Computer Science

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>
</tr>
</thead>
<tbody>
<tr>
<td>62182</td>
<td>Lecture-Discussion</td>
<td>AGB</td>
<td>11:00 AM - 12:20 PM</td>
<td>TR</td>
<td>1109 - Siebel Center for Comp Sci</td>
<td>Warnow, T</td>
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<tr>
<td>58502</td>
<td>Lecture-Discussion</td>
<td>MAN</td>
<td>12:30 PM - 01:45 PM</td>
<td>TR</td>
<td>1304 - Siebel Center for Comp Sci</td>
<td>Prabhakaran, M</td>
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<tr>
<td>31666</td>
<td>Lecture-Discussion</td>
<td>MS</td>
<td>09:30 AM - 11:00 AM</td>
<td>F</td>
<td>1103 - Siebel Center for Comp Sci</td>
<td>Snir, M</td>
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<tr>
<td>63500</td>
<td>Lecture-Discussion</td>
<td>PF</td>
<td>09:30 AM - 10:45 AM</td>
<td>TR</td>
<td>1131 - Siebel Center for Comp Sci</td>
<td>Fischer, P</td>
</tr>
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</table>

Credit Hours: 4 hours
Algorithmic Genomic Biology
Course description: This course covers four fascinating and related problems: constructing evolutionary trees, computing multiple sequence alignments, genome assembly, and analyzing microbiomes. Students will learn the mathematical and computational foundations in these areas, read the current literature, and do a team research project. The techniques involved include discrete algorithms, graph theory, simulations, and probabilistic analysis of algorithms. The course is appropriate for graduate students in computer science, computer engineering, bioengineering, mathematics, and statistics; graduate students in the biological sciences are also welcome, and will have different homework and exams. Pre-requisites: No biology background is required, but students should have some mathematical maturity, and at least one undergraduate course in algorithm design, data structures, or probability theory. Students without this background (e.g., biology graduate students, or undergraduates in engineering who have not completed an algorithms course) may be admitted, but should contact the instructor to discuss the course. Meets with BIOE 598

Credit Hours: 4 hours
Cryptography
For more information regarding this course, please see http://courses.engr.illinois.edu/cs598man/fa2011/

Credit Hours: 4 hours
Fundamentals of Parallel Comp
Topic: Fundamentals of Parallel Computing: The course will cover topics in the theory of parallel algorithms and parallel programming models. Topics include: parallel computation complexity -- work and depth, parallel reduction and parallel prefix, sorting networks, parallel sorting algorithms, parallel graph algorithms, communication complexity and network models, FFT. The prerequisite for this course is CS 473 (Fundamental Algorithms), or a similar course.

Credit Hours: 4 hours
High-Order Methods for PDEs
Title: High-Order Methods for PDEs High-Order Methods for Partial Differential Equations Analysis and development of high-order discretizations for PDEs. Topics include weighted residual methods in space, stability and accuracy of timesteppers, fast solution techniques in multiple space dimensions for complex domains, multilevel preconditioning for separable and nonseparable operators, Krylov-subspace projection methods, multilevel preconditioning, matrix assembly, boundary conditions, and parallel implementation. Prerequisites: differential equations, linear algebra, facility with matlab, python, or equivalent. Weekly assignments with bi-weekly computing projects.
Algorithmic Game Theory

Algorithmic game theory has become more relevant than ever before with the advent of online markets, ad auctions, social networks, and recommendation systems, where rational agents interact to achieve selfish goals. The last two decades have witnessed the development of a rich theory in this area and deep mathematical connections have been established. The first half of the course will provide a broad introduction to games and market models, solution concepts, classical as well as recent developments in the field on equilibrium computation & complexity, mechanism design, price of anarchy, matching markets, game dynamics, and others. The second half will address a selection of advanced topics and research projects.

Probabilistic Methods for Biological Sequence Analysis

Topic: Probabilistic Methods for Biological Sequence Analysis. This is an advanced topics course in bioinformatics. We will discuss (i) probabilistic techniques such as Expectation-Maximization, Hidden Markov Models, Bayesian inference, Monte carlo sampling (ii) computational assessment of sequence statistics (such as alignment scores and word frequencies), (iii) mathematical models of evolution and their use in sequence analysis, among other topics. Computational techniques will be discussed in the context of the important biological process of gene regulation, and problems such as "sequence alignment", "motif finding", and "module detection", will be studied in detail. NO BACKGROUND IN BIOLOGY IS REQUIRED: biological concepts used will be introduced early in the course. The course will involve a research project. Prerequisites: Programming, basic probability and statistics.

Designing and Building Applications for Extreme Scale Systems

Title: Designing and Building Applications for Extreme Scale Systems Learn how to design and implement applications for extreme scale systems, including analyzing and understanding the performance of applications, the primary causes of poor performance and scalability, and how both the choice of algorithm and programming system impact achievable performance. The course covers multi- and many-core processors, interconnects in HPC systems, parallel I/O, and the impact of faults on program and algorithm design.