. Applications of animation such as games and virtual environments. Basic introduction to artistic issues in animation, such as cinematography. Special effects for film and video.
Requisites: COMP SCI 559
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Spring 2013

COMP SCI 784 — FOUNDATIONS OF DATA MANAGEMENT
3 credits.
Foundational concepts in databases and data management. The first part of the course discusses topics on query languages (conjunctive queries, Datalog), their expressivity and complexity of evaluation. The second part studies advanced topics in modern data management, including data streams, massive parallelism, provenance, uncertain data management and privacy. There are no specific course prerequisites. It is strongly encouraged that the students are familiar with databases and relational algebra (COMP SCI 564 or equivalent). Knowledge of algorithms, complexity theory and probability will also be helpful.
Requisites: Graduate or professional standing
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Spring 2017

COMP SCI 787 — ADVANCED ALGORITHMS
3 credits.
Advanced paradigms for the design and analysis of efficient algorithms, including the use of randomness, linear programming, and semi-definite programming. Applications to data structures, approximating NP-hard optimization problems, learning, on-line and distributed problems.
Requisites: COMP SCI 577 or 509
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Fall 2016

COMP SCI 790 — MASTER'S THESIS
1-9 credits.
Requisites: Grad st; Master's candidates only
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: Yes, unlimited number of completions
Last Taught: Summer 2017

COMP SCI 799 — MASTER'S RESEARCH
1-9 credits.
Requisites: Grad st; Master's candidates only
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: Yes, unlimited number of completions
Last Taught: Summer 2017

COMP SCI 809 — MATHEMATICAL TECHNIQUES IN THE ANALYSIS OF ALGORITHMS
3 credits.
Techniques for quantitative analysis of algorithms. Charging arguments, amortization, probabilistic methods. Adversary and information lower bounds. Use of methods from combinatorics, complex analysis, and asymptotics in obtaining precise analyses of quicksort, chained hashing, and other algorithms.
Requisites: COMP SCI 577, MATH 321 or equiv MATH/STAT 431 or equiv
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Spring 2009

COMP SCI 812 — ARITHMETIC ALGORITHMS
3 credits.
Survey of algorithms and design paradigms for exact arithmetic, as used in public-key cryptography, computer algebra, and pseudo-random number generation. Topics include primality testing, factorization of integers and polynomials, discrete logarithms, and (optionally) elliptic curves and integer lattices.
Requisites: MATH 541 CS 367, or cons inst
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Spring 2017

COMP SCI/MATH 837 — TOPICS IN NUMERICAL ANALYSIS
3 credits.
From advanced areas. Contents may vary.
Requisites: Cons inst
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: Yes, unlimited number of completions
Last Taught: Fall 2011

COMP SCI 838 — TOPICS IN COMPUTING
1-3 credits.
From advanced areas. Contents may vary. May be repeated any number of times for credit.
Requisites: Consent of instructor
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: Yes, unlimited number of completions
Last Taught: Spring 2017
COMP SCI/B M I/PSYCH 841 — COMPUTATIONAL COGNITIVE SCIENCE
3 credits.
Studies the biological and computational basis of intelligence, by combining methods from cognitive science, artificial intelligence, machine learning, computational biology, and cognitive neuroscience.
Requisites: COMP SCI 302 (or equivalent)
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Fall 2014

COMP SCI 880 — TOPICS IN THEORETICAL COMPUTER SCIENCE
3 credits.
Advanced topics in algorithms, complexity, and cryptography. The exact topic varies.
Requisites: Cons inst
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: Yes, unlimited number of completions
Last Taught: Spring 2015

COMP SCI 899 — PRE-DISSERTATOR RESEARCH
1-9 credits.
Requisites: Grad st, for post-masters degree, pre-dissertator stdts only
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: Yes, unlimited number of completions
Last Taught: Summer 2017

COMP SCI 900 — ADVANCED SEMINAR IN COMPUTER SCIENCE
1 credit.
Seminar on recent research on various aspects of computer science.
Requisites: Cons inst
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: Yes, unlimited number of completions
Last Taught: Spring 2017

COMP SCI/B M E/B M I/BIOCHEM/CBE/GENETICS 915 — COMPUTATION AND INFORMATICS IN BIOLOGY AND MEDICINE
1 credit.
Participants and outside speakers will discuss current research in computation and informatics in biology and medicine. This seminar is required of all CIBM program trainees.
Requisites: Cons inst
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: Yes, unlimited number of completions
Last Taught: Spring 2017

COMP SCI 999 — DISSERTATOR RESEARCH
1-6 credits.
Advanced level mentored reading and research for dissertators.
Requisites: Dissertator status
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: Yes, unlimited number of completions
Last Taught: Summer 2017