Design and Analysis of Algorithms
Department of Computing Sciences
Spring 2015

A. COURSE INFORMATION
Course number/section: COSC5334/01
Class meeting time: Tuesday and Thursday from 2:00 to 3:15 PM
Class location: Center for the Sciences 115
Course Website: TBD

B. INSTRUCTOR INFORMATION
Instructor: David R. Thomas
Office location: Center for Instruction Room 319
Office hours: Tuesday and Thursday 12:00:-- 12:30 PM, 4:00 – 4:30PM
Wednesday 1:30 – 3:30, or by appointment
Telephone: 361-825-2475
E-mail: david.thomas@tamucc.edu
Appointments: at lecture, through email, by serendipity (please knock)

C. COURSE DESCRIPTION
Catalog Course Description
An advanced course that concentrates on the design and analysis of algorithms used to solve a variety of problems. The methods of design covered include such topics as: divide-and-conquer, the greedy method, dynamic programming, search and traversal techniques, and backtracking.

D. PREREQUISITES AND COREQUISITES
Prerequisites: COSC 5321, MATH 2413, and MATH 2305
Corequisites: none

E. REQUIRED TEXTBOOK(S), READINGS AND SUPPLIES
Required Textbook(s)
Introduction to Algorithms, 3rd edition
T. H. Cormen, C. E. Leiserson, R. L. Rivest, and Clifford Stein
Published by: MIT Press or McGraw-Hill

Optional Textbook(s) or Other References: none
Supplies: none
F. **STUDENT LEARNING OUTCOMES AND ASSESSMENT**

By the end of this course, students should be able to:

1. Demonstrate knowledge of a general framework for the analyses and general discussion of algorithmic complexity. These analyses will be independent of implementation specifics,
2. Perform or understand detailed analyses of selected fundamental algorithms.
3. Exhibit an understanding of the P and NP classes of problems and appreciate some implications of the P vs. NP problem.
4. Demonstrate knowledge and understanding of algorithmic optimality theorems for selected problems.
5. Exhibit knowledge of other topics to include (as time permits) the halting problem, greedy methods, and graphical algorithms.

G. **INSTRUCTIONAL METHODS AND ACTIVITIES**

Lecture/ and discussion, examination topic review discussions, written examinations

H. **MAJOR COURSE REQUIREMENTS AND GRADING**

Course grades will be determined by three examinations whose contents will be guided by the previously described learning outcomes. The examinations will consist of problems and examples selected from the course textbook, definitions, theorem statements, and related material. A detailed list of examination topics will be distributed in class prior to each examination.

Each examination will contribute equally towards the final grade. The examination average score will be used to assign grades using a traditional 90, 80, 70, 60 percent distribution for “A”, “B”, “C”, and “D”, respectively. The examinations will occur approximately during the fifth week, the tenth week, and during the University-determined final examination period.

I. **COURSE CONTENT/SCHEDULE**

We will proceed *guided* by the outline that follows. The numbers indicate the appropriate text portions, while an item followed by "(?)" may be omitted or greatly abbreviated.

**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- Not Covered)

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. Quick sort  
   7.1 Description  
   7.2 Performance  
   7.3 Randomized Quick sort  
   7.4 Analysis

8. Sorting in Linear Time  
   8.1 Optimal sorting methods  
   8.2 Counting Sort (Brief overview only)  
   (8.3 Radix Sort Not Covered)  
   (8.4 Bucket Sort-Not Covered)

EXAMINATION #2

III. Selected Topics (weeks 10 - 15)  
9. NP-Completeness  
   34.1 Polynomial Time  
   34.2 Polynomial-time Verification  
   34.3 NP-completeness and reducibility  
   34.4 NP-completeness proofs (overview only)  
   34.5 NP-complete problems
EXAMINATION #3

J. COLLEGE AND UNIVERSITY POLICIES

- **Academic Integrity (University)**
  It is expected that university students will demonstrate a high level of maturity, self-direction, and ability to manage their own affairs. Students are viewed as individuals who possess the qualities of worth, dignity, and the capacity for self-direction in personal behavior.
  See Full University Policy at [http://catalog.tamucc.edu/content.php?catoid=10&navoid=313#Academic_Integrity](http://catalog.tamucc.edu/content.php?catoid=10&navoid=313#Academic_Integrity)

- **Classroom/Professional Behavior**
  Texas A&M University-Corpus Christi, as an academic community, requires that each individual respect the needs of others to study and learn in a peaceful atmosphere. Under Article III of the Student Code of Conduct, classroom behavior that interferes with either (a) the instructor’s ability to conduct the class or (b) the ability of other students to profit from the instructional program may be considered a breach of the peace and is subject to disciplinary sanction outlined in article VII of the Student Code of Conduct. Students engaging in unacceptable behavior may be instructed to leave the classroom. This prohibition applies to all instructional forums, including classrooms, electronic classrooms, labs, discussion groups, field trips, etc.

- **Deadline for Dropping a Course with a Grade of W (University)**
  The grade of W will be assigned to any student officially dropping a course by Friday, April 10, 2015. No student is eligible to receive a W without completing the official drop process by this deadline. Visit the Office of the University Registrar for the Course Drop Form that must be submitted. After April 10, 2015 a student will not be allowed to drop a course.

- **Grade Appeals (College of Science and Engineering)**
  As stated in University Procedure 13.02.99.C2.01, Student Grade Appeal Procedures, 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 upon 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, including the responsibilities of the parties involved in the process and the number of days allowed for completing the steps in the process, see University Procedure 13.02.99.C2.01, Student Grade Appeal Procedures. These documents are accessible through the University Rules website at http://www.tamucc.edu/provost/university_rules/index.html, and the College of Science and Engineering Grade Appeals webpage at 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, the Office of the College of Science and Engineering Dean, or the Office of the Provost.

- **Disability Services**
  Disability Services (DS) is the hub for coordinating services and accommodations to ensure accessibility and utilization of all programs for all Texas A&M University-Corpus Christi students with disabilities. Our services are designed to meet the unique educational needs of enrolled students with documented permanent or temporary disabilities. DS provides intake and consultation services to students seeking to register with our office. DS reviews an individual’s documentation of disability and assesses eligibility for services and the determination of reasonable accommodations. For more information visit the Disability Services Office at 116 Corpus Christi Hall or go to http://disabilityservices.tamucc.edu/

K. **OTHER INFORMATION**

None

M. **GENERAL DISCLAIMER**

I reserve the right to modify the information, schedule, assignments, deadlines, and course policies in this syllabus if and when necessary. I will announce such changes in a timely manner during regularly scheduled lecture periods.