JOHNS HOPKINS
WHITING SCHOOL
of ENGINEERING

Syllabus
Computer Science 601.433/633
Introduction to Algorithms/Algorithms 1
Spring, 2018
(3 credits, EQ)

Description

This course concentrates on the design of algorithms and the rigorous analysis of their efficiency. topics include the basic definitions of algorithmic complexity (worst case, average case); basic tools such as dynamic programming, sorting, searching, and selection; advanced data structures and their applications (such as union-find); graph algorithms and searching techniques such as minimum spanning trees, depth-first search, shortest paths, design of randomized algorithms and competitive analysis.

Prerequisites

EN.601.226, EN.550.171.

Instructor

Assistant Professor Vladimir Braverman, vova@cs.jhu.edu, www.cs.jhu.edu/~vova
Office: Malone 211, 410-516-9999
Office hours: Tuesday/Thursday 1.30-2.30pm, and by appointment

Teaching Assistants

Nikita Ivkin
Email: ivkinnikita@gmail.com
Office: TBA,
Office hours: Friday 10am-noon

Alan (Zaoxing) Liu
Email: zaoxing@jhu.edu
Office: TBA,
Office hours: Friday 10am-noon

Meetings

Tuesday, Thursday, noon–1:15 pm, Hodson 110

Textbook

Required: Cormen, Leiserson, Rivest, and Stein (CLRS), "Introduction to Algorithms," MIT Press, The Third Edition.
Recommended: Kleinberg and Tardos. “Algorithm Design.” Addison Wesley, 2005.

Online Resources

http://www.cs.jhu.edu/~vova/alg.html

Course Objectives

(1) Students will learn to design efficient algorithms for basic problems in Computer Science.
(2) Students will learn to rigorously prove the correctness of their claims.
(3) Students will learn to compute the running time of algorithms.

Course Topics

- Sorting algorithms, divide and conquer, recurrences, red-black trees, the union-find data structure, dynamic programming, greedy algorithms
- Graph algorithms: shortest paths, minimum spanning trees, maximum flows, applications
- Advanced topics: Approximation algorithms, randomized algorithms, algorithms for Big Data

Course Expectations & Grading
Grading: Your total grade will be an integer between 0 and 1000. The distribution of the grades is as follows:

Homework	350
Quiz	250
Final Exam	400
Total	1000

Quiz and Final exam schedule:

The quiz and the final exam will take place in the regular classroom. For the quiz you are allowed to bring one page of handwritten notes (writing is allowed on both sides). For the final, you are allowed to bring three pages of handwritten notes (writing is allowed on both sides).

You must take the final exam to pass the course.

Homework assignments:

There are 7 homework assignments. Each homework is worth 50 points.

Please note that all assignments (except assignment #1) must be written in LATEX and submitted as PDF. Here are two useful LATEX tutorials:
http://en.wikibooks.org/wiki/LaTeX
http://www.andy-roberts.net/writing/latex

Please note that no late assignments will be accepted. If you have special circumstances then you must make prior arrangement with the TA or instructor. A late submission (even 5 minutes!) without prior arrangement will require an email from the Dean's office.

Each homework assignment will be distributed by email and will also be available on Gradescope. Please write every problem on a separate page.

The first homework assignment can be submitted either electronically or in the mailbox of Dr. Braverman in Malone 160. Please read the assignments carefully and submit your solutions on time. If you have questions about your grade, please contact the course assistants. If your submission has not been graded please let us know at least two weeks before the final.

How to write your solutions?

Please be as clear and precise as possible. Try to support your statements by examples when helpful. You can explain your answers in English and support it with a pseudocode when necessary. If you choose to write a pseudocode, always add a short explanation. In general unclear and/or sloppy answers will receive fewer points. Please write all arguments that are necessary to reach the conclusion even if they seem obvious.

Even if you do not know how to solve a problem, try to give your best intuition. Even if you do not know the full solution, try to solve special cases. The same is true for the analysis of the problem. You will be judged for the ability to think independently more than for memorization.

Full credit will be given for a complete solution with all technical details, clear explanation, precise analysis and correct running time. A correct intuition of the full solution that lacks details will receive more points than the correct solution of special cases. The correct solution of special cases will receive more points than an incorrect solution (even if the incorrect solution is nicely written). Thus, it is very important to understand the problem before solving it. If you are solving a special case, please make sure that you explain clearly all assumptions that you are making. Any solution will receive more points than an empty submission.

What is a rigorous proof?
Sometimes you will be asked to give a rigorous proof of a statement. Informally, your goal is to describe a sequence of logical statements S1, S2,…, Sm such that every statement follows from the previous statement(s) and the description of the problem, and the final statement Sm is the one that we need to prove. You can find examples of rigorous proofs in CLRS and in the examples that we post on BlackBoard.

General advice:
Try to solve as many problems as possible on a daily basis. It is very important to understand that for this class, (1 hour x 10 days) >> (10hours x 1 day). Solve problems beyond your HW assignments even if they seem unrelated. Start solving HW assignments right after they are posted. After solving a problem, try to disprove your claim by giving a counter example. Make sure that you understand the basics (big-O notations, running time, basic data structures).

Necessary mathematical background:
The necessary background for this course is contained in CLRS Appendices A-C and Chapter 3. If you are unsure as to whether or not your background is adequate, speak to the professor or to the TA as soon as possible.

Key Dates
Quiz: March 15th
Final: May 15th, 9am-noon

Assignments & Readings
The assignments will be posted on the Gradescope. Enrollment code is 9D5RDG.
Some questions will be discussed on Piazza. Please enroll here:
piazza.com/jhu/spring2018/en600433en600633

Ethics
Students are expected to adhere to the Department of Computer Science Academic Integrity Code. In particular, copying answers from the Internet or from each other is considered cheating in this

course. You are encouraged to discuss the problems with each other. However, you must write the solutions yourself and list any and all of your classmates with whom you collaborated on each problem.

The strength of the university depends on academic and personal integrity. In this course, you must be honest and truthful, abiding by the *Computer Science Academic Integrity Policy*:

> Cheating is wrong. Cheating hurts our community by undermining academic integrity, creating mistrust, and fostering unfair competition. The university will punish cheaters with failure on an assignment, failure in a course, permanent transcript notation, suspension, and/or expulsion. Offenses may be reported to medical, law or other professional or graduate schools when a cheater applies.
>
> Violations can include cheating on exams, plagiarism, reuse of assignments without permission, improper use of the Internet and electronic devices, unauthorized collaboration, alteration of graded assignments, forgery and falsification, lying, facilitating academic dishonesty, and unfair competition. Ignorance of these rules is not an excuse.
>
> Academic honesty is required in all work you submit to be graded. Except where the instructor specifies group work, you must solve all homework and programming assignments without the help of others. For example, you must not look at anyone else's solutions (including program code) to your homework problems. However, you may discuss assignment specifications (not solutions) with others to be sure you understand what is required by the assignment.
>
> *If* your instructor permits using fragments of source code from outside sources, such as your textbook or on-line resources, you must properly cite the source. Not citing it constitutes plagiarism. Similarly, your group projects must list everyone who participated.
>
> Falsifying program output or results is prohibited.
>
> Your instructor is free to override parts of this policy for particular assignments. To protect yourself: (1) Ask the instructor if you are not sure what is permissible. (2) Seek help from the instructor, TA or CAs, as you are always encouraged to do, rather than from other students. (3) Cite any questionable sources of help you may have received.
>
> On every exam, you will sign the following pledge: "I agree to complete this exam without unauthorized assistance from any person, materials or device. [Signed and dated]". Your course instructors will let you know where to find copies of old exams, if they are available.

Report any violations you witness to the instructor.

You can find more information about university misconduct policies on the web at these sites:

- For undergraduates: http://e-catalog.jhu.edu/undergrad-students/student-life-policies/
- For graduate students: http://e-catalog.jhu.edu/grad-students/graduate-specific-policies/

Students with Disabilities
Any student with a disability who may need accommodations in this class must obtain an accommodation letter from Student Disability Services, 385 Garland, (410) 516-4720, studentdisabilityservices@jhu.edu .