COURSE DESCRIPTION

Department and Course Number:  CSC 206  Coordinator: Chung-E Wang

Course Title:  Algorithms and Paradigms  Total Credits:  3

Catalog Description: Design and analysis of algorithms. Classical design paradigms including greedy, divide-and-conquer, dynamic programming, and backtracking algorithmic methods. Alternative paradigms of computing including parallel and numerical approaches. Theoretical limits of computation. Selected additional topics such as genetic, approximation, and probabilistic algorithms. Prerequisite: fully classified graduate status in Computer Science or Software Engineering. 3 units.


References: None

Course Goals:
To learn methods of designing and analyzing computer algorithms. To develop an appreciation for alternative paradigms of computation, beyond the traditional sequential algorithmic methods. To understand the strengths and limitations of various algorithms and paradigms.

Prerequisites by Topic
Thorough understanding of:
1. Discrete mathematics.
2. Data structures and elementary analysis of algorithms.
3. High-level language programming.

Major Topics Covered in the Course
1. Introduction, mathematical preliminaries, and review of data structures (3 hours)
2. Worst-case and average-case analysis (3 hours)
3. Analyzing recursive algorithms; solving recurrences (3 hours)
4. Greedy method (3 hours)
5. Divide-and-conquer (3 hours)
6. Dynamic programming (3 hours)
7. Backtracking (2 hours)
8. Correctness proof of algorithms (3 hours)
9. Polynomial reducibility and NP-completeness (3 hours)
10. Parallel algorithms (3 hours)
11. Numerical algorithms (2 hours)
12. Selected topics: (11 hours)
   a. Analysis techniques (e.g. amortized, competitive)
   b. Design techniques (e.g. genetic, probabilistic, heuristic, approximation, branch-and-bound)
   c. Advanced data structures (e.g. Fibonacci heaps, red-black trees)
d. Advanced algorithms (e.g. network flow, string matching, number-theoretic)

13. Review and exams (3 hours)

**Laboratory Projects:** None

**Estimated CSAB Category Content**

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<thead>
<tr>
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<th>CORE</th>
<th>ADVANCED</th>
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<tbody>
<tr>
<td>Data Structures</td>
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<td>0.5</td>
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<tr>
<td>Algorithms</td>
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<td>Software Design</td>
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<td>Computer Organization and Architecture</td>
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<td>Concepts of Programming Languages</td>
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**Oral and Written Communications**
No significant component.

**Social and Ethical Issues**
No significant component.

**Theoretical Content**
Correctness proof of algorithms, NP completeness.

**Analysis**
Algorithm design involves analyzing problems and designing solutions.

**Design**
Algorithm design.

*CSC 206 Course Description*
*April 10, 2006*