CSCI 3532 Advanced Data Structures and Algorithms

Description:

Pre-requisites: MATH 3331 and CSCI 3333 or equivalent.

Audience:
This course is designed for students in the undergraduate program in computer science.

Professor: Dr. Said Bettayeb
Ph. 283-3857
Rm. Delta 166

Office Hours: Tues. 5:00 -7:00 pm and Wed. 2:00 pm -- 4:00 p.m.
Or by Appointment

Teaching Assistant: Mr Aditya Macherla
TA’s Office Hours:
Mond. 4:00 - 7:00 pm
Wed. 4:00 - 10:00 pm
Frid. 9:00 - 2:00 pm

Text: Title: Introduction to Algorithms
2nd Edition
Grading Policy:

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<td>Final Exam</td>
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Specification of Course and Objectives

Statement of General Goals and Objectives:

The student learns in this course the fundamentals of Data Structures. The student will learn the skills required to represent data in order to make programs run more efficiently. The various techniques for representing data are covered. The student learns the paradigms of Algorithm Design and techniques for Algorithm Analysis.

Upon completion of this course, students will be able to:

- Understand algorithm analysis concepts including worst-case (Big-O), best case, and average case.
- Use the following data structures in program implementations: trees, hash tables, heaps, dictionaries, B-trees, B+-trees.
- Sort data using various sorting methods including heap sort, merge sort, bubble sort, radix sort, quick sort, and external merge sort.
- Understand classic graph problems and algorithms such as spanning tree, shortest path, and topological sorts.
- Understand B- and B+-trees and their use with files.
- Design solutions to simple and moderately complex problems.
• Understand basic issues in program complexity (i.e., P-class, NP-class, and NP-complete class problems).
• Understand basic applications of recursion and when it fails to be efficient.

**COURSE OUTLINE**

I. Preliminaries and Foundations: August 24-September 5, 2009

A. Introduction: Philosophy of Data Structures, Abstract Data Types, Data Structures and Algorithms.  
   Chapter 1
B. Review of Mathematical Principles: Sets and Relations, Recursion, Recurrence Relations, Proof by Induction, Proof by Contradiction.
C. Algorithm Analysis and Design: Chapter 2
D. Growth of Functions: Asymptotic Notation Chapter 3
   Chapter 4

II. Sorting: September 7-19, 2009

A. Internal Sorting: 
   Heapsort, Chapter 6
   Quicksort, Chapter 7
   Sorting in Linear Time Chapter 8
   File Processing and External Sorting Searching: Replacement Selection, Multiway Merging

III. Fundamentals of Data Structures: Sept. 21-October 10, 2009

A. Lists, Stacks and Queues, Chapter 10
B. Hash Tables Chapter 11
C. Binary Search Trees Chapter 12
D. Red-Black Trees Chapter 13
E. B-Trees Chapter 18

Midterm Exam October 14, 2009

IV. Graphs and Graph Algorithms: October 19-November 21, 2009

A. terminology and Representations Chapter 22
B. Graph Implementations Chapter 22
C. Graph Traversals Chapter 22
D. Minimum Cost Spanning Trees
   (Prim's and Kruskal's Algorithms) Chapter 23
E. Shortest Path Problem Chapter 24, and Chapter 25.
F. Maximum Flow:
   The Ford-Fulkerson Method Chapter 26

V. Advanced Topics:  Nov. 23- Dec. 5, 2009
A. Analysis Techniques
B. Turing Machines and its variations
C. The notion of NP Completeness
D. How to prove NP-Completeness
E. Undecidable Problems

Final Exam December 9, 2009.

Regulations:

Late Homework and Project Assignments are accepted with a 10% penalty for each day for up to 2 days or until the solutions are posted whichever comes first. No make-up for quizzes! Cell phones must be turned off during class.

Accommodations (as specified by the Americans with Disabilities Act) - If you will require special academic accommodations, please contact the Disability Services Office at 281-283-2627.

Academic Honesty Code: see section 2.1.4 in the Students Life Policies handbook for the UHCL Academic Honesty Code.

http://prtl.uhcl.edu/portal/page/portal/PRV/FORMS_POLICY_PROCEDURES/STUDENT_POLICIES/Academic_Honesty_Policy

6 Drop Rule
6 Drop Rule Limitation - Students who entered college for the first time in Fall 2007 or later should be aware of the course drop limitation imposed by the Texas Legislature. Dropping this or any other course between the first day of class and the census date for the semester/session does not affect your 6 drop rule count. Dropping a course between the census date and the last day to drop a class for the semester/session will count as one of your 6 permitted drops. You should take this into consideration before dropping this or any other course. Visit www.uhcl.edu/records for more information on the 6 drop rule and the census date information for the semester/session.