COMP 3371
Advanced Data Structures and Algorithms
Spring 2017

Meeting Times and Place: 4:00-5:50pm Tuesday, Thursday in ECS 200.

Instructor: Mario A. Lopez; office: ECS 327, phone: 303-871-3287, e-mail: `mlopez@cs.du.edu`

Instructor Office Hours: Tuesday, Thursday: 2:30pm–3:45pm, or by appointment.

GTA: Ariel Huckabay; office: ECS 126, e-mail: `Ariel.Huckabay@du.edu`.

GTA Office Hours: Monday: 10-11:50am, Friday: 12-1:50pm, or by appointment.

Textbook: *Introduction to Algorithms, 3rd edition*, by T.H. Cormen, C.E. Leiserson, R.L. Rivest, C. Stein; published by MIT Press, 2009.

Course Content:

- Performance analysis: space and time complexities, worst case and average analysis, asymptotic notation (Chapters 1, 2, 3).
- Algorithm design paradigms: incremental and greedy methods, divide-and-conquer, dynamic programming, iterative improvement, augmentation, backtracking (Chapters 4, 7, 9, 14, 15, 16).
- Randomized algorithms (Chapter 5).
- Order statistics. (Chapter 9).
- Optimal sorting algorithms, lower bounds, sorting in linear time (Chapters 6, 8).
- Amortized complexity (Sections 17.1, 17.2, 17.3).
- Augmented red-black trees (Chapters 12, 13).
- Universal and perfect hashing (Chapter 11).
- Graph algorithms: traversals, minimum spanning trees, shortest paths (single source, all-pairs) (Chapters 22, 23, Sections 24.1-24.3).
- Disjoint sets (Sections 21.1, 21.2, 21.3).
- NP-completeness (Sections 34.1, 34.2, 34.5). Students receiving graduate credit will be expected to complete additional exercises on this topic.

Prerequisites: COMP 2370 (*Introduction to Algorithms*) and COMP 3200 (*Discrete Structures*). In particular, you should be familiar with the following topics: fundamental mathematical functions (polynomials, logarithms, exponentials, factorials), sums of geometric and arithmetic series, basic discrete structures, including sets, relations, permutations, combinations, trees and graphs, and their properties including basic algorithms (traversals, isomorphism, colorability, connectedness, biconnectedness, etc.), proof and analysis techniques including mathematical induction, contradiction, and recurrences. You should be comfortable with the use of recursion, linked lists, stacks, queues, hash tables, binary search trees, and graphs. Most of this material can be reviewed from Sections 3.2, 4.4, Chapter 10, 11, 12 and the appendices in Section VIII (Mathematical Background) of the textbook.

The class moves quickly and builds the material incrementally on a solid foundation provided by the required background. Consequently, you should not take this class if you haven't had the prerequisite courses or if you are not comfortable with the expected background.

Class Materials: Additional class materials, including copies of slides, will be available by logging into `http://canvas.du.edu`.

Assignments and Exams: There will be several homework assignments, several biweekly quizes, and a closed-book final exam. The final is scheduled on Tuesday, June 5 (4:00 - 6:00 pm). The dates of the quizzes will be announced in class.

The best way to succeed in this course is to keep up with the reading and to review regularly the class slides and textbook. Assignments are due at the *beginning* of class on the due date and they must be uploaded into canvas.

With the possible exception of graphs and pictures your write-ups should be typed (the LaTeX word processing system is highly recommended). Try to be as clear and precise as possible in your write-ups. Understandability of the solution is as desirable as correctness. Sloppy and unclear answers will receive fewer points, even if they are correct. Be prepared to present your solutions in front of the class or instructor. If you cannot explain your work you may not get any credit for it.

Grading Policy: Homework assignments 30%, quizzes 40%, final 30%. Grade cut-offs are as follows: A (86 to 100 points), B (71 to 85 points), C (60 to 70 points), D (50 to 59 points), F (less than 50 points). However, you must pass the quizzes and exam (by getting more than 50% of the total score) in order to pass the class. Additional curving, if any, may only improve your grade.

Scholastic Conduct: The University of Denver takes a strong stance on cheating and maintaining academic integrity. You are expected to uphold DU's honor code (as described in `https://www.du.edu/studentlife/studentconduct/`).

All work you present in writing must be prepared individually, not in groups. You may discuss homework problems with your classmates but may not use or copy all or part of someone else's work. Your are strongly encouraged to work alone before you discuss ideas with others. Make sure to list anyone that you discussed solutions with. You may use materials from other textbooks or published technical papers, provided you understand and cite these materials in your writeup. However, you may not search for or use answers from the web. Ultimately, you must understand and write your solutions on your own. I reserve the right to quiz you about your homework solutions. Exams and quizzes are to be done individually and without consulting or receiving help from anyone else. Violations of these policies will adversely affect your grade.

Class Attendance: You are responsible for all announcements made and all material covered in class. There will be no makeup quizzes for missed classes or late arrivals.

Computing Facilities: Any programming required in this class must be done in C, C++, Python, or Java and must run correctly on the `cs.du.edu` machines. If you do not have an account on `cs.du.edu`, you may request one at: `http://support.cs.du.edu/` .