Course: COSC4370, Models of Computation

Course Prerequisites: MATH2305, Discrete Mathematics I; COSC5321, Data Structures


Course Description:
This course concerns selected fundamental properties and/or limitations shared by all digital computer systems. In our study we will not be concerned with questions concerning any particular hardware or software. Instead, we will answer questions such as those that follow.

(1) What are some relevant computational models for digital computation?
(2) What are the capabilities and limitations of a particular model?
(3) What is the complexity in both time and space of a particular solution to some problem?

In our course we will be mostly concerned with solutions to questions (1), and (2).

Course Objectives:
1. To provide a framework for a theoretical analysis of relevant models of digital computation.
2. To perform detailed analyses of the capabilities of selected computational models.
3. To investigate some general time-complexity characteristics of selected models.

Student Performance Evaluation:
Course grades will be determined by three examinations concerning textbook material, lectures, and assigned problems. Each examination will contribute equally towards the final grade, which will be determined using a “traditional” 90%, 80%, 70% … scheme. These examinations will occur (approximately) on the 7-th, 14-th and last class meeting.
Course Overview:
We will proceed guided by the outline that follows. The integer at the left of a line indicates the appropriate textbook section.

Part 0: Introduction (Chapter 0, 2 meetings)
  0. General Information
    0.1 Automata, Computability, and Complexity
    0.2 Mathematical Essentials
    0.3 Definitions, Theorems, and Proofs
    0.4 Methods for proof

Part 1: Automata and Languages
  1. Regular Languages, (Chapter 1, 6 meetings)
    1.1 Finite Automata
    1.2 Nondeterminism
    1.3 Regular Expressions
    1.4 Nonregular Languages
  2. Context-Free Languages (Chapter 2, 3 meetings)
    2.1 Context-free Grammars
    2.2 Pushdown Automata
    2.3 Non-context-free Languages

Part 2: Computability Theory
  3. The Church-Turing Thesis (Chapter 3, 3 meetings)
    3.1 Turing Machines
    3.2 Variants of Turing Machines
    3.3 A Definition of Algorithm
  4. Decidability (Chapter 4, 2 meeting)
    4.1 Decidable Languages
    4.2 The Halting Problem

Part 3: Complexity Theory
  5. Time Complexity (Chapter 7, 3 meetings)
    7.1 Measuring Complexity
    7.2 The Class P
    7.3 The Class NP
    7.4 NP-completeness
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:**
  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 (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.