Class Schedule - Fall 2015

Computer Science

Computer Science
Head of Department: Rob A. Rutenbar
Department Office: 2232 Siebel Center, 201 N. Goodwin Avenue, Urbana
Phone: 333-3426
www.cs.uiuc.edu

CS 100  **Freshman Orientation**  credit: 1 hours.
Introduction to Computer Science as a field and career for computer science majors. Overview of the field and specific examples of problem areas and methods of solution.

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<th>Section</th>
<th>Time</th>
<th>Days</th>
<th>Location</th>
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Restricted to First Time Freshman students.
Restricted to Computer Science or Statistics & Computer Science or Math & Computer Science or Computer Sci & Anthropology or Computer Sci & Astronomy or Computer Sci & Chemistry or Computer Sci & Linguistics major(s). Restricted to Undergrad - Urbana-Champaign.
First day of instruction for this course is 09/23/15.

CS 101  **Intro Computing: Engrg & Sci**  credit: 3 hours.
Fundamental principles, concepts, and methods of computing, with emphasis on applications in the physical sciences and engineering. Basic problem solving and programming techniques; fundamental algorithms and data structures; use of computers in solving engineering and scientific problems. Intended for engineering and science majors. Prerequisite: MATH 220 or MATH 221.

Students must register for one lab-discussion and one lecture section. Engineering students must obtain a dean's approval to drop this course after the second week of instruction.

This course satisfies the General Education Criteria for a:
Quantitative Reasoning II

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Quant Reasoning II course.
Restricted to Undergrad - Urbana-Champaign.

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Quant Reasoning II course.

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Quant Reasoning II course.
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Quant Reasoning II course.
CS 105  Intro Computing: Non-Tech  credit: 3 hours.
Computing as an essential tool of academic and professional activities. Functions and interrelationships of computer system components: hardware, systems and applications software, and networks. Widely used application packages such as spreadsheets and databases. Concepts and practice of programming for the solution of simple problems in different application areas. Intended for non-science and non-engineering majors. Prerequisite: MATH 012.

Students must register for one lab-discussion and one lecture section.

This course satisfies the General Education Criteria for a:
Quantitative Reasoning I

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Quant Reasoning I course.

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**CS 125  Intro to Computer Science  credit: 4 hours.**

Basic concepts in computing and fundamental techniques for solving computational problems. Intended as a first course for computer science majors and others with a deep interest in computing. Prerequisite: Three years of high school mathematics or MATH 012.

Students must register for one lab-discussion and one lecture section. Engineering students must obtain a dean's approval to drop this course after the second week of instruction.

This course satisfies the General Education Criteria for a:
Quantitative Reasoning I

<table>
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<tr>
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<th>Time</th>
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Quant Reasoning I course.
Restricted to Undergrad - Urbana-Champaign.
Restrictions will be removed on the first day of class

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Quant Reasoning I course.
Restricted to Undergrad - Urbana-Champaign.
Restrictions will be removed on the first day of class

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Quant Reasoning I course.

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Quant Reasoning I course.
LAPTOP LAB SECTION -- Student are required to bring their own computer to this lab section

CS 173  **Discrete Structures**  credit: 3 hours.

Discrete mathematical structures frequently encountered in the study of Computer Science. Sets, propositions, Boolean algebra, induction, recursion, relations, functions, and graphs. Credit is not given for both CS 173 and MATH 213. Prerequisite: One of CS 101, CS 125, ECE 190, INFO 103; one of MATH 220, MATH 221, MATH 234.

Students must register for a lecture and discussion section.

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</table>
Restricted to Computer Science or Statistics & Computer Science or Math & Computer Science or Computer Sci & Anthropology or Computer Sci & Astronomy or Computer Sci & Chemistry or Computer Sci & Linguistics major(s). Restricted to Undergrad - Urbana-Champaign.

Restricted to Computer Science or Statistics & Computer Science or Math & Computer Science or Computer Sci & Anthropology or Computer Sci & Astronomy or Computer Sci & Chemistry or Computer Sci & Linguistics major(s). Restricted to Undergrad - Urbana-Champaign.

**CS 196  Freshman Honors**  credit: 1 hours.
Offered for honors credit in conjunction with other 100-level computer science courses taken concurrently. A special examination may be required for admission to this course. May be repeated. Prerequisite: Concurrent registration in another 100-level computer science course (see Schedule).
SECTION 25 is for students registered in CS 125. This course will remain closed until the first day of class.

58187  Lecture-Discussion  73  ARRANGED -  -  Fleck, M Warnow, T

Credit Hours: 1 hours
SECTION 73 is for students registered in CS 173. Restricted to James Scholars Program students.

CS 199  Undergraduate Open Seminar  credit: 1 TO 5 hours.
May be repeated.

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Credit Hours: 4 hours
Problem Solving W/Data Struct
Not intended for Computer Engineering or Computer Science or Electrical Engineering or Statistics & Computer Science or Math & Computer Science or Computer Sci & Anthropology or Computer Sci & Astronomy or Computer Sci & Chemistry or Computer Sci & Linguistics major(s).

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Credit Hours: 2 hours
Instructor Approval Required
This course is for students that have dropped CS 225, this helps prepare the student to re-take CS 225 next semester.

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Credit Hours: 1 hours
De-Bug your Brain
Topic: De-Bug Your Brain: Thinking about Computer Science is designed for students enrolled in CS 125 who are new to programming and are looking for extra help in a small classroom setting. Classes meet weekly for 2 hours. This one credit course shows how to analyze algorithms, solve computational problems, debug and write complete working programs. Examples will be drawn from material covered in CS 125. Requires concurrent enrollment in CS 125.

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Credit Hours: 3 hours
Hypergraphics
Camp Honors/Chanc Schol course.
Special Topic: Hypergraphics, 3 hours. This section for Chancellor's Scholars only (not restricted by major or year); other students may only enroll with consent of instructor and the Campus Honors Program. This section of CS 199 meets with Math 198, Section G1H. Restricted to Chancellor's Scholar-CHPHonors students.
56567  Discussion/Recitation  OTF  07:00 PM - 08:50 PM  MTWRF  -  Heeren, C

Credit Hours: 1 hours

59318  Lecture-Discussion  PUR  ARRANGED -  ARR - Siebel Center for Comp Sci  Pitt, L

Credit Hours: 1 hours

PURE Program
Students work with graduate students on research projects, under the auspices of the P.U.R.E. program. Students must have an assigned mentor and research project before registering. See the P.U.R.E. website for more information. (http://wiki.engr.illinois.edu/display/PURE)

CS 210  Ethical & Professional Issues  credit: 2 hours.
Ethics for the computing profession. Ethical decision-making; licensing; intellectual property, freedom of information, and privacy. Credit is not given for both CS 210 and ECE 316. Prerequisite: CS 225. Junior standing required.

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Restricted to Computer Science major(s). Restricted to students with Junior or Senior class standing. Restricted to Undergrad - Urbana-Champaign.

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CS 225  **Data Structures**  credit: 4 hours.
Data abstractions: elementary data structures (lists, stacks, queues, and trees) and their implementation using an object-oriented programming language. Solutions to a variety of computational problems such as search on graphs and trees. Elementary analysis of algorithms. Prerequisite: CS 125 or ECE 190; CS 173 or MATH 213.

Students must register for one lecture-discussion and one lecture section.

This course satisfies the General Education Criteria for a:
Quantitative Reasoning II

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Quant Reasoning II course.
Not intended for Computer Engineering or Electrical Engineering major(s).

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Quant Reasoning II course.
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Quant Reasoning II course.

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</table>
CS 233  **Computer Architecture**  credit: 4 hours.
Fundamentals of computer architecture: digital logic design, working up from the logic gate level to understand the function of a simple computer; machine-level programming to understand implementation of high-level languages; performance models of modern computer architectures to enable performance optimization of software; hardware primitives for parallelism and security. Prerequisite: CS 125 and CS 173; credit or concurrent enrollment in CS 225.

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<td>CS 241</td>
<td>System Programming</td>
<td>4 hours.</td>
<td>Basics of system programming, including POSIX processes, process control, inter-process communication, synchronization, signals, simple memory management, file I/O and directories, shell programming, socket network programming, RPC programming in distributed systems, basic security mechanisms, and standard tools for systems programming such as debugging tools. Credit is not given for both CS 241 and ECE 391. Prerequisite: CS 225; credit or concurrent registration in CS 233. Students must register for one lecture and one discussion section.</td>
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CS 296 **Honors Course** credit: 1 hours.

Group projects for honors credit in computer science. Sections of this course are offered in conjunction with other 200-level computer science courses taken concurrently. A special examination may be required for admission to this course. May be repeated. Prerequisite: Concurrent registration in another 200-level computer science course (see Schedule).

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Honors Section 25 is for students registered in CS 225 Data Structures

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Credit Hours: 1 hours
Honors section 33 is for students registered in CS 233 Computer Architecture

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Credit Hours: 1 hours
Honors Section 41 is for students registered in CS 241 System Programming

CS 357 **Numerical Methods I** credit: 3 hours.

Fundamentals of numerical methods for students in science and engineering; floating-point computation, systems of linear equations, approximation of functions and integrals, the single nonlinear equation, and the numerical solution of ordinary differential equations; various applications in science and engineering; programming exercises and use of high quality mathematical library routines. Same as MATH 357. Credit is not given for CS 357 if credit for CS 450 has been earned. (Counts for advanced hours in LAS). Prerequisite: A 100-level computer science course; MATH 225 or MATH 415; MATH 241.

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Credit Hours: 3 hours
Restricted to Computer Science or Statistics & Computer Science or Math & Computer Science or Computer Sci & Anthropology or Computer Sci & Astronomy or Computer Sci & Chemistry or Computer Sci & Linguistics major(s). Restricted to Undergrad - Urbana-Champaign.

CS 397 **Individual Study** credit: 1 TO 3 hours.

May be repeated. Prerequisite: Consent of instructor.
CS 411  **Database Systems**  credit: 3 OR 4 hours.
Examination of the logical organization of databases: the entity-relationship model; the hierarchical, network, and relational data models and their languages. Functional dependencies and normal forms. Design, implementation, and optimization of query languages; security and integrity; concurrency control, and distributed database systems. 3 undergraduate hours. 3 or 4 graduate hours. Prerequisite: CS 225.

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Restricted to MS: Civil Engr - Online - UIUC, MCS:Computer Sci Online -UIUC, MS:Mechanical Engineering -UIUC, MS: Aerospace Engr-Online-UlUC, NDEG:Grad Nondegree-CE-UlUC, NDEG:Undergrad Nondeg-CE-UlUC, or MCS: Computer Sci Online-UlUC. Restricted to online non-degree, online MCS, online MSAE, online MSME, and online MSCE students. Center for Innovation in Teaching & Learning (CITL) restrictions and assessments apply, see http://www.citl.illinois.edu. For more details on this course section, please see http://engineering.illinois.edu/online/courses/.

OCE Tuition $1034.00 per Bill Hour, and OCE Fees $50.00 per Bill Hour.

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Credit Hours: 3 hours

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Credit Hours: 4 hours

Restricted to Graduate - Urbana-Champaign.

CS 412  **Introduction to Data Mining**  credit: 3 OR 4 hours.
Concepts, techniques, and systems of data warehousing and data mining. Design and implementation of data warehouse and on-line analytical processing (OLAP) systems; data mining concepts, methods, systems, implementations, and applications. 3 undergraduate hours. 3 or 4 graduate hours. Prerequisite: CS 225.

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Restricted to MS: Civil Engr - Online - UIUC, MCS:Computer Sci Online -UIUC, MS:Mechanical Engineering -UIUC, MS: Aerospace Engr-Online-UlUC, NDEG:Grad Nondegree-CE-UlUC, NDEG:Undergrad Nondeg-CE-UlUC, or MCS: Computer Sci Online-UlUC. Restricted to online non-degree, online MCS, online MSAE, online MSME, and online MSCE students. Center for Innovation in Teaching & Learning (CITL) restrictions and assessments apply, see http://www.citl.illinois.edu. For more details on this course section, please see http://engineering.illinois.edu/online/courses/.

OCE Tuition $1034.00 per Bill Hour, and OCE Fees $50.00 per Bill Hour.
CS 413  Intro to Combinatorics  credit: 3 OR 4 hours.
Same as MATH 413. See MATH 413.

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Credit Hours: 3 hours

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Credit Hours: 4 hours
Departmental Approval Required

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Credit Hours: 3 hours

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</table>

Credit Hours: 4 hours
Departmental Approval Required

CS 418  Interactive Computer Graphics  credit: 0 TO 4 hours.
Basic mathematical tools and computational techniques for modeling, rendering, and animating 3-D scenes. Same as CSE 427. 3 undergraduate hours. 3 or 4 graduate hours. Prerequisite: CS 225; MATH 225 or MATH 415; MATH 241.
Students will register for a lecture and a discussion section.

<table>
<thead>
<tr>
<th>CRN</th>
<th>Type</th>
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page 22 - Computer Science, Fall 2015
CS 420  **Parallel Progrmg: Sci & Engrg**  credit: 3 OR 4 hours.
Fundamental issues in design and development of parallel programs for various types of parallel computers. Various programming models according to both machine type and application area. Cost models, debugging, and performance evaluation of parallel programs with actual application examples. Same as CSE 402 and ECE 492. 3 undergraduate hours. 3 or 4 graduate hours.
Prerequisite: CS 225.

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Credit Hours: 3 hours

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Credit Hours: 4 hours
CS 421  **Programming Languages & Compilers**  credit: 3 OR 4 hours.

Structure of programming languages and their implementation. Basic language design principles; abstract data types; functional languages; type systems; object-oriented languages. Basics of lexing, parsing, syntax-directed translation, semantic analysis, and code generation. 3 undergraduate hours. 3 or 4 graduate hours. Prerequisite: CS 233 and CS 373.

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Credit Hours: 3 hours

Students registered in this section will watch the regular CS 421 lecture, online. This is an overflow accommodation for the course. Students in this section will be responsible to turn in all homeworks and take all exams with CS 421.

<table>
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<tr>
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Credit Hours: 4 hours

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Credit Hours: 3 hours

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Credit Hours: 4 hours

Restricted to Graduate - Urbana-Champaign.

CS 425  **Distributed Systems**  credit: 3 OR 4 hours.

Protocols, specification techniques, global states and their determination, reliable broadcast, transactions and commitment, security, and real-time systems. Same as ECE 428. 3 undergraduate hours. 3 or 4 graduate hours. Prerequisite: CS 241 or ECE 391.

<table>
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Restricted to MS: Civil Engr - Online - UIUC, MCS:Computer Sci Online -UIUC, MS:Mechanical Engineering -UIUC, MS: Aerospace Engr-Online-UIUC, NDEG:Grad Nondegree-CE-UIUC, NDEG:Undergrad Nondeg-CE-UIUC, or MCS: Computer Sci Online-UIUC. Restricted to online non-degree, online MCS, online MSAE, online MSME, and online MSCE students. Center for Innovation in Teaching & Learning (CITL) restrictions and assessments apply, see http://www.citl.illinois.edu. For more details on this course section, please see http://engineering.illinois.edu/online/courses/.

OCE Tuition $1034.00 per Bill Hour, and OCE Fees $50.00 per Bill Hour.

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CS 426  **Compiler Construction**  credit: 3 OR 4 hours.
Compiler structure, syntax analysis, syntax-directed translation, automatically constructed recognizers, semantic analysis, code
generation, intermediate language, optimization techniques. 3 undergraduate hours. 3 or 4 graduate hours. Prerequisite: CS 421.

<table>
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Credit Hours: 3 hours

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Credit Hours: 4 hours

CS 427  **Software Engineering I**  credit: 3 OR 4 hours.
Software process, analysis and design. Software development paradigms, system engineering, function-based analysis and design,
and object-oriented analysis and design. Course will use team-projects for hands-on exercises. Same as CSE 426. 3 undergraduate
hours. 3 or 4 graduate hours. Prerequisite: CS 225 and CS 373.

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Restricted to MS: Civil Engr - Online - UIUC, MCS:Computer Sci Online -UIUC, MS: Mechanical Engineering -UIUC, MS: Aerospace
Engr-Online-UIUC, NDEG:Grad Nondegree-CE-UIUC, NDEG:Undergrad Nondeg-CE-UIUC, or MCS: Computer Sci Online-UIUC.
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Credit Hours: 3 hours

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Credit Hours: 4 hours
CS 431  **Embedded Systems**  credit: 0 TO 4 hours.
A survey of sampled data systems and embedded architecture; key concepts in common embedded system applications; signal processing and control; embedded microprocessor and device interface; time-critical I/O handling; data communications; real-time operating systems and techniques for the development and analysis of embedded real-time software; hands-on laboratory projects. 3 undergraduate hours. 3 or 4 graduate hours. Prerequisite: CS 241 or ECE 391.
Students must register for one lab and one lecture section.

<table>
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Restricted to Graduate - Urbana-Champaign.

CS 433  **Computer System Organization**  credit: 3 OR 4 hours.
Computer system analysis and design. Organizational dependence on computations to be performed; speed and cost of parts and overall machines; instruction set design; pipeline and vector machines; memory hierarchy design. Same as CSE 422. 3 undergraduate hours. 3 or 4 graduate hours. Prerequisite: CS 233.
**CS 438 Communication Networks**  credit: 3 OR 4 hours.

Layered architectures and the OSI Reference Model; design issues and protocols in the transport, network, and data link layers; architectures and control algorithms of local-area, point-to-point, and satellite networks; standards in networks access protocols; models of network interconnection; overview of networking and communication software. Same as ECE 438. 3 undergraduate hours. 3 or 4 graduate hours. Prerequisite: CS 241 or ECE 391; one of ECE 313, MATH 461, MATH 463.

<table>
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Credit Hours: 3 hours

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Credit Hours: 4 hours
Restricted to Graduate - Urbana-Champaign.

**CS 439 Wireless Networks**  credit: 3 OR 4 hours.

Same as ECE 439. See ECE 439.

<table>
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Credit Hours: 3 hours

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Credit Hours: 4 hours
Restricted to Graduate - Urbana-Champaign.

**CS 440 Artificial Intelligence**  credit: 3 OR 4 hours.
Major topics in and directions of research in artificial intelligence: AI languages (LISP and PROLOG), basic problem solving techniques, knowledge representation and computer inference, machine learning, natural language understanding, computer vision, robotics, and societal impacts. Same as ECE 448. 3 undergraduate hours. 3 or 4 graduate hours. Prerequisite: CS 225 or ECE 391.

<table>
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Restricted to MS: Civil Engr - Online - UIUC, MCS:Computer Sci Online -UIUC, MS:Mechanical Engineering -UIUC, MS: Aerospace Engr-Online-UlUC, NDEG:Grad Nondegree-CE-UlUC, NDEG:Undergrad Nondeg-CE-UlUC, or MCS: Computer Sci Online-UlUC. Restricted to online non-degree, online MCS, online MSAE, online MSME, and online MSCE students. Center for Innovation in Teaching & Learning (CITL) restrictions and assessments apply, see http://www.citl.illinois.edu. For more details on this course section, please see http://engineering.illinois.edu/online/courses/.

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Credit Hours: 3 hours

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Credit Hours: 4 hours

Restricted to Graduate - Urbana-Champaign.

CS 445  **Computational Photography**  credit: 3 OR 4 hours.

Computer vision techniques to enhance, manipulate, and create media from photo collections, such as panoramic stitching, face morphing, texture synthesis, blending, and 3D reconstruction. 3 undergraduate hours. 3 or 4 graduate hours. Prerequisite: CS 225, MATH 225, and MATH 231.

<table>
<thead>
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<th>Type</th>
<th>Section</th>
<th>Time</th>
<th>Days</th>
<th>Location</th>
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Credit Hours: 3 hours

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Credit Hours: 4 hours

Restricted to Graduate - Urbana-Champaign.

CS 446  **Machine Learning**  credit: 3 OR 4 hours.

Theory and basic techniques in machine learning. Major theoretical paradigms and key concepts developed in machine learning in the context of applications such as natural language and text processing, computer vision, data mining, adaptive computer systems and others. Review of several supervised and unsupervised learning approaches: methods for learning linear representations; on-line learning, Bayesian methods; decision-trees; features and kernels; clustering and dimensionality reduction. 3 undergraduate hours. 3 or 4 graduate hours. Prerequisite: CS 373 and CS 440.

<table>
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<th>Days</th>
<th>Location</th>
<th>Instructor</th>
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page 28 - Computer Science, Fall 2015
### CS 447  **Natural Language Processing**  credit: 3 OR 4 hours.

Part-of-speech tagging, parsing, semantic analysis and machine translation. Relevant linguistics concepts from morphology (word formation) and lexical semantics (the meaning of words) to syntax (sentence structure) and compositional semantics (the meaning of sentences). 3 undergraduate hours. 3 or 4 graduate hours. Credit is not given for both CS 447 and LING 406. Prerequisite: CS 373.

<table>
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Credit Hours: 3 hours

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Credit Hours: 4 hours  
Restricted to Graduate - Urbana-Champaign.

### CS 450  **Numerical Analysis**  credit: 0 TO 4 hours.

Linear system solvers, optimization techniques, interpolation and approximation of functions, solving systems of nonlinear equations, eigenvalue problems, least squares, and quadrature; numerical handling of ordinary and partial differential equations. Same as CSE 401, ECE 491, and MATH 450. 3 undergraduate hours. 3 or 4 graduate hours. Credit is not given for both CS 450 and CS 457. Prerequisite: CS 101 or CS 125; CS 357 or MATH 415; MATH 285.

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Credit Hours: 3 hours
Restricted to Graduate - Urbana-Champaign.

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<th>Location</th>
<th>Instructor</th>
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| 50456  | Online      | ONL     | ARRANGED -       |      |                           | Bailey, M  
|        |             |         |                  |      | Kim, M                    |            |

Restricted to MS: Civil Engr - Online - UIUC, MCS:Computer Sci Online -UIUC, MS:Mechanical Engineering -UIUC, MS: Aerospace Engr-Online-UIUC, NDEG:Grad Nondegree-CE-UIUC, NDEG:Undergrad Nondeg-CE-UIUC, or MCS: Computer Sci Online-UIUC. Restricted to online non-degree, online MCS, online MSAE, online MSME, and online MSCE students. Center for Innovation in Teaching & Learning (CITL) restrictions and assessments apply, see http://www.citl.illinois.edu. For more details on this course section, please see http://engineering.illinois.edu/online/courses/.
OCE Tuition $1034.00 per Bill Hour, and OCE Fees $50.00 per Bill Hour.

CS 465  User Interface Design  credit: 3 OR 4 hours.
A project-focused course covering fundamental principles of user interface design, implementation, and evaluation. Small teams work on a term-long project that involves: analysis of the problem domain, user skills, and tasks; iterative prototyping of interfaces to address user needs; conducting several forms of evaluation such as cognitive walkthroughs and usability tests; implementation of the final prototype. Non-technical majors may enroll as non-programmers who participate in all aspects of the projects with the possible exception of implementation. 3 undergraduate hours. 3 or 4 graduate hours. Prerequisite: CS 225.
CS 476  **Program Verification**  credit: 3 OR 4 hours.

Formal methods for demonstrating correctness and other properties of programs. Invariant assertions; Hoare axiomatics; well-founded orderings for proving termination; structural induction; computational induction; data structures; parallel programs; overview of predicate calculus. 3 undergraduate hours. 3 or 4 graduate hours. Prerequisite: CS 225; CS 373 or MATH 414.

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Credit Hours: 3 hours

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Credit Hours: 4 hours

Restricted to Graduate - Urbana-Champaign.

CS 477  **Formal Software Devel Methods**  credit: 3 OR 4 hours.

Mathematical models, languages, and methods for software specification, development, and verification. Same as ECE 478. 3 undergraduate hours. 3 or 4 graduate hours. Prerequisite: CS 225; CS 373 or MATH 414.

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Credit Hours: 3 hours
CS 481  **Stochastic Processes & Applic**  credit: 3 OR 4 hours.
Same as IE 410. See IE 410.

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Credit Hours: 3 hours
Restricted to Undergrad - Urbana-Champaign.

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</table>

Credit Hours: 4 hours
Restricted to Graduate - Urbana-Champaign.
3 or 4 hours.

CS 483  **Applied Parallel Programming**  credit: 4 hours.
Same as CSE 408 and ECE 408. See ECE 408.

<table>
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<th>Type</th>
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CS 491  **Seminar**  credit: 0 TO 4 hours.
Seminar on topics of current interest as announced in the Class Schedule. 0 to 4 undergraduate hours. 0 to 4 graduate hours.
Approved for S/U grading only. May be repeated in the same or separate terms if topics vary to a maximum of 4 hours. Prerequisite: As specified for each topic offering, see Class Schedule or departmental course description.

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<thead>
<tr>
<th>CRN</th>
<th>Type</th>
<th>Section</th>
<th>Time</th>
<th>Days</th>
<th>Location</th>
<th>Instructor</th>
</tr>
</thead>
</table>

page 32 - Computer Science, Fall 2015
Intro Competitive Programming

Credit Hours: 1 hours

Course Descriptions: This course introduces the algorithms and concepts necessary to compete effectively in the ACM International Collegiate Programming Contest (ICPC) and similar contests. It is highly recommended for students intending to compete in the 2015 ICPC Mid-Central Regional contest. The course requires weekly completion of short problem sets. Topics covered include standard library classes and data structures useful for programming contest problems, basic complexity analysis, dynamic programming, graph algorithms, number theory, combinatorics, computational geometry, combinatorial games, and competitive programming contest strategy. Prerequisites: Must have programming competency in Java or C++. Preferably have taken CS 225 Data Structures.

Cyber Security Scholar Program
Instructor Approval Required
Topic: Information Assurance and Trust Seminar. This course is an undergraduate seminar for students admitted to the Illinois Cyber Security Scholar Program. In addition, this course would be open and serve as an orientation seminar to all college of engineering undergraduate student interested in topics of information assurance and trust. The seminars will feature information assurance subject matter expert guest speakers from industry and government, community leaders, distinguished external researchers, faculty, and students discussing both the technical challenges and limitations of IA. Standard information assurance topics such as authentication, data integrity, ethics, and cyber security will be covered.

CS 492  Senior Project I  credit: 3 hours.

First part of a project course in computer science. Students work in teams to solve typical commercial or industrial problems. Work involves planning, design, and implementation. Extensive oral and written work is required both on-campus and possibly off-campus at sponsors' locations. CS 492 must be taken as a sequence with either CS 493 or CS 494. 3 undergraduate hours. No graduate credit. Credit is not given for both CS 492 and a project course in another engineering department for the same project. Prerequisite: For Computer Science majors with senior standing.

CS 498  Special Topics  credit: 0 TO 4 hours.

Subject offerings of new and developing areas of knowledge in computer science intended to augment the existing curriculum. See Class Schedule or departmental course information for topics and prerequisites. 1 to 4 undergraduate hours. 1 to 4 graduate hours. May be repeated in the same or separate terms if topics vary.

Digital Forensics
Digital Forensics

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Credit Hours: 4 hours
Digital Forensics
Digital forensics concerns the acquisition and investigation of evidence from all devices capable of storing digital data and is often related to the prosecution of cyber crime and fraud. The class introduces the process of forensic investigation, chain of custody, forensics analysis, court proceedings and the legal justice system. It includes examination of digital storage and network traffic from personal computers, enterprise systems, embedded devices, and mobiles. Laboratory student exercises will use the tools and techniques of digital forensics investigators. Prerequisite: a basic knowledge of computer science concepts including operating systems and networking. Information about pre-requisites and the self-assessment quiz can be seen at this link - http://publish.illinois.edu/digitalforensics1/prerequisite/

Algorithms and Models of Comp

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### Algorithms and Models of Comp

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**Credit Hours: 4 hours**

*Algorithms and Models of Comp is restricted to Computer Engineering or Computer Science or Electrical Engineering or Statistics & Computer Science or Math & Computer Science or Computer Sci & Anthropology or Computer Sci & Astronomy or Computer Sci & Chemistry or Computer Sci & Linguistics major(s). This course (CS 374) will not count towards CS 400 level elective credit -- but will replace the requirements to take CS 373 and CS 473*

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### Probability in CS

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**Credit Hours: 4 hours**

*Probability in CS*

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Credit Hours: 4 hours  
Theory II

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Credit Hours: 3 hours  
AI for Computer Games
Artificial intelligence is becoming an important component of modern computer games. Example applications of AI include increasing the subty, sophistication, and intelligent behavior of non-player characters, enhancing the realism of the game world?s dynamics, and adapting game play to fit the user. In the context of computer games, fundamental AI methods for learning, planning, inference, and intelligent control can often be greatly strengthened compared to their real world counterparts. This course focusses on AI methods in a game setting which will be contrasted with AI in the real world. Students will develop an understanding of the methods rooted in this foundational difference and develop an appreciation for the state of the art. Grading is based on written and programming homework, and in particular on a sequence of implementation projects. An understanding of AI concepts and a solid facility in programming are required. Prerequisite CS 440 / ECE 448

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<th>Instructor</th>
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</thead>
<tbody>
<tr>
<td>65575</td>
<td>Lecture-Discussion</td>
<td>09:00 AM - 11:50 AM</td>
<td>46 - Grad Sch of Lib &amp; Info Science</td>
<td>Stodden, V</td>
</tr>
</tbody>
</table>

Credit Hours: 4 hours  
Intro to Data Science
Course Description: This course is intended to introduce students to modern programs and technologies that are useful for organizing, manipulating, analyzing, and visualizing data. We start with an overview of the R language, which will become the foundation for your work in this class. Then we?ll move on to other useful tools, including working with regular expressions, basic UNIX tools, XML, and SQL. We?ll also cover supervised and unsupervised statistical learning techniques made possible by recent advances in computing power. This course is very computer-oriented, so it?s very important to take the time outside of class to learn by doing ? to explore the software we?ll be covering in class, and try out new skills on real datasets in the homework assignments.

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Type</th>
<th>Time</th>
<th>Location</th>
<th>Instructor</th>
</tr>
</thead>
<tbody>
<tr>
<td>49190</td>
<td>Lecture</td>
<td>11:00 AM - 12:15 PM</td>
<td>1109 - Siebel Center for Comp Sci</td>
<td>Viswanathan, M</td>
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</table>

Credit Hours: 3 hours  
Logic
Topic: This section is for undergraduate or graduate students.

<table>
<thead>
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<th>Course Code</th>
<th>Type</th>
<th>Time</th>
<th>Location</th>
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<tbody>
<tr>
<td>64294</td>
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Credit Hours: 3 hours  
Open Source Project
Instructor Approval Required

<table>
<thead>
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<th>Type</th>
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<th>Location</th>
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<tr>
<td>40091</td>
<td>Lecture</td>
<td>12:30 PM - 01:45 PM</td>
<td>1310 - Digital Computer Laboratory</td>
<td>Yershova, G</td>
</tr>
</tbody>
</table>

Credit Hours: 3 hours  
Virtual Reality
Fundamentals of virtual reality systems, including geometric modeling, transformations, graphical rendering, optics, the human vision system, the vestibular system, interface design, human factors, developer recommendations, and technological issues. Implementation exercises and a final project are included. Extensive programming background not required

<table>
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<tr>
<th>Course Code</th>
<th>Type</th>
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<th>Location</th>
<th>Instructor</th>
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</thead>
<tbody>
<tr>
<td>40092</td>
<td>Lecture</td>
<td>12:30 PM - 01:45 PM</td>
<td>1310 - Digital Computer Laboratory</td>
<td>Yershova, G</td>
</tr>
</tbody>
</table>
Credit Hours: 4 hours
Virtual Reality
Restricted to Graduate - Urbana-Champaign.
Fundamentals of virtual reality systems, including geometric modeling, transformations, graphical rendering, optics, the human vision system, the vestibular system, interface design, human factors, developer recommendations, and technological issues. Implementation exercises and a final project are included. Extensive programming background not required.

CS 499  **Senior Thesis**  credit: 3 hours.
Research and thesis development experience in computer science underguidance of a faculty member. Literature search, oral presentation, analysis and implementation, paper preparation, and completion of a written thesis. 3 undergraduate hours. No graduate credit. May be repeated to a maximum of 6 hours. Prerequisite: Consent of instructor.
This course satisfies the General Education Criteria for a:
Advanced Composition

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<tr>
<th>CRN</th>
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<th>Section</th>
<th>Time</th>
<th>Days</th>
<th>Location</th>
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<tr>
<td>10465</td>
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</tbody>
</table>

Advanced Composition course. Instructor Approval Required
Students must see the CS Department to receive the appropriate CRN for the instructor.

CS 519  **Scientific Visualization**  credit: 4 hours.
Visualization techniques useful in analysis of engineering and scientific data. Physical models; methods of computational science; two- and three-dimensional data types; visual representation schemes for scalar, vector, and tensor data; isosurface and volume visualization methods; visual monitoring; interactive steering. Same as CSE 527. Prerequisite: CS 418.

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<tr>
<th>CRN</th>
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<th>Section</th>
<th>Time</th>
<th>Days</th>
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<th>Instructor</th>
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<tr>
<td>35905</td>
<td>Lecture</td>
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<td>02:00 PM - 03:15 PM</td>
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<td>1302 - Siebel Center for Comp Sci</td>
<td>Shaffer, E</td>
</tr>
</tbody>
</table>

Restricted to Graduate - Urbana-Champaign.

CS 527  **Topics in Software Engineering**  credit: 4 hours.
Fault-tolerant software, software architecture, software patterns, multi-media software, and knowledge-based approaches to software engineering. Case studies. Prerequisite: CS 428 or CS 429.

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<tr>
<th>CRN</th>
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<th>Section</th>
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<th>Instructor</th>
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<tr>
<td>41597</td>
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<td>ARRANGED -</td>
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<td>Gu, M Xie, T</td>
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</table>

Restricted to MS: Civil Engr - Online - UIUC, MCS:Computer Sci Online -UIUC, MS:Mechanical Engineerng -UIUC, MS: Aerospace Engr-Online/UIUC, NDEG:Grad Nondegree-CE-UIUC, or MCS: Computer Sci Online-UIUC.
Restricted to online grad non-degree, online MCS, online MSAE, online MSME, and online MSCE students. Center for Innovation in Teaching & Learning (CITL) restrictions and assessments apply, see http://www.citl.illinois.edu. For more details on this course section, please see http://engineering.illinois.edu/online/courses/.
OCE Tuition $1034.00 per Bill Hour, and OCE Fees $50.00 per Bill Hour.
CS 541  Computer Systems Analysis  credit: 4 hours.
Same as ECE 541. See ECE 541.

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<tr>
<th>CRN</th>
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<th>Section</th>
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<tr>
<td>35921</td>
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<td>B</td>
<td>09:30 AM - 10:45 AM</td>
<td>WF</td>
<td>4070 - Electrical &amp; Computer Eng Bldg</td>
<td>Sanders, W</td>
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CS 549  Seminar in Cognitive Science  credit: 2 OR 4 hours.
Same as PSYC 514, ANTH 514, EPSY 551, LING 570, and PHIL 514. See PSYC 514.

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<tr>
<th>CRN</th>
<th>Type</th>
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<th>Time</th>
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<tr>
<td>48226</td>
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<td>A</td>
<td>03:30 PM - 04:50 PM</td>
<td>TR</td>
<td>32 - Psychology Building</td>
<td>Hummel, J</td>
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</table>

CS 554  Parallel Numerical Algorithms  credit: 4 hours.
Numerical algorithms for parallel computers: parallel algorithms in numerical linear algebra (dense and sparse solvers for linear systems and the algebraic eigenvalue problem), numerical handling of ordinary and partial differential equations, and numerical optimization techniques. Same as CSE 512. Prerequisite: One of CS 450, CS 457, CS 555.

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<thead>
<tr>
<th>CRN</th>
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<th>Instructor</th>
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<tr>
<td>57701</td>
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<td>TR</td>
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</tbody>
</table>

CS 565  Human-Computer Interaction  credit: 4 hours.
In-depth coverage of advanced topics in human-computer interaction (HCI). Applied models of human performance and attention, design tools for creative design tasks, interruptions and peripheral displays, gestures, and bimanual input, and usability evaluation techniques. Students complete a research-oriented term project of their choosing. Prerequisite: CS 465.

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<tr>
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<tbody>
<tr>
<td>65321</td>
<td>Online</td>
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<td>ARRANGED -</td>
<td>-</td>
<td>-</td>
<td>Bailey, B Yen, Y</td>
</tr>
</tbody>
</table>
Restricted to online grad non-degree, online MCS, online MSAE, online MSME, and online MSCE students. Center for Innovation in Teaching & Learning (CITL) restrictions and assessments apply, see http://www.citl.illinois.edu. For more details on this course section, please see http://engineering.illinois.edu/online/courses/.

OCE Tuition $1034.00 per Bill Hour, and OCE Fees $50.00 per Bill Hour.

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<th>Location</th>
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<td>65099</td>
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<td>Bailey, B</td>
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Credit Hours: 4 hours
Restricted to Graduate - Urbana-Champaign.

**CS 571 Combinatorial Mathematics** credit: 4 hours.
Same as MATH 580. See MATH 580.

<table>
<thead>
<tr>
<th>CRN</th>
<th>Type</th>
<th>Section</th>
<th>Time</th>
<th>Days</th>
<th>Location</th>
<th>Instructor</th>
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<tbody>
<tr>
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<td>Lecture-Discussion</td>
<td>D1</td>
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<td>MWF</td>
<td>347 - Altgeld Hall</td>
<td>Balog, J</td>
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</table>

**CS 572 Extremal Graph Theory** credit: 4 hours.
Same as MATH 581. See MATH 581.

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<thead>
<tr>
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<tr>
<td>65443</td>
<td>Lecture-Discussion</td>
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<td>02:00 PM - 02:50 PM</td>
<td>MWF</td>
<td>341 - Altgeld Hall</td>
<td>Kostochka, A</td>
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</table>

**CS 574 Randomized Algorithms** credit: 4 hours.
Basic and advanced concepts in the design and analysis of randomized algorithms. Sampling; concentration inequalities such as Chernoff-Hoeffding bounds; probabilistic method; random walks, dimension reduction; entropy; martingales and Azuma's inequality; derandomization. Randomized algorithms for sorting and searching; graphs; geometric problems. Basics of pseudorandomness and randomized complexity classes. Prerequisite: CS 473; MATH 461 or STAT 400.

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<tr>
<th>CRN</th>
<th>Type</th>
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<th>Time</th>
<th>Days</th>
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<td>65259</td>
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</table>

Credit Hours: 4 hours

**CS 575 Methods of Combinatorics** credit: 4 hours.
Same as MATH 584. See MATH 584.

<table>
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<tr>
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<th>Type</th>
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<th>Time</th>
<th>Days</th>
<th>Location</th>
<th>Instructor</th>
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<tr>
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<td>E1</td>
<td>01:00 PM - 01:50 PM</td>
<td>MWF</td>
<td>445 - Altgeld Hall</td>
<td>Balog, J</td>
</tr>
</tbody>
</table>
CS 591 **Advanced Seminar**  credit: 0 TO 4 hours.

Seminar on topics of current interest as announced in the Class Schedule. Approved for S/U grading only. May be repeated in the same or separate terms if topics vary. Prerequisite: As specified for each topic offering, see Class Schedule or departmental course description.

<table>
<thead>
<tr>
<th>CRN</th>
<th>Type</th>
<th>Section</th>
<th>Time</th>
<th>Days</th>
<th>Location</th>
<th>Instructor</th>
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<tr>
<td>35941</td>
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<td>ACT</td>
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<td>ARR - Siebel Center for Comp Sci</td>
<td>Adve, V, Garzaran, M, Padua, D</td>
</tr>
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</table>

Credit Hours: 1 hours
Advanced Compiler Technology
Topic: Advanced Compiler Technology. Prerequisite: CS 426.

| 43832 | Lecture-Discussion | BIO     | 10:00 AM - 10:50 AM | M    | -                            | Peng, J, Sinha, S, Warnow, T |

Credit Hours: 1 hours
Topic: Readings and Research in Bioinformatics. This Course will meet in 3401 SC

| 35943 | Lecture-Discussion | CCR     | 05:00 PM - 06:20 PM | W    | 1304 - Siebel Center for Comp Sci | Campbell, R |

Credit Hours: 1 hours
Cloud Computing Research
Topic: Cloud Computing Research.

| 46417 | Lecture-Discussion | FM      | 03:30 PM - 04:20 PM | F    | -                            | Gunter, E, Viswanathan, M |

Credit Hours: 1 hours
Formal Methods Seminar

| 36448 | Lecture-Discussion | GFX     | ARRANGED -         |      | ARR - Siebel Center for Comp Sci | Hart, J |

Credit Hours: 1 hours
Computer Graphics Seminar
Topic: Research Topics in Computer Graphics.

| 35974 | Lecture-Discussion | HCI     | 11:00 AM - 11:50 AM | T    | ARR - Siebel Center for Comp Sci | Bailey, B, Karahalios, K |

Credit Hours: 1 hours
Human-Computer Interaction
Topic: Seminar in Human-Computer Interaction. Course restricted to PhD Students only.

| 43828 | Lecture-Discussion | IG      | 01:30 PM - 02:20 PM | W    | -                            | Gupta, I |

Credit Hours: 1 hours
<table>
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<tr>
<th>Course Code</th>
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<th>Topic</th>
<th>Prerequisites</th>
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<td>Credit Hours: 1 hours</td>
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<tr>
<td></td>
<td>Scientific Computing Seminar</td>
<td>PHD</td>
<td>11:00 AM - 11:50 AM</td>
<td>0216 - Siebel Center for Comp Sci</td>
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<td>PHD Orientation Seminar</td>
<td>RAR</td>
<td>04:00 PM - 05:30 PM</td>
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<td>Credit Hours: 1 hours</td>
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<tr>
<td></td>
<td>Comp Arch Era of Custom Accel</td>
<td>RHC</td>
<td>ARRANGED -</td>
<td>ARR - Siebel Center for Comp Sci</td>
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<td>Campbell, R</td>
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<tr>
<td></td>
<td>TITLE: Computer Architecture in the Era of Custom Accelerators The end of Moore's Law scaling for chips is having a remarkable side effect: dramatic and rising interest in special-purpose computer architectures to accelerate difficult computing tasks. Said differently: we don't just look at faster processors, or more cores, any longer. We are willing to look at ?novel? architectures. Examples abound. GPUs are now everywhere, from phones to supercomputers. The backend of the Microsoft Bing search engine runs on FPGAs. Intel has just purchased Altera, the world's biggest FPGA company. IBM, Intel and Qualcomm have just launched research groups to explore custom architectures to implement Machine Learning (ML) tasks. One of the world's fastest engines for protein folding was done entirely in custom silicon; the effort was led by a rather famous Wall Street hedge fund billionaire. Indeed, much of the action in high-frequency trading for computational finance happens on FPGAs, because competitive advantage is measured in fractions of a microsecond. Something BIG is happening here. In this course, we're going to grab several of the key papers in this area, read them and discuss them. LOGISTICS: Monday, 4-5:30 (mostly); one or a few days, Monday 5-6:30. ROOM: 3403 Siebel Center</td>
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<td>ARR - Siebel Center for Comp Sci</td>
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<td>Marinov, D</td>
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<td></td>
<td>Software Engineering Seminar</td>
<td>TA</td>
<td>03:00 PM - 03:50 PM</td>
<td>0216 - Siebel Center for Comp Sci</td>
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<td>Teaching Assistant Training</td>
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</table>
CS 597  **Individual Study**  credit: 2 TO 16 hours.
Individual study or reading in a subject not covered in normal course offerings. May be repeated. Prerequisite: Consent of instructor.

<table>
<thead>
<tr>
<th>CRN</th>
<th>Type</th>
<th>Section</th>
<th>Time</th>
<th>Days</th>
<th>Location</th>
<th>Instructor</th>
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<tbody>
<tr>
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Instructor Approval Required
Students must see the CS Department to receive the appropriate CRN for the instructor.

<table>
<thead>
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<th>CRN</th>
<th>Type</th>
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<th>Time</th>
<th>Days</th>
<th>Location</th>
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<tr>
<td>54947</td>
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Credit Hours: 4 hours
Restricted to MCS:Computer Sci Online -UIUC or MCS: Computer Sci Online-UIUC.
Center for Innovation in Teaching & Learning (CITL) restrictions and assessments apply, see http://citl.illinois.edu.
OCE Tuition $1094.00 per Bill Hour, and OCE Fees $50.00 per Bill Hour.

CS 598  **Special Topics**  credit: 2 TO 4 hours.
Subject offerings of new and developing areas of knowledge in computer science intended to augment the existing curriculum. See Class Schedule or departmental course information for topics and prerequisites. May be repeated in the same or separate terms if topics vary.

<table>
<thead>
<tr>
<th>CRN</th>
<th>Type</th>
<th>Section</th>
<th>Time</th>
<th>Days</th>
<th>Location</th>
<th>Instructor</th>
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<tbody>
<tr>
<td>63912</td>
<td>Lecture-Discussion</td>
<td>AGP</td>
<td>09:00 AM - 10:15 AM</td>
<td>MW</td>
<td>1109 - Siebel Center for Comp Sci</td>
<td>Parameswaran, A</td>
</tr>
</tbody>
</table>

Credit Hours: 4 hours
Human-in-the-loop Data Mgmt
Restricted to Graduate - Urbana-Champaign.
The course explores two complementary roles for humans as applied to interactive data analytics: one, where humans are the analysts performing or supervising the analysis; here, the emphasis is on building usable tools for these analysts, and second, where humans are the crowdsourced workers assisting with the computation and analysis; here, the emphasis is on having humans process as little data as possible while gaining maximum benefit. Students will read a number of papers -- both important landmark papers as well as cutting-edge papers, act as a discussant for a paper at least once, and complete a semester-long implementation project. Familiarity with basic databases, machine learning, and algorithms expected.

<table>
<thead>
<tr>
<th>CRN</th>
<th>Type</th>
<th>Section</th>
<th>Time</th>
<th>Days</th>
<th>Location</th>
<th>Instructor</th>
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<tr>
<td>62086</td>
<td>Lecture-Discussion</td>
<td>AK</td>
<td>09:30 AM - 10:45 AM</td>
<td>WF</td>
<td>1103 - Siebel Center for Comp Sci</td>
<td>Kirlik, A</td>
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</tbody>
</table>

Credit Hours: 4 hours
Cognitive Engineering
Restricted to Graduate - Urbana-Champaign.
This course is oriented to engineering and computer science students who would like their research on interactive systems and technologies to be informed by relevant research in the social, behavioral and cognitive sciences, and to students in these sciences who would like their research to be relevant to technology or engineering design. The format will combine group projects and seminar discussions based on readings to be provided from the "Oxford Handbook of Cognitive Engineering" (J.D. Lee & A. Kirlik, 2013, NY: OUP), whose table of contents (list of topics to be covered) can be found on OUP and related websites. Open to graduate students and to senior undergraduates by permission of instructor.

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Type</th>
<th>Time</th>
<th>Instructor</th>
<th>Location</th>
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</thead>
<tbody>
<tr>
<td>64616</td>
<td>Lecture-Discussion</td>
<td>APK 02:00 PM - 03:15 PM</td>
<td>Kloeckner, A</td>
<td>1109 - Siebel Center for Comp Sci</td>
</tr>
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Credit Hours: 4 hours
Fast Algorithms & Intrgl Equat
Restricted to Graduate - Urbana-Champaign.


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<th>Course Code</th>
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<tbody>
<tr>
<td>46983</td>
<td>Lecture-Discussion</td>
<td>DAF 11:00 AM - 11:50 AM</td>
<td>Forsyth, D</td>
<td>-</td>
</tr>
</tbody>
</table>

Credit Hours: 4 hours
Geometry for AI Students
Restricted to Graduate - Urbana-Champaign.

Topic: Computer vision methods for recognizing human activity. One of the great problems in computer vision is to say what people are doing from a picture or a video of them doing it. There are numerous applications, ranging from building models of how people behave to advance architectural design, to surveillance. This problem is very hard indeed, for several reasons. There is not a clean vocabulary for what people are doing, particularly for everyday activity. Often, the interesting stuff is very rare indeed, and people just walk. People can do a lot of different things. Finally, what they're doing looks different when seen from different angles. The course will involve a series of lectures, discussions and paper readings. Class meets in 3405 SC.

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<tbody>
<tr>
<td>64617</td>
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<td>Padua, D</td>
<td>1105 - Siebel Center for Comp Sci</td>
</tr>
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</table>

Credit Hours: 4 hours
Scripting Lang - Design Implem
Restricted to Graduate - Urbana-Champaign.

Prerequisites: Graduate standing Scripting languages are widely used for all types of applications. They are the programming languages of the web and are also widely used for scientific computing and data analytics. This course will discuss the main characteristics of scripting languages, their capabilities for parallelism, their impact on productivity and performance, and interpreter and compiler techniques to implement them. Reading assignments will include research papers and class notes.

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<th>Course Code</th>
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<tr>
<td>63587</td>
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<td>1103 - Siebel Center for Comp Sci</td>
</tr>
</tbody>
</table>

Credit Hours: 4 hours
Social & Information Networks
Restricted to Graduate - Urbana-Champaign.

Description: Networks are powerful frameworks to analyze large, complex data from vastly diverse sources?social networks such as Twitter, protein-protein interactions in biology, trade markets or information networks such as the World Wide Web. In this class, we shall study and critique recent work in key research areas in networks, including network formation, community discovery, web search, behavior diffusion, markets, epidemics and collective action. Students shall work together in teams to develop algorithms and to build systems to solve emerging research questions.

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<th>Course Code</th>
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<tbody>
<tr>
<td>54314</td>
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<td>JGE 02:00 PM - 03:15 PM</td>
<td>Erickson, J</td>
<td>317 - Gregory Hall</td>
</tr>
</tbody>
</table>
### Advanced Data Structures

**Credit Hours:** 4 hours  
**Restricted to Graduate - Urbana-Champaign.**  
**Topic:** Advanced Data Structures  
This course will survey important developments in data structures that have not (yet) worked their way into the standard computer science curriculum. The precise topics will depend on the interests and background of the course participants. Potential topics include self-adjusting binary search trees; dynamic trees and graphs; geometric data structures; persistent data structures; kinetic data structures, I/O-efficient and cache-oblivious data structures; data structures for streaming, sketching, and filtering; data structures that beat information-theoretic lower bounds; and applications in computational geometry, optimization, networking, machine learning, databases, and other areas of computer science. Students in all areas of computer science and related disciplines are welcome, including algorithmically mature undergraduates. An undergraduate algorithms course at the level of CS 473 is a prerequisite; however, specific background material will be introduced as needed.

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<td>TR</td>
<td>4101 - Materials Science &amp; Eng Bld</td>
<td>Peng, J</td>
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</table>

### Machine Learning Computation Bio

**Credit Hours:** 4 hours  
**Restricted to Graduate - Urbana-Champaign.**  
**This course focuses on modern machine learning techniques in computational biology, including probabilistic modeling, feature selection, graphical models, approximate inference and learning, Monte Carlo methods and neural networks. Students will learn the development of the theoretical concepts for these methods and the applications of these methods to a variety of problems in computational biology. This course is appropriate for graduate students in computer science, bioengineering, mathematics and statistics. Familiarity with basic statistics, probability and algorithms is expected.

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</tbody>
</table>

### Social Spaces on the Internet

**Credit Hours:** 4 hours  
**Restricted to Graduate - Urbana-Champaign.**  
**Topic:** Social Spaces on the Internet. The Internet is home to a panoply of varieties of human interaction. Social media, interactive games, telepresence, online environments, and simple text e-mails now mediate our normal experiences of education, medicine, politics, business, sociality, collective action, and more. As the Internet has become an infrastructure for social life and society itself, our ability to measure and represent that society is also transforming. In this cross-disciplinary university-wide seminar we will investigate the rise of "culture as data:" that is, the use of widespread networked computation to quantify, analyze, explain, and navigate our relationships to social institutions and each other. Students from all disciplines and colleges are welcome. There are no pre-requisites. This section meets with CAS 587, 30145.

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<td>1131 - Siebel Center for Comp Sci</td>
<td>Parthasarathy, M</td>
</tr>
</tbody>
</table>

### Software Verification

**Credit Hours:** 4 hours  
**Restricted to Graduate - Urbana-Champaign.**  
**Topic:** Software Verification. Scientific methods for engineering reliable software is a grand challenge in computer science. This course is dedicated to studying state-of-the-art techniques for ensuring high reliability of software. We will study several techniques, ranging from testing, type-checking, static analysis, and formal verification, for ensuring correctness to ensure safety and security. The course will be driven by extensive student presentations of research papers and projects aimed to learn, explore, and perhaps even accomplish new research. The course will involve a project, aligned with the student's research area if possible. Graduate students already working on verification, security, or programming languages, with some basic knowledge of formal methods in verification, are encouraged to attend. The course will differ from CS476 as we will not be using rewriting techniques, and from CS477 as it will be more in-depth and research-oriented.

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<td>0216 - Siebel Center for Comp Sci</td>
<td>Smaragdis, P</td>
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**Credit Hours: 4 hours**
Mach Lrng for Signal Processng
Restricted to Graduate - Urbana-Champaign.
Topic: Machine Learning for Signal Processing. Prerequisite: Linear algebra, Probability theory. Today we see an increasing need for machines that can understand complex real-world signals, such as speech, images, movies, music, biological and mechanical readings, etc. In this course we will cover the fundamentals of machine learning and signal processing as they pertain to this goal, as well as exciting recent developments. We will learn how to decompose, analyze, classify, detect and consolidate signals, and examine various commonplace operations such as finding faces from camera feeds, organizing personal music collections, designing speech dialog systems and understanding movie content. The course will consist of lectures and student projects and presentations. Students are expected to have a working knowledge of linear algebra, probability theory, and programming skills to carry an implementation of a final project (preferably in MATLAB, but all languages are welcome).

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<tbody>
<tr>
<td>60407</td>
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<td>PSO</td>
<td>ARRANGED -</td>
<td>-</td>
<td>-</td>
<td>Kim, M, Smaragdis, P</td>
</tr>
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</table>

Credit Hours: 4 hours
Mach Lrng for Signal Processng
Restricted to MS: Civil Engr - Online - UIUC, MCS: Computer Sci Online - UIUC, MS: Mechanical Engineering - UIUC, MS: Aerospace Engr-Online-UIUC, NDEG:Grad Nondegree-CE-UIUC, or MCS: Computer Sci Online-UIUC.
Restricted to online grad non-degree, online MCS, online MSAE, online MSME, and online MSCE students. Center for Innovation in Teaching & Learning (CITL) restrictions and assessments apply, see http://www.citl.illinois.edu. For more details on this course section, please see http://engineering.illinois.edu/online/courses/.
OCE Tuition $1034.00 per Bill Hour, and OCE Fees $50.00 per Bill Hour.

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<tr>
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<td>RK</td>
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<td>1105 - Siebel Center for Comp Sci</td>
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</tbody>
</table>

Credit Hours: 4 hours
Data-Driven Design
Restricted to Graduate - Urbana-Champaign.
Explores the use of data-driven methods to support creative design processes by examining recent work in human computer-interaction, product design, cognitive science, machine learning, graphics, vision, and natural language processing. Students will read and discuss recent papers from these fields, and work in teams on a multi-week project to build data-driven tools to solve real-world design problems. Practical data mining and machine learning knowledge is emphasized: crowdsourcing and web scraping, model and feature selection, parameter tuning. The course has no formal prerequisites, but students should be algorithmically and programmatically mature.

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<td>TAR</td>
<td>09:30 AM - 10:45 AM</td>
<td>TR</td>
<td>1109 - Siebel Center for Comp Sci</td>
<td>Abdelzaher, T</td>
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</tbody>
</table>

Credit Hours: 4 hours
Sensing in Social Spaces
Restricted to Graduate - Urbana-Champaign.
Topic: Sensing in Social Spaces According to the United Nations, presently 54% of the world population live in cities. This percentage will increase to 66% by 2050. Arguably, the most versatile "sensor" in urban areas is the human observer. Collectively, human observers post over 500 million tweets and over 70 million Instagram photos per day, making social media an interesting new "sensor network" for obtaining insights on a variety of events. This paper-reading course investigates unfolding research challenges and directions in distributed social sensing, overviews the broader landscape of its urban applications, including sustainability, green computing, IoT, and urban cyber-physical systems, discusses common misconceptions, presents the underlying theoretical foundations, and sheds light on related recent technologies and publications. The course includes an experimental project on a social sensing testbed.

CS 599  Thesis Research  credit: 0 TO 16 hours.
Approved for S/U grading only. May be repeated.

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<tr>
<th>10469</th>
<th>Independent Study</th>
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Instructor Approval Required  
Students must see the CS Department to receive the appropriate CRN for the instructor.