Course Outline

ECE 3790 – Engineering Algorithms

Winter 2015

Course Objectives

The objective of this course is to obtain a better understanding of algorithm and algorithmic problems. Many interesting problems are inherently difficult if approached using deterministic methods. This course introduces a variety of useful methods for "solving" these problems.

Course Content

The following topics will be covered:

- Foundations (1 week)
  - The Role of Algorithms in Computing
  - Growth of Functions
  - Divide-and-Conquer
- Sorting and Order Statistics (1 week)
  - Heapsort
  - Quicksort
  - Median and Order Statistics
- Data Structures (2 weeks)
  - Elementary Data Structures
  - Hash Tables
  - Binary Search Tree
- Advanced Design and Analytical Techniques (3 weeks)
  - Dynamic Programming
  - Greedy Algorithms
  - Meta-heuristics
- Graph Algorithms (4 weeks)
  - Elementary Graph Algorithms
  - Minimum Spanning Tree
  - Single-Source Shortest Paths
  - All-Pairs Shortest Paths
  - Maximum Flow
- Selected Topics (2 weeks)
  - Linear Programming
  - NP-Completeness
  - Approximation Algorithms
  - Number-Theoretic Algorithms applied to Encryption
  - Public Key, Key Exchange

Textbook


Requirements/Regulations

- Attendance at lectures and laboratories is essential for successful completion of this course. Students must satisfy each evaluation component in the course to receive a final grade.
- It is the responsibility of each student to contact the instructor in a timely manner if he or she is uncertain about his or her standing in the course and about his or her potential for receiving a failing grade. Students should also familiarize themselves with the University's General Academic Regulations, as well as Section 3 of the Faculty of Engineering Academic Regulations dealing with incomplete term work, deferred examinations, attendance and withdrawal.

Important Dates

- Quiz
  February 12th, 2015
- Term Tests
  March 5th, 2015
- Voluntary Withdrawal Deadline
  March 19th, 2015
- Mid-term Break
  February 16–20, 2015
  No classes or examinations
- Good Friday
  April 3rd, 2015
  No classes or examinations
Competency
A11: Accreditation
A10: Impact
A9: Integrity
A8: Professionalism
A7: Communication skills
A6: Use of engineering tools
A5: individual and team work
A4: Design
A3: Investigation
A2: Problem analysis
A1: A knowledge base for engineering

Attributes
A1: A knowledge base for engineering
A2: Problem analysis
A3: Investigation
A4: Design
A5: Use of engineering tools
A6: Individual and team work
A7: Communication skills
A8: Professionalism
A9: Impact of engineering on society/environment
A10: Ethics and equity
A11: Economics and project management
A12: Life-long learning

Competency Levels
1 - Knowledge (Able to recall information)
2 - Comprehension (Ability rephrase information)
3 - Application (Ability to apply knowledge in a new situation)
4 - Analysis (Able to break problem into its components and establish relationships)
5 - Synthesis (Able to combine separate elements into a whole)
6 - Evaluation (Able to judge the worth of something)

• No programmable devices or systems (such as calculators, PDAs, iPods, iPads, cell phones, wireless communication or data storage devices) are allowed in examinations unless approved by the course instructor.

Learning Outcomes
1. Assign complexity metrics to algorithms and algorithmic problems.
2. Solve combinatorial problems through the use of non-deterministic algorithms such as simulated annealing and evolutionary algorithms.
3. Extrapolate and reorganize non-deterministic algorithm analogs to similar combinatorial types of problems solving.
4. Understanding the fundamentals of recursion and how it relates to algorithms.

Expected Competency Levels

<table>
<thead>
<tr>
<th>Outcome</th>
<th>A1</th>
<th>A2</th>
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<th>A4</th>
<th>A5</th>
<th>A6</th>
<th>A7</th>
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Evaluation

The final course grade is determined by the student's performance on the quiz, in laboratories, and on examinations (midterm and final). Students must complete all the laboratories in order to be eligible to receive a passing grade.

<table>
<thead>
<tr>
<th>Component</th>
<th>Value (%)</th>
<th>Method of Feedback</th>
<th>Learning Outcomes Evaluated</th>
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</thead>
<tbody>
<tr>
<td>Practice Problems</td>
<td>0</td>
<td>F</td>
<td>1, 2, 4</td>
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<tr>
<td>Quiz</td>
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<td>F, S</td>
<td>1, 2, 3</td>
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<tr>
<td>Laboratories</td>
<td>15</td>
<td>F, S</td>
<td>2, 3, 4</td>
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<td>F, S</td>
<td>1, 2, 3</td>
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<tr>
<td>Final Examination</td>
<td>50</td>
<td>S</td>
<td>2, 4</td>
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* Method of Feedback: F - Formative (written comments and/or oral discussion), S - summative (numerical grade)

Academic Integrity

Students are expected to conduct themselves in accordance with the highest ethical standards of the Profession of Engineering and evince academic integrity in all their pursuits and activities at the university. As such, in accordance with the General Academic Regulations on Academic Integrity, students are reminded that plagiarism or any other form of cheating in examinations, term tests, assignments, projects, or laboratory reports is subject to serious academic penalty (e.g. suspension or expulsion from the faculty or university). A student found guilty of contributing to cheating by another student is also subject to serious academic penalty.

Updated: 03 January 2015