COSC5334, Design and Analysis of Algorithms

Course Description:
An advanced course that concentrates on the design and analysis of algorithms used to solve a variety of problems. The topics covered include asymptotic notation; divide-and-conquer methods; heaps; randomized quicksort; optimal sorting; P, NP, and NP-completeness; and the greedy method.

Course Learning Objectives:
The student will have been provided with:
1. a framework for the general discussion of algorithmic complexity. These notions will be independent of implementation specifics,

2. an opportunity for detailed analyses of some fundamental algorithms, and

3. an appreciation of some "real-life" implications of the asymptotic complexity measures.

Textbook: Introduction to Algorithms, 3rd edition
T. H. Cormen, C. E. Leiserson, R. L. Rivest, and Clifford Stein
Published by: MIT Press or McGraw-Hill

Student Performance Evaluations:
Course grades will be determined by three examinations concerning text material, lectures, etc. Each of these parts will contribute equally towards the final grade. To be more specific, the course examination average will be used to determine course marks using the "traditional" 90, 80, 70, 60 percent minima for “A”, “B”, “C” and “D”, respectively.
Tentative Course Schedule:

We will proceed guided by the outline that follows. The numbers indicate the appropriate text portions.

I. Foundations (weeks 1 - 5)

1. Introduction-The Role of Algorithms in Computing

2. Getting Started-Mathematical Foundations
   2.1 Insertion Sort
   2.2 Analyzing Algorithms
   2.3 Designing Algorithms

3. Growth of Functions
   3.1 Asymptotic Notation
   3.2 Standard Notations and Standard Functions

4. Divide and Conquer-Recurrence Relations
   (4.1 The Maximum Sub-array Problem- Not Covered)
   4.2 Strassen’s Method- overview only
   4.3 The Substitution Method for Solving Recurrences- overview only
   4.4 The Recursion tree method for solving Recurrences
   4.5 The master method for solving Recurrences
   (4.6 Proof of the master method- Overview only)

EXAMINATION #1

II. Sorting and Order Statistics (weeks 5-10)

6. Heapsort
   6.1 Heaps
   6.2 Heap property
   6.3 Building a Heap
   6.4 Heapsort
   6.5 Priority Queues

7. Quicksort
   7.1 Description
   7.2 Performance
   7.3 Randomized Quicksort
   7.4 Analysis
8. Sorting in Linear Time
   8.1 Optimal sorting methods
   8.2 counting Sort (Overview Only)
   (8.3 Radix Sort Not Covered)
   (8.4 Bucket Sort-Not Covered)

EXAMINATION #2

III. Selected Topics (weeks 10 - 15)
   34. NP-Completeness
       34.1 Polynomial Time
       34.2 Polynomial Time Verification
       34.3 NP-completeness and Reducibility
       34.4 NP-completeness proofs (brief overview only)
       34.5 NP-complete Problems

Should Time Allow:
   15. Dynamic programming (Overview only)
   16. Greedy Algorithms
       16.1 An Activity-selection Problem
       16.2 Elements of the Greedy Strategy
       16.3 Huffman Codes
   22. Elementary Graphical Algorithms
   23. Minimal Spanning Trees

EXAMINATION #3
   (During the University-mandated Final Examination time)
Some Notes Concerning Various University and School Procedures:

- **Course Withdrawal:**
The student is responsible for the paperwork associated with registration in this course. In the unlikely event that you decide to withdraw from this (or any) course you must submit the required documents prior to any University deadline date(s).

You should initiate the course withdrawal process by going to the Student Services Center and filling out a course drop form. Please be certain that you properly submit this paperwork. Should my signature be required you may obtain it either at a class meeting, during my regularly scheduled office hours, or by appointment. Failure to properly complete this course withdrawal procedure will result in your receiving a course grade based on the work you have actually completed.

- **Academic Integrity/Plagiarism.**
University students are expected to conduct themselves in accordance with the highest standards of academic honesty. Academic misconduct for which a student is subject to disciplinary action includes all forms of cheating, such as illicit possession of examination materials, falsification of records, forgery, and plagiarism. (Plagiarism being the presentation of the work of another as one’s own work.)

- **Accommodations for Students with Disabilities:**
The Americans with Disabilities Act (ADA) is a federal anti-discrimination statute that provides comprehensive civil rights protection for persons with disabilities. Among other things, this legislation requires that all students with disabilities be guaranteed a learning environment that provides for reasonable accommodation of their disabilities. If you believe you have a disability requiring an accommodation, please call or visit Disability Services at (361) 825-5816 in Driftwood 101.

If you are a returning veteran and are experiencing cognitive and/or physical access issues in the classroom or on campus, please contact the Disability Services office for assistance at (361) 825-5816.

- **Appeals of Course Grades:**
A student who believes that he or she has not been held to appropriate academic standards as outlined in the class syllabus, equitable evaluation procedures, or appropriate grading, may appeal the final grade given in the course. The burden of proof is on the student to demonstrate the appropriateness of the appeal. A student with a complaint about a grade is encouraged to first discuss the matter with the instructor. For complete details on the process, including the responsibilities of the parties involved in the process and the number of days allowed for completing the steps in the process, consult Texas A&M University-Corpus Christi University Procedure 13.02.99.C2.01 Student Grade Appeal Procedures (http://www.tamucc.edu/provost/university_rules/index.html), and the College of Science and
Engineering Grade Appeals webpage (http://sci.tamucc.edu/students/GradeAppeal.html). For assistance and/or guidance in the grade appeal process, students may contact the chair or director of the appropriate department or school or the College of Science and Engineering Dean’s Office.