SCHOOL OF COMPUTER SCIENCE - Course Descriptions Fall 2014

CMPSCI 105 Computer Literacy (R2)

CREDITS 3

William Verts

Microcomputers are used widely in all areas of modern life. For this reason it is important for all students to understand how computers work and how computers can be used as a problem-solving tool. The focus of this course is on computer applications. The course stresses the ways in which computers can help you solve problems efficiently and effectively. The course provides a broad introduction to hardware, software, and mathematical aspects of computers. Four application areas are discussed: Internet tools (including Web page design), word processing, spreadsheets, and databases. Weekly lab assignments are an integral part of the course, and it is expected that students have access to their own computing equipment. There are optional lab times set up for students who do not have the proper equipment or software available to them. This course is a "Foundations" course for the Information Technology minor. Students who are more interested in computer programming should take a course such as CMPSCI 119 or CMPSCI 121. Prerequisites: reasonable high school math skills. Typing ability is also an important asset for the course. Some previous computer experience, while not absolutely required, will prove helpful. Not for CMPSCI majors. 3 credits.

CMPSCI 119 Introduction to Programming

CREDITS 3

William Verts

The Internet has transformed computers from machines that calculate to machines that communicate. This introduction to computer programming with Python emphasizes multimedia (graphics and sound) applications that are relevant for Web designers, graphic artists, and anyone who just wants to have more fun with their computer. Students will explore basic concepts in computer science and computer programming by manipulating digital images and sound files. No prior programming experience is needed. Not for CMPSCI majors. 3 credits.

CMPSCI 120 Introduction to Problem Solving with the Internet (R2)

CREDITS 3

William Verts

The Internet is a goldmine of information and software resources for those who know how to plug in and navigate it. Originally designed by computer scientists for computer scientists, the net is now a driving force behind life in the information age and a new global economy. This course will provide non-CMPSCI majors with timely skills needed to tap the net as well as an introduction to basic networking, client-side web programming in HTML, CSS, and Javascript, and server-side programming in Python. In addition to static and dynamic web page and web site design and implementation, we will cover strategies for finding information, managing e-mail, and ensuring privacy. We will survey current social, technical, and political topics that are relevant to the Internet such as spam and malware, net neutrality, censorship, copyright laws, and public key cryptography. Prerequisites: some hands-on experience with PCs or MACs or UNIX (programming experience is NOT required). Not for CMPSCI majors. 3 credits.

CMPSCI 121 Introduction to Problem Solving with Computers (R2)

CREDITS 4

Gordon Anderson, Robert Moll

CMPSCI 121 provides an introduction to problem solving and computer programming using the programming language Java; it also provides an integrated introduction to some of the wonderful innovations to modern science and indeed modern life that can be attributed to computer science. The course teaches how real-world problems can be solved computationally using the object-oriented metaphor that underlies Java. Concepts and techniques covered include data types, expressions, objects, methods, top-down program design, program testing and debugging, state representation, interactive programs, data abstraction, conditionals, iteration, interfaces, inheritance, arrays, graphics, and GUIs. No previous programming experience required. A companion introduction to programming class, CMPSCI 191P is also offered. If you are fairly sure you only want to do just one programming class, take that course; if you think it likely that you will do more than one programming course, take 121. Use of computer is required. Prerequisite: R1. 4 credits.

CMPSCI 187 Programming with Data Structures (R2)

CREDITS 4

David Barrington

The course introduces and develops methods for designing and implementing abstract data types using the Java programming language. The main focus is on how to build and encapsulate data objects and their associated operations. Specific topics include linked structures, recursive structures and algorithms, binary trees, balanced trees, and hash tables. These topics are fundamental to programming and are essential to other courses in computer science. There will be weekly assignments and assignments in discussion sections consisting of programming and written exercises. There will also be several exams. Prerequisites: CMPSCI 121 (or equivalent Java experience) and Basic Math Skills (R1). Basic Java language concepts are introduced quickly; if unsure of background, contact instructor. 4 credits.

CMPSCI 190DM A Mathematical Foundation for Informatics

CREDITS 3

David Barrington

Mathematical techniques useful in the study of computing and information processing. The mathematical method of definition and proof. Sets, functions, and relations. Combinatorics, probability and probabilistic reasoning. Graphs and trees as models of data and of computational processes. Prerequisite: R1 math skills recommended. Not intended for Computer Science majors – students interested in a majors-level treatment of this material should see CMPSCI 240 and 250, or MATH 455. 3 credits.

CMPSCI 190IN Introduction to Informatics

CREDITS 3

William Verts, Michelle Trim

An introduction to the main concepts of Informatics. There are several "Big Ideas" in computing, including but not limited to abstraction, data and information, algorithms, programming, and analysis of both computational problems and computational artifacts. This class provides an introduction to those ideas and considers some of the ways that those computing principles might be used to solve real world problems. Computer-based assignments are an integral part of this course but no programming knowledge or prior programming experience is expected or required. Not for CMPSCI majors. 3 credits.

CMPSCI 191A Computer Science Majors RAP Seminar

CREDITS 1

David Barrington, Robert Moll

A weekly seminar for students in the CMPSCI RAP residential program. Exploration of computer science topics through presentations and problem-solving games. Mandatory pass/fail. Open only to first-year students in the CMPSCI RAP. This course does not count toward any requirements for the CMPSCI major or minor. 1 credit.

CMPSCI 197B Special Topics - Advanced Assignments for CMPSCI 121

CREDITS 1

Gordon Anderson, Robert Moll

This add on to CMPSCI 121 consists entirely of five additional more advanced programs that students write to extend the coding experience available in the base 121 class. The course is intended primarily for students in 121 who have some previous programming experience. Must be enrolled in CMPSCI 121 concurrently. 1 credit.

CMPSCI 197C Special Topics - Programming in C

CREDITS 1

Nicolas Scarrci

A brief introduction to the C programming language for students with a good working knowledge of Java and data structures. This course is good preparation for CMPSCI 230 and courses that use C and C++. Prerequisites: CMPSCI 121 and 187. Runs for 6 weeks. This course is for CMPSCI minors and majors only, but it does not count towards either degree. 1 credit.

CMPSCI 197U Special Topics - A Hands-on Introduction to UNIX

CREDITS 1

Jarred DeVaughn-Brown

This course offers a 6-week introduction to working with Unix, and it is intended to help students work with tools commonly used in CS courses. The class is comprised of both discussion and hands-on exercises in the EdLab. Topics covered include working with the command line, installing and maintaining the OS and software packages, version control systems, compiling programs, and more. No previous experience with Unix is required. This course is for CS minors and majors only, but it does not count towards either degree. 1 credit.

CMPSCI 197WP Special Topics - Introduction to HTML/CSS

CREDITS 1

Nicolas Scarrci

An academic approach to building websites with html and css. This course is aimed at beginning programmers and self-taught web developers who would like to cement their skills. Topics include structural html5, css, and introductory javascript/jquery (if time permits). Prerequisite: CMPSCI 121. Mandatory P/F. Students who are enrolled in or have taken CMPSCI 326 are not eligible to take this course. 1 credit.

CMPSCI 220 Programming Methodology

CREDITS 4

Arjun Guha, Timothy Richards

Development of individual skills necessary for designing, implementing, testing and modifying larger programs, including: use of integrated design environments, design strategies and patterns, testing, working with large code bases and libraries, code refactoring, and use of debuggers and tools for version control. There will be significant programming and a mid-term and final examination. Prerequisite: CMPSCI 187 or ECE 242. 4 credits.

CMPSCI 230 Computer Systems Principles

CREDITS 4

Timothy Richards, Vasanta Chaganti

Large-scale software systems like Google - deployed over a world-wide network of hundreds of thousands of computers - have become a part of our lives. These are systems success stories - they are reliable, available ("up" nearly all the time), handle an unbelievable amount of load from users around the world, yet provide virtually instantaneous results. On the other hand, many computer systems don't perform nearly as well as Google - hence the now-cliché "the system is down." In this class, we study the scientific principles behind the construction of high-performance, scalable systems. The course begins with a discussion of the relevant features of modern architectures, and moves up the stack from there to operating system services such as programming language runtime systems, concurrency and synchronization, with a focus on key operating system features, I/O and networking, and distributed services. Prerequisites: CMPSCI 187 or ECE 242. 4 credits.

CMPSCI 240 Reasoning Under Uncertainty

CREDITS 4

David Jensen

Development of mathematical reasoning skills for problems that involve uncertainty. Each concept will be illustrated by real-world examples and demonstrated though in-class and homework exercises, some of which will involve Java programming. Counting and probability -- basic counting problems, probability definitions, mean, variance, binomial distribution, Markov and Chebyshev bounds. Probabilistic reasoning -- conditional probability and odds, Bayes' Law, Naive Bayes classifiers, Monte Carlo simulation. Markov chains, Markov decision processes, classical game theory, introduction to information theory. This is a core course for the new CMPSCI curriculum and may be used as a math elective for the old curriculum. Prerequisites: CMPSCI 187 (or ECE 242) and MATH 132 or consent of instructor. 4 credits.

CMPSCI 250 Introduction to Computation

CREDITS 4

Neil Immerman

Lecture, discussion. Basic concepts of discrete mathematics useful to computer science: set theory, strings and formal languages, propositional and predicate calculus, relations and functions, basic number theory. Induction and recursion: interplay of inductive definition, inductive proof, and recursive algorithms. Graphs, trees, and search. Finite-state machines, regular languages, nondeterministic finite automata, Kleene's Theorem. Problem sets, 2-3 midterm exams, timed final. Corequisite: MATH 132 or equivalent. Prerequisite: MATH 131 and CMPSCI 187 (or ECE 242). 4 credits.

CMPSCI 290NW A Networked World

CREDITS 3

Marc Liberatore

The course will cover the technical foundations of today's communication networks, particularly the Internet. It will also address key social, policy, economic and legal aspects of these networks, their use (and abuse), and their regulation. This course covers computer science topics, but all material will be presented in a way that is accessible to an educated audience with or without a strong technical background. Not intended for Computer Science majors – students interested in a majors-level treatment of this material should see CMPSCI 453. 3 credits.

CMPSCI 305 Social Issues in Computing

CREDITS 3

Michelle Trim

Using a range of different disciplinary perspectives we will explore various impacts of computers on modern society. This exploration will focus primarily on the social impacts of computers, with an emphasis on ethical concerns. Students will gain practice in several technical communication genres, public writing, and academic writing. Students will produce approximately 10 informal writing assignments and 4-6 larger written projects. Writing experiences will also include writing for electronic environments, collaborative writing, and public writing; there will be one individual and one team presentation assignment. Prerequisite: ENGLWRIT 112. 3 credits.

CMPSCI 311 Introduction to Algorithms

CREDITS 4

Hava Siegelmann

This course will introduce you to algorithms in a variety of areas of interest, such as sorting, searching, string-processing, and graph algorithms. You will learn to study the performance of various algorithms within a formal, mathematical framework. You will also learn how to design very efficient algorithms for many kinds of problems. There will be one or more programming assignments as well to help you relate the empirical performance of an algorithm to theoretical predictions. Mathematical experience (as provided by CMPSCI 250) is required. You should also be able to program in Java, C, or some other closely related language. Prerequisite: CMPSCI 250 or MATH 455. 4 credits.

CMPSCI 320 Introduction to Software Engineering (IE)

CREDITS

Gordon Anderson Honors Collog

In this course, students learn and gain practical experience with software engineering principles and techniques. The practical experience centers on a semester-long team project in which a software development project is carried through all the stages of the software life cycle. Topics in this course include requirements analysis, specification, design, abstraction, programming style, testing, maintenance, communication, teamwork, and software project management. Particular emphasis is placed on communication and negotiation skills and on designing and developing maintainable software. Use of computer required. Several written assignments, in-class presentations, exams, and a term project. This course satisfies the IE Requirement. Prerequisite: CMPSCI 220. 4 credits.

CMPSCI 325 Usability

CREDITS

3

Eva Hudlicka

In this course we examine the important problems in Usability, Human Computer Interaction, User Interfaces, and Human Centered Computing. We will examine elements of HCI history, understanding human capabilities, HCI design, several methods for prototyping user interfaces, and new applications and paradigms in human computer interaction. This is not a course in how to make dialog boxes, but rather a much more general approach to design and to interacting with human beings and evaluating designs. Some elementary programming (or user interface prototyping tools) may be required, but people without prior programming experience should feel right at home in this class. The course is available to any undergraduate student, not just computer scientists. IT-minor students, and students from other majors with an interest in design, are especially encouraged to participate. The course emphasizes group projects, class discussions and presentations of on-going work in class. There is one midterm exam and periodic in-class guizzes. No prerequisites. 3 credits.

CMPSCI 326 Web Programming (IE)

CREDITS 3

Timothy Richards

The World Wide Web was proposed originally as a collection of static documents inter-connected by hyperlinks. Today, the web has grown into a rich platform, built on a variety of protocols, standards, and programming languages, that aims to replace many of the services traditionally provided by a desktop operating system. Topics will include: producing dynamic content using a server-based language, content serving databases and XML documents, session state management, multi-tier web-based architectures, web security, and core technologies including HTTP, HTML5, CSS, JavaScript, and SQL will be emphasized. This course will also study concepts and technologies including AJAX, social networking, mashups, JavaScript libraries (e.g., jQuery), and web security. This course is hands-on and project-based; students will construct a substantial dynamic web application based on the concepts, technologies, and techniques presented during lecture. This course satisfies the IE Requirement. Prerequisites: CMPSCI 187 or ECE 242. 3 credits.

CMPSCI 345 Practice and Applications of Data Management

CREDITS 3

Alexandra Meliou

Honors Collog

Computing has become data-driven, and databases are now at the heart of commercial applications. The purpose of this course is to provide a comprehensive introduction to the use of data management systems within the context of various applications. Some of the covered topics include application-driven database design, schema refinement, implementation of basic transactions, data on the web, and data visualization. The class will alternate between lecture and practice, and the students will experience the covered topics through a semester-long collaborative mini-project. This course counts as a CS Elective toward the CMPSCI major (BA/BS). Students who have taken CMPSCI 445 are not eligible to take this course. Prerequisite: CMPSCI 187 (or ECE 242). 3 credits.

CMPSCI 377 Operating Systems

CREDITS 4

Prashant Shenoy

In this course we examine the important problems in operating system design and implementation. The operating system provides a well-known, convenient, and efficient interface between user programs and the bare hardware of the computer on which they run. The operating system is responsible for allowing resources (e.g., disks, networks, and processors) to be shared, providing common services needed by many different programs (e.g., file service, the ability to start or stop processes, and access to the printer), and protecting individual programs from one another. The course will start with a brief historical perspective of the evolution of operating systems over the last fifty years, and then cover the major components of most operating systems. This discussion will cover the tradeoffs that can be made between performance and functionality during the design and implementation of an operating system. Particular emphasis will be given to three major OS subsystems: process management (processes, threads, CPU scheduling, synchronization, and deadlock), memory management (segmentation, paging, swapping), file systems, and operating system support for distributed systems. Prerequisites: CMPSCI 230 with a grade of 'C' or better. 4 credits.

CMPSCI 383 Artificial Intelligence

Marc Liberatore

The Course explores key concepts of artificial intelligence, including state-space and heuristic search techniques, game playing, knowledge representation, automated planning, reasoning under uncertainty, decision theory and machine learning. We will examine how these concepts are applied in the context of several applications. Prerequisites: CMPSCI 220 (or CMPSCI 230) and CMPSCI 240. 3 credits.

CMPSCI 390MB Mobile Health Sensing and Monitoring

CREDITS 3

CREDITS

3

Deepak Ganesan

In recent years, the ability to continuously monitor activities, health, and lifestyles of individuals using sensor technologies has reached unprecedented levels. The typical smartphone comes equipped with a plethora of sensors for monitoring activity, speech patterns, social interactions, and location. In addition, mobile accessories such as wearable wristbands and chestbands now enable routine and continuous monitoring of a host of physiological signals (e.g., heart rate, respiratory rate, skin Conductance, and others.). In conjunction, these sensors can enable higher-order inferences about more complex human activities/behavioral states (e.g., activity patterns, stress, sleep, etc.). Such ubiquitous sensing in daily life, referred to as mobile health sensing and monitoring, promises to revolutionize our understanding of human activities and health conditions. This course is an introduction to personal health sensing and monitoring through mobile phones and on-body sensors and addresses several aspects including mobile devices and applications for health, sensor data quality and reliability challenges, inference of key health assessments from sensor data including such as activity patterns, sleep patterns, or stress, sensor data visualization and feedback, and practical considerations such as battery lifetime. This course counts as a CS Elective toward the CMPSCI major (BA/BS). Prerequisite: CMPSCI 187 (or equivalent). 3 credits.

CMPSCI 391IB Seminar - Inside the Box: How Computers Really Work

CREDITS 3

Charles Weems

Honors Collog

How does the computer actually work? In this course we peel away the layers of abstraction and look at how switches become logic circuits, how logic circuits do math, and how programs really execute. We will wire up some simple examples of logic, then move on to programming an embedded ARM processor in a mix of assembly language and C, interfacing with various I/O devices and sensors, to experience what happens when machine code executes. We will also see the impact of hidden acceleration mechanisms like caches, pipelines, and branch predictors. This course counts as a CS Elective toward the CMPSCI major (BA/BS). Prerequisite: CMPSCI 220 (or CMPSCI 230). 3 credits.

CMPSCI 391LI Seminar - Computer Crime Law and the Technologies of Investigation CREDITS 3

Brian Levine

A study, analysis, and discussion of the legal issues related to crimes involving computers and networks, including topical actions by dissidents and governments. We will also study the technologies of forensic investigation, intelligence gathering, privacy enhancement, and censorship resistance. Our main legal topics will include recent and important case law, statutes, and constitutional clauses concerning authorization, access, search and seizure, wiretaps, the right to privacy, and FISA. Our technology topics will include methods of investigation and resistance in the context of the Internet and Cellular networks. Students are assumed to have no background in legal concepts. Students will be required to complete substantial legal readings, complete significant written analysis of rulings, learn about technologies in detail, and participate in lively class discussion. Prerequisite: CMPSCI 230 and ENGLWRIT 112. This course counts as a CS Elective toward the CMPSCI major. 3 credits.

CMPSCI 403 Introduction to Robotics: Mechanics, Dynamics, and Control CREDITS 3

Roderic Grupen

This course covers basic methods and concepts in order to explain how robots work. We will study how they sense things in the world, how you make a robot move, and how robots can make their own decisions. We will study mechanisms (kinematics and dynamics), actuators, sensors, (with a focus on machine vision), signal processing, feedback control theory, machine learning, and path planning. Students will build software systems to control a simulated mobile manipulator and do experiments with system identification and control, image processing, and path planning to reinforce the material presented in class. Prerequisites: Math 235 (or Math 236) and CMPSCI 220 (or CMPSCI 230). 3 credits.

CMPSCI 410 Compiler Techniques

CREDITS 3

J. Eliot Moss

This course explores the basic problems in the translation of programming languages focusing on theory and common implementation techniques for compiling traditional block structured programming languages to produce assembly or object code for typical machines. The course involves a substantial laboratory project in which the student constructs a working compiler for a considerable subset of a realistic programming language, within a provided skeleton. The lectures are augmented by a discussion section that covers details of the programming language used to build the compiler, the operating system, the source language, and various tools. Use of computer required. Text: Engineering a Compiler, Cooper and Torczon. Prerequisites: CMPSCI 250 (or MATH 455) and CMPSCI 377. 3 credits.

CMPSCI 453 Computer Networks

Arunkumar Venkataramani Honors Collog

This course provides an introduction to fundamental concepts in computer networks, including their design and implementation. Topics covered include the Web and other applications, transport protocols (providing reliability and congestion control), routing, and link access. Special attention is also paid to wireless networks and security. Homework assignments involve programming and written tasks. Prerequisites: Experience programming; CMPSCI 230 (or CMPSCI 377) and CMPSCI 240 (or STATS 515). 3 credits.

CMPSCI 460 Introduction to Computer and Network Security

CREDITS 3

CREDITS

3

Christopher Misra

This course provides an introduction to the principles and practice of system and network security with a focus on both fundamentals and practical information. The three key topics of this course are cryptography, system and network security, and protecting information technology resources. Subtopics include ciphers, key exchange, security services (integrity, availability, confidentiality, etc.), system, network, and web based security attacks, vulnerabilities, exploits, countermeasures and responses. Students will complete several lab assignments experimenting with security countermeasures. Grades will be determined by class participation, lab work, homework, guizzes and exams. Prerequisites include CMPSCI 377 and a familiarity with Unix. 3 credits.

CMPSCI 491IP Seminar - Programming the iPhone and iPad

CREDITS 3

Charles Weems

The iPad, iPhone, and iPod Touch present examples of a mobile processor with an interesting set of peripheral devices and limitations. They are programmed using Objective C and a large set of APIs. This seminar will be an introduction to the Objective C language and iOS development environment, and will include student programming assignments and development projects targeting the Apple iPhone/iPad simulator. We will spend much of the class time actually working through examples, and discovering how some of the features really work. Students will need to have access to an Intel machine running OSX, because the development environment and simulator work only on that platform. Students also must join the Apple Developer Program, and accept their license agreements in order to obtain and use the necessary software. This course counts as a CS Elective toward the CMPSCI major (BA/BS). Prerequisites: CMPSCI 320. 3 credits.

CMPSCI 521 Software Engineering: Analysis and Evaluation

CREDITS 3

Yuriy Brun

Software has become ubiquitous in our society. It controls life-critical applications, such as air traffic control and medical devices, and is of central importance in telecommunication and electronic commerce. In this course, we will examine state-of-the-art practices for software testing and analysis to verify software quality. We will initially look at techniques for testing and analyzing sequential programs, and then examine the complexity that arises from distributed programs. The students will be required to complete regular homework assignments and exams, and carry out a group research project extending techniques described in class and/or applying them to new domains. No required text. Papers from the open literature will be assigned and made available. Prerequisites: CMPSCI 320, Introduction to Software Engineering (or equivalent course). 3 credits.

CMPSCI 529 Software Engineering Project Management

CREDITS 3

Gordon Anderson

The purpose of this course is to provide students with practical experience in the management of software development projects. Students in this course will gain this experience by serving as software development team technical managers for teams of software engineering students in CMPSCI 320. As project managers, the students in CMPSCI 529 will be responsible for: supervising and managing the work of teams of CMPSCI 320 students; interfacing with the other CMPSCI 529 students managing other teams in the course; interfacing with the course instructor, course TA, and course customer. CMPSCI 529 students will be assigned readings in software engineering project management to provide a theoretical basis for their work in this course. But the majority of work in the course will be related to the actual management of assigned development teams. As team managers, CMPSCI 529 students will set goals and schedules for their teams, track and report team progress, negotiate with leaders of other teams and the course customer, and evaluate the work of members of their teams. CMPSCI 529 course assignments may include: written team goals, plans and schedules; periodic reports on team progress; documentation of agreements reached with other team leaders and customers; evaluations of the applicability of theoretical papers to the work of this course. This course will meet at the same times and places as CMPSCI 320. Additional meetings with team members and other students in CMPSCI 529 are also expected to be arranged by mutual agreement. An additional one hour weekly meeting of all of the students in CMPSCI 529 is required. Enrollment in this course is only by permission of the instructor, and is restricted to students who have previously taken CMPSCI 320, and received a grade of A or A-. 3 credits.

CMPSCI 575 Combinatorics and Graph Theory [MATH 513]

CREDITS 3

Robert Moll

This course is a basic introduction to combinatorics and graph theory for advanced undergraduates in computer science, mathematics, engineering and science. Topics covered include: elements of graph theory; Euler and Hamiltonian circuits; graph coloring; matching; basic counting methods; generating functions; recurrences; inclusion-exclusion; and Polya's theory of counting. Prerequisites: mathematical maturity; calculus; linear algebra; strong performance in some discrete mathematics class, such as CMPSCI 250 or MATH 455. Modern Algebra - MATH 411 - is helpful but not required. 3 credits.

CMPSCI 585 Introduction to Natural Language Processing

CREDITS 3

Brendan O'Connor

Natural Language Processing addresses fundamental questions at the intersection of human languages and computer science. How can computers acquire, comprehend and produce English? How can computational methods give us insight into observed human language phenomena? How can you get a job at Google? In this interdisciplinary introductory course, you will learn how computers can do useful things with human languages, such as translate from French into English, filter junk email, extract social networks from the web, and find the main topics in the day's news. You will also learn about how computational methods can help linguists explain language phenomena, including automatic discovery of different word senses and phrase structure. Over the past decade, natural language processing has been revolutionized by statistical and probabilistic methods; you will learn about robust approaches to parameter estimation and inference. Our work will include learning new methods, discussions, and hands-on laboratories modifying provided programs. Prerequisites: CMPSCI 220 (or CMPSCI 230, or equivalent). 3 credits.

CMPSCI 610 Compiler Techniques

CREDITS 3

J. Eliot Moss

This course explores the basic problems in the translation of programming languages focusing on theory and common implementation techniques for compiling traditional block structured programming languages to produce assembly or object code for typical machines. The course involves a substantial laboratory project in which the student constructs a working compiler for a considerable subset of a realistic programming language, within a provided skeleton. The lectures are augmented by a discussion section that covers details of the programming language used to build the compiler, the operating system, the source language, and various tools. Use of computer required. Text: Engineering a Compiler, Cooper and Torczon. 3 credits.

CMPSCI 611 Advanced Algorithms

CREDITS 3

Ramesh Sitaraman

Principles underlying the design and analysis of efficient algorithms. Topics to be covered include: divide-and-conquer algorithms, graph algorithms, matroids and greedy algorithms, randomized algorithms, NP-completeness, approximation algorithms, linear programming. Prerequisites: The mathematical maturity expected of incoming Computer Science graduate students, knowledge of algorithms at the level of CMPSCI 311. 3 credits.

CMPSCI 621 Advanced Software Engineering: Analysis and Evaluation

CREDITS 3

Yuriy Brun

Software has become ubiquitous in our society. It controls life-critical applications, such as air traffic control and medical devices, and is of central importance in telecommunication and electronic commerce. In this course, we will examine state-of-the-art practices for software testing and analysis to verify software quality. We will initially look at techniques for testing and analyzing sequential programs, and then examine the complexity that arises from distributed programs. The students will be required to complete regular homework assignments and exams, and carry out a group research project extending techniques described in class and/or applying them to new domains. No required text. Papers from the open literature will be assigned and made available. Prerequisites: CMPSCI 320, Introduction to Software Engineering (or equivalent course). 3 credits.

CMPSCI 630 Systems

CREDITS 3

Emery Berger

This class is an in-depth introduction to systems, focusing on principles of system design that cross-cut numerous systems artifacts, including operating systems, databases, runtime systems, and architecture. We will cover all levels of the "system stack", from chips to distributed systems. This class may be used to satisfy systems core requirements. 3 credits.

CMPSCI 646 Information Retrieval

CREDITS 3

James Allan

The course will cover basic and advanced techniques for text-based information systems. Topics covered include retrieval models, indexing and text representation, browsing and query reformulation, data-intensive computing approaches, evaluation, and issues surrounding implementation. The course will include a substantial project such as the implementation of major elements of search engines and applications. Prerequisite: CMPSCI 446, CMPSCI 445, or equivalent. 3 credits.

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CMPSCI 650 Applied Information Theory

Erik Learned-Miller

This course will introduce the basic concepts of Information Theory: entropy, relative entropy, mutual information, channel capacity, and rate distortion. Applications, rather than proofs, will be emphasized. In addition, the statistical problem of computing information theoretic quantities from data will be emphasized. Non-parametric and semi-parametric statistical models will also be covered. Applications in vision, machine learning, coding, and medical imaging will be covered. 3 credits.

CMPSCI 653 Computer Networking

CREDITS 3

CREDITS

3

James Kurose

This course covers advanced fundamental principles of computer networks, studying foundational material in the field. Topics include advanced network architecture, network algorithmics, network control, network measurement, and wireless networks. The goal of this course is to teach networking fundamentals/techniques that will be useful for years to come. Prerequisites: Introductory (undergraduate level) courses in computer networks (e.g., CMPSCI 453), and algorithms (e.g., CMPSCI 311). Some familiarity with probability and with optimization theory will be helpful. 3 credits.

CMPSCI 670 Computer Vision

CREDITS 3

Subhransu Maji

People are able to infer the characteristics of a scene or object from an image of it. In this course, we will study what is involved in building artificial systems which try to infer such characteristics from an image. Topics include: Basics of image formation - the effect of geometry, viewpoint, lighting and albedo on image formation. Basic image operations such as filtering, convolution and correlation. Frequency representations of images. The importance of scale in images. Measurements of image properties such as color, texture, appearance and shape. Inference of motion and structure from moving objects and images. Detecting and recognizing objects in images. Statistical methods in computer vision. Prerequisite: Linear algebra, calculus, basic knowledge of probability, and an ability to program. 3 credits.

CMPSCI 683 Artificial Intelligence

CREDITS 3

Shlomo Zilberstein

In-depth introduction to Artificial Intelligence focusing on techniques that allow intelligent systems to reason effectively with uncertain information and cope limited computational resources. Topics include: problem-solving using search, heuristic search techniques, constraint satisfaction, local search, abstraction and hierarchical search, resource-bounded search techniques, principles of knowledge representation and reasoning, logical inference, reasoning under uncertainty, belief networks, decision theoretic reasoning, representing and reasoning about preferences, planning under uncertainty using Markov decision processes, multi-agent systems, and computational models of bounded rationality. 3 credits.

CMPSCI 689 Machine Learning

CREDITS 3

** DELETED

Machine learning is the computational study of artificial systems that can adapt to novel situations, discover patterns from data, and improve performance with practice. This course will cover the popular frameworks for learning, including supervised learning, reinforcement learning, and unsupervised learning. The course will provide a state-of-the-art overview of the field, emphasizing the core statistical foundations. Detailed course topics: overview of different learning frameworks such as supervised learning, reinforcement learning, and unsupervised learning; mathematical foundations of statistical estimation; maximum likelihood and maximum a posteriori (MAP) estimation; missing data and expectation maximization (EM); graphical models including mixture models, hidden-Markov models; logistic regression and generalized linear models; maximum entropy and undirected graphical models; nonparametric models including nearest neighbor methods and kernel-based methods; dimensionality reduction methods (PCA and LDA); computational learning theory and VC-dimension; reinforcement learning; state-of-the-art applications including bioinformatics, information retrieval, robotics, sensor networks and vision. Prerequisites: undergraduate level probability and statistics, linear algebra, calculus, AI; computer programming in some high level language. 3 credits.

CMPSCI 690IV Intelligent Visual Computing

CREDITS 3

Evangelos Kalogerakis

The course will teach students algorithms that intelligently process, analyze and generate visual data. The course will start by covering the most commonly used image and shape descriptors. It will proceed with statistical models for representing 2D images, textures, 3D shapes and scenes. The course will then provide an in-depth background on topics of shape and image analysis and co-analysis. Particular emphasis will be given on topics of automatically inferring function from shapes, as well as their contextual relationships with other shapes in scenes and human poses. Finally, the course will cover topics on automating the design and synthesis of 3D shapes with machine learning algorithms and advanced human-computer interfaces. Students will read, present and critique state-of-the-art research papers on the above topics. This course counts as a CS Elective toward the CMPSCI major (BA/BS). 3 credits.

CMPSCI 690PE Performance Evaluation CREDITS 3

Donald Towsley

This course will provide an introduction to the tools and techniques needed to construct and analyze performance models of computer systems, distributed systems, and communication networks. The course covers three topics: i) analytical methods including discrete and continuous time Markov chain models, queues in isolation, queueing networks, and fluid queues; ii) computer/communication system measurement methodology including statistical inference and estimation of pertinent performance metrics, optimal measurement design, and bias removal; iii) applications to solving real world problems including model validation against measurements and/or simulation, case studies will be drawn from the areas of parallel and distributed systems, and networks. The goal is to teach fundamentals with a long half-life. Students are expected to have taken probability theory at at least the undergraduate level. 3 credits.

CMPSCI 6910 Seminar - Tools for Explanatory and Tutoring Systems

CREDITS 3

Beverly Woolf

This seminar examines recent work in explanatory and tutoring systems. Participants study artificial intelligence in education, a young field that explores theories about learning, and explores how to build software that delivers differential teaching as it adapt its response to student needs and domain knowledge. Such software supports people who work alone or in collaborative inquiry, students who question their own knowledge, and students who rapidly access and integrate global information. This course describes how to build these tutors and how to produce the best possible learning environment, whether for classroom instruction or lifelong learning. The objective of the course is to stimulate awareness of research issues and to promote sound analytic and design skills as they pertain to building knowledge representations and control strategies. Specific topics include collaboration, inquiry, dialogue systems, machine learning, simulators, authoring tools and user models. The course is appropriate for students from many disciplines (computer science, linguistics, education, and psychology), researchers, and practitioners from academia, industry, and government. No programming is required. Students read and critique tools, methods, and ideas, learn how artificial intelligence is applied (e.g., vision, natural language), and study the complexity of human learning through advances in cognitive science. Weekly assignments invite students to critique the literature and a final project requires a detailed specification (not a program) for a tutor about a chosen topic. Students present book chapter material weekly in parallel with readings from the research literature. Several working systems will be available for hands-on critique. 3 credits.

CMPSCI 691PT Seminar - Hot Topics in Privacy Enhancing Technologies

CREDITS 1-3

Amir Houmansadr

Have you ever wondered how governments, companies, and organizations surveil and restrict the activities and behavior of their Internet users? If so, you may find this course interesting. This is a seminar course that targets special issues in privacy enhancing technologies for the Internet. The topics covered in the course include anonymous communications, Internet censorship and circumvention, Internet surveillance, privacy-preserving social networking, and private computation and storage. The class will meet weekly. Students are asked to read and review two papers per week. Every student is also required to present two papers to the class during the semester (the actual number depends on the class enrollment). Additionally, students who register for 3 credit hours are required to work with the instructor to pick a research project, which should be reported and presented by the end of the semester. Lect 01=3 credits; Lect 02=1 credit.

CMPSCI 701 Advanced Topics in Computer Science

CREDITS 6

STAFF

This is a 6 credit reading course corresponding to the master's project. The official instructor is the GPD although the student does the work with and is evaluated by the readers of his or her master's project.

CMPSCI 891M Theory of Computation

CREDITS 1

David Barrington

The theory seminar is a weekly meeting in which topics of interest in the theory of computation - broadly construed - are presented. This is sometimes new research by visitors or local people. It is sometimes work in progress, and it is sometimes recent material of others that some of us present in order to learn and share. This is a one-credit seminar which may be taken repeatedly for credit up to six times.

CMPSCI H320 Honors Colloquium for CMPSCI 320

CREDITS 1

Leon Osterweil

The purpose of this course is to provide students with supplementary material and insights about the software development enterprise. Students meet once a week for a one-hour discussion of software engineering topics whose exploration is intended to provide depth and perspective on the regular material of CS 320. Topics may be suggested by current events or by problems that may arise in the course of the 320 semester. Students will be required to write a term paper as part of the requirements for this course. 1 credit.

CMPSCI H345 Honors Colloquium for CMPSCI 345

CREDITS 1

Alexandra Meliou

Students will study in depth data management topics covered in class. Activities include discussions with the professor and TA, readings, and a project. The project is a semester-long group activity that combines several advanced topics into a practical application. 1 credit.

CMPSCI H391IB Honors Colloquium for CMPSCI 391IB

CREDITS 1

Charles Weems

CMPSCI H391IB provides an opportunity for University Honors students enrolled in CMPSCI 391IB to take a deeper look at some aspect of computer hardware technology and low-level programming. The specific choice of topics and activities is agreed upon by the instructor and student on an individual or team basis at the beginning of the semester. This may involve additional reading and discussion, a special programming project, conducting experiments, writing a research paper, additional lecture material or whatever mode of learning that we collaboratively agree will best meet the interests of each student. The colloquium students meet with the instructor one hour per week for discussion. Depending on how we decide to structure the class, this time may also be used for instructor presentations, review of project progress and help with problems, findings from experiments, preliminary reports on research, etc. Recommended for Sophomores, Juniors, Seniors; Majors. 1 credit.

CMPSCI H453 Honors Colloquium for CMPSCI 453

CREDITS 1

Arunkumar Venkataramani

Students will meet with instructor in small group setting with the class instructor on a weekly basis to discuss related topics of interest, including but not limited to: Internet privacy, network neutrality, network source code implementation. 1 credit.