COMP/MATH 354: Analysis of Algorithms
Fall 2018
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Instructor

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Course Information

COMP/MATH 354
Lecture time & place: MW 12:00-1:15, Sierra Hall 1422
Course web page: https://soltys.cs.csuci.edu/blog/?page_id=3519

Course Description

This course is an introduction to the analysis of algorithms. The material covered consists of five parts: (i) basics of proving correctness of algorithms using pre/post-conditions, loop invariants and termination. (ii) Three classical algorithm design techniques: greedy, divide-and-conquer and dynamic programming (most of the course is dedicated to this part). (iii) Analysis of performance using worst-case complexity. (iv) Implementation issues (we will implement algorithms in Python 3). (v) Finally, we will also mention briefly NP-hardness, and other classes of algorithms such as online, randomized and parallel.

Prerequisite: MATH 300 (Discrete Math), & some computer programming experience.

Student Learning Outcomes

Upon a successful completion of the course you will be able to:

1. Prove rigorously that an algorithm solves a given problem;

2. Design algorithms to solve problems according to standard design principles (greedy, divide-and-conquer and dynamic programming);

3. Measure the performance of an algorithm in terms of worst-case complexity and Big-Oh notation.

Course Outline

Topics in order:

1. Correctness: pre/post-conditions, examples of division and Euclid's algorithm.

2. Ranking algorithms: PageRank, Stable Marriage, Pairwise Comparisons.

3. Greedy algorithms: Minimum-cost spanning trees, especially the idea of a promising solution; job scheduling with profits; other examples.

4. Divide and conquer algorithms: Mergesort, multiplication of binary numbers, Savitch's algorithm for reachability in little space (Savitch's algorithm is an example of performance where little space requires a long time); other examples.

5. Dynamic Programming Algorithms: Longest monotone subsequence problem, All pairs shortest path problem, variants of the Knapsack problem and introduction to NP-completeness and approximation algorithms. Illustration of the "overwriting" technique in implementation. Activity selection with profits.

6. Briefly online, randomized and parallel algorithms.

Textbook

3rd edition of *An Introduction to the Analysis of Algorithms*, by Michael Soltys, published by World Scientific (ISBN: 978-981-3235-90-8). See web page: http://www.msoltys.com/book, for additional material related to the textbook: slides, GitHub repository with solutions to programming problems and an errata sheet for the 3rd edition.

Grading

1. Quizzes: 0% (not graded)
   Very useful for your own assessment of your understanding of the material, and as preparation for the midterm and to the final exam. To be given weekly.

2. Assignments: 60%
   Three assignments, to be completed in teams of two or three students, submitted on Canvas as a pdf and/or Python3 file, each worth 20%.

3. Exams: 40%

   (a) Midterm: 20%
   (b) Final: 20% (cumulative, i.e., containing material from the entire course)

Policies

1. **Academic Dishonesty:** By enrolling at CSU Channel Islands, students are responsible for upholding the University's policies and the Student Conduct Code. Academic integrity and scholarship are values of the institution that ensure respect for the academic reputation of the University, students, faculty, and staff. Cheating, plagiarism, unauthorized collaboration with another student, knowingly furnishing false information to the University, buying, selling or stealing any material for an examination, or substituting for another person may be considered violations of the Student Conduct Code (located at http://www.csuci.edu/campuslife/student-conduct/academic-dishonesty.htm). If a student is found responsible for committing an act of academic dishonesty in this course, the student may receive academic penalties including a failing grade on an assignment or in the course, and a disciplinary referral will be made and submitted to the Dean of Students office. For additional information, please see the faculty (located at https://senate.csuci.edu/policies/2013-2014/sp-13-06-policy-on-academic-dishonesty-rev-oct2016.pdf), also in the CI Catalog.

   The assignments will be written in groups. Each group has to work independently of the other groups; verbal discussions of problems among groups are allowed, but you should not show written notes, and you should not leave such discussions with written notes. Please speak to the instructor if these expectations are not clear.

2. **Disability Statement:** If you are a student with a disability requesting reasonable accommodations in this course, please visit Disability Accommodations and Support Services (DASS) located on the second floor of Arroyo Hall, or call 805-437-3331. All requests for reasonable accommodations require registration with DASS in advance of need: https://www.csuci.edu/dass/students/apply-for-services.htm. Faculty, students and DASS will work together regarding classroom accommodations. You are encouraged to discuss approved accommodations with your faculty.

3. **Course Policies Subject to Change:** It is the student's responsibility to check the course's web page frequently to stay abreast of the course, and for corrections or updates to the syllabus. Any changes will be posted there.