CS 344: Design & Analysis of Computer Algorithms

Fall 2017, Sections 1,2,3. Credits: 4

INSTRUCTOR: Bahman Kalantari Hill Center 444, Tel: (848)445-7297

E-mail: kalantar@cs.rutgers.edu URL: http://www.cs.rutgers.edu/∼kalantar/

LECTURE: M-W 2:50 - 4:10 PM CAC: AB-2160

OFFICE HOURS: W 1:00-2:00 PM 444 Hill Center

Section 1 Recitation : Monday 4:45 - 5:40 PM CAC: CA-A3

TA: Abhishek Bhrushundi ab1373@cs.rutgers.edu, Hill 257, Office Hr.: F 3:00-4:00 PM.

Section 2 Recitation: Wednesday 4:45 - 5:40 PM CAC: MU-210

TA: Junchi Liang jl2068@scarletmail.rutgers.edu, CBIM-D, Office Hr.: W 10:30-11:30 AM.

Section 3 Recitation: Monday 8:55 - 9:50 AM LIV: BE-250

TA: Pritish Sahu ps851@scarletmail.rutgers.edu, Hill 405, Office Hr.: M 11:00-12:00 AM.

Prerequisites: 198:112 Data Structures, 198:206 Introduction to Discrete Structures II

Exams:

Midterm I: October 4

Midterm II (incremental): November 6

Thanksgiving break: Thur, Nov 23- Sun, Nov 26

Last lecture: Dec 13

Final Exam: TBA (cumulative). No Makeup Exams.

Grading Guideline: The better of the two scores:

(1) 0.15 HW & Quizzes + 0.20 MIDTERM I + 0.20 MIDTERM II + 0.45 FINAL

(2) 0.15 HW & Quizzes + 0.25 MIDTERM II + 0.60 FINAL.

Class & recitation attendance will be kept track of and taken into account in grading.

TOPICS: The course will cover all or a large subset of the following material

• 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; merge-sort; 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.

Textbook: Algorithms, Dasgupta, Papadimitriou & Vazirani, McGraw Hill, 1st Edn, 2008.

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

Reference: PROOFS: From Schematic to Prose: Part I: Logic, Sets, and Elementary Topics, Iraj Kalantari, Available on Amazon, 2016. Will be helpful to students wishing to learn to write down formal proofs to mathematical assertions. (A copy will be placed on reserve at SERC.)
