CS 344: Design & Analysis of Computer Algorithms
Spring 2019, Sections 1-3, 4 Credits

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LECTURE: M-W 8:10-9:30 PM, LIV BE-AUD
OFFICE HOURS: W 2:00-4:00 PM
Section 1 Recitation: Monday 8:55 - 9:50 AM, LIV BE-250
Section 2 Recitation: Tuesday 10:35 - 11:30 AM, LIV LSH-B115
Section 3 Recitation: Friday 10:35 - 11:30 AM, LIV LSH-B115
Prerequisites: 198:112 Data Structures, 198:206 Introduction to Discrete Structures II

Exams (No Makeup Exams!):
Midterm I: Feb 20 (covers 8 lectures);
Spring break: Sat March 16 - Sun March 24;
Midterm II: April 3 (incremental, covers 8 lectures)
Last lecture: May 6;
Final: TBA (cumulative).

Grading Guideline: The better of the two scores:
0.15 HW & Quizzes + 0.20 MIDTERM I + 0.20 MIDTERM II + 0.45 FINAL
0.15 HW & Quizzes + 0.25 MIDTERM II + 0.60 FINAL.

TOPICS: The course will cover a large subset of the following topics:
• Methods for expressing and comparing complexity of algorithms: worst and average cases, lower bounds, and asymptotic analysis.
• Searching, sorting. Lower bounds for comparison-based sorting; binsort and radix sort.
• Divide and conquer. Fast integer multiplication; recurrences; the master theorem; mergesort; randomized median and selection algorithms; quicksort; fast matrix multiplication.
• Graph search algorithms. Graphs representations; depth first search; topological search; strongly connected components. Breadth first search and layered DAGs.
• Greedy algorithms. Spanning trees and cuts, union-find and path compression; minimum spanning tree (MST) algorithms; randomized algorithms.
• Shortest Paths (SPs) in digraphs. Single-source SPs for nonnegative edge weights; priority queues and Dijkstra’s; SPs in DAGs; single-source SPs for general edge weights.
• Dynamic programming. Paradigm of SPs in DAGs; longest increasing subsequence; (approximate) string matching; integer and (0,1) knapsack problems; chain matrix multiplication;
single-pair reliable SPs, all-pairs SPs; independent sets.

- **Network flows.** Max flow min cut theorem; bipartite matching; Menger’s theorem and disjoint dipaths. Global minimum cuts.
- **Elements of NP-completeness & problem reductions.**
- **NP-hard problems.** Approximation algorithms.


**Reference:** Introduction to Algorithms, Cormen, Leiserson, Rivest & Stein, McGraw Hill, 3rd Edn, 2001. (Will be placed on reserve at SERC.)