CLASS SYLLABUS

Class Info

Lectures: W 10:20am - 11:40am, F 3:20pm - 4:40pm @ Engineering Building B120

Recitations:

1. W 12:15pm - 1:10pm SEC-202
2. W 1:55pm - 2:50pm ARC-206
3. F 1:55pm - 2:50pm SEC-216

Webpage: `http://www.pracsyslab.org/cs344`
The webpage will be containing updated syllabus information as the semester progresses and a calendar. Homework announcements, practice questions for exams and other information will be available on the Sakai website of the course.

Instructor

Kostas Bekris, Assistant Professor
CBIM, Computer Science Department

Office: CBIM 9
Hours: W 3:30 - 5:30 pm
Email: kostas.bekris/AT/cs.rutgers.edu
Phone: 848 445-8854
Webpage: `http://www.pracsyslab.org/bekris`

Teaching Assistants

Amr Naguib Bakry (Section 1)
Email: amrbakry/AT/dragon.rutgers.edu
Office Location: HILL 206
Office Hours: Tu 12pm-1pm

Athanasios Krontiris (Handling Grading Questions and Sakai)
Email: ak979/AT/cs.rutgers.edu
Office Location: CBIM 16
Office Hours: F 11am-12pm

Chen Cong (Section 3)
Email: chen.cong/AT/cs.rutgers.edu
Office Location: HILL 402
Office Hours: M 2pm - 3pm

Meng Li (Section 2)
Email: ml910/AT/cs.rutgers.edu
Office Location: HILL 488
Office Hours: Th 11am-12pm

Description

A large subset of the following algorithmic topics and applications will be covered depending on progress:

- Mathematical tools. Review of mathematical background, concepts of algorithm design, complexity, asymptotics, induction, and randomization. Fibonacci numbers. Euclidean gcd algorithms. Universal hashing.
- Divide and conquer. Fast integer multiplication; recurrences; the master theorem; mergesort; randomized median and selection algorithms; quicksort; fast matrix multiplication.
- Sorting. Lower bounds for comparison-based sorting; binsort and radix sort.
- 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.
- Graph search. Graph classes and representations; depth first search in undirected and directed graphs; topological search; strongly connected components. Breadth first search and layered DAGs.
- Shortest Paths (SPs) in digraphs. Single-source SPs for nonnegative edge weights; priority queues and Dijkstra; SPs in DAGs; single-source SPs for general edge weights. Maximum adjacency search.
- Greedy algorithms. Spanning trees and cuts, analysis of union-find and path compression; MST algorithms; randomized algorithm for global minimum cuts; approximate set cover.
- Network flows. Max flow min cut theorem and integrality; fast algorithms; disjoint (s,t)-dipaths; maximum bipartite matching & minimum vertex cover. Global minimum cuts.
- Elements of NP-completeness & problem reductions.
- NP-hard problems. Search and selected approximation algorithms.

Prerequisites

Courses:

- CS 112 Data Structures
- CS 206 Introduction to Discrete Structures II

We assume (and briefly review early on in the class) elements of discrete mathematics, such as logarithms, proofs by induction, series and sums, permutations, asymptotics (big-Oh, big-Omega notation), basics of solving recurrences, as well as concepts of programming and data structures, e.g., linked lists, stacks, queues, trees, binary search, recursion, hashing, priority queues, graph algorithms, sorting.

Reading Material

The class will primarily draw upon material from the following book:

- “Algorithms” by Dasgupta, Papadimitriou & Vazirani, McGraw Hill, 2008

The following book may also be used as reference:

- “Introduction to Algorithms” by Cormen, Leiserson, Rivest & Stein, McGraw Hill - 2nd edition

The books are not required for the class. Students are expected to take notes during the presentation of the material in the classroom and the recitations. Homeworks and exams will be based on the presented material.

Exams

There will be three exams: two midterms and one final. The first midterm will cover the material of the first third of the course (tentatively: lectures 1-9), and the second midterm will cover the second third of the course (tentatively: lectures 11-19). The final exam will cover material from the entire class. Check the tentative schedule on the webpage for more information. All exams will be in-class on a date arranged and announced ahead of time in class.

A missed exam draws zero credit. Emergencies will be considered upon submitting a University-issued written verification to the Instructor; for assistance contact your Dean's Office. Also, check the definition of Final Exam Conflicts by SAS.

Homework Assignments

There will be 4 to 5 sets of homework problems. You will be informed in advance when an assignment is due. A tentative schedule will be available on the website after the first week of lectures. The homework sets consist of practice questions which are intended to assist students in mastering the course content. They may also potentially involve limited programming effort.

Homeworks should be completed by teams of students - three at most. No additional credit will be given for students that complete a homework individually. Please inform Athanasios Krontiris about the members of your team (email: ak979/AT/cs.rutgers.edu).

Students will receive 10% extra credit if they typeset (in LaTeX) or 5% extra credit if they typewrite their answers (e.g., if a pair was to receive a score of 62/100 and they provide a typesetted homework, then their score will be 68/100, i.e,. +10% of 62 points. Resources on how to use LaTeX are available on the course's website.

Submission Rules

No late submission is allowed. If you don't submit a homework on time, you get 0 points for that homework. The deadline will typically correspond to the beginning of a lecture. Students can submit their homeworks electronically via Sakai.

Grading System

The final grade will be computed according to the following rule **(this is tentative and can change)**: final grade = max(Case A: With Homeworks, Case B: Without Homeworks)

	Case A: With Homeworks	Case B: Without Homeworks
Homeworks	20 points total	0 point total
First midterm	25 points	30 points
Second midterm	25 points	30 points
Final exam	30 points	40 points
Participation (at the discretion of instructor/TAs)	+/- 5 points	+/- 5 points

On any assignment (homework or exam), you can either attempt to answer the question, in which case you will receive between 0 and 100% credit for that question, or you can write "I don't know", in which case you receive 25% credit for that question. Leaving the question blank is the same as writing "I don't know." You can and will get less than 25% credit for a question that you answer erroneously.

Finally, the first exam is a make-or-break situation. If your score on the first exam is 26% or less

(i.e., a blank exam) then you fail the class. The first exam will be early enough to drop the course.

Your participation grade can be positive or negative. By default your participation grade is 0..., e.g., if you typically come to the lectures/recitations but you rarely answer questions during the lectures or the recitations, your participation grade will be 0. Positive participation grades will be given to students that actively participate in lectures and recitations. You can also receive a negative participation grade depending on the level of your involvement in the course lectures and recitations (or lack there of) or because of issues related to collusion or cheating in homeworks and exams.

The mapping of scores to letter grades will be determined at the end of the semester. As a **rough** guide, the following rule may be used for the final grade **(it will be adapted close to the end of the semester)**:

Final Grade	A	B+	B	C+	C	D	F
Range	> 89	80-89	70-79	60-69	50-59	40-49	≤ 39

Students interested in a recommendation letter by the instructor will be offered one only if they achieve a score above 95 after the completion of the course.

Questions about Grading

If you have a question or complaint regarding the points you received on specific parts of a HW assignment, or an exam, staple a sheet of paper on the graded item, stating specifically but very briefly what parts of that document you wish to have reviewed and forward it to Athanasios Krontiris, who will handle the process of communicating with the instructor and the other TAs. Please refrain from verbal arguments about grades with the instructor or with any of the TAs. This does not improve your participation grade in any way. We will try to get back to you within two weeks. The deadline for submitting such requests is the last lecture.

Academic Standards

Exams are to be treated as individual efforts. Homeworks are not to be treated as collective efforts beyond the participation of the team members! Discussions between teams are not allowed on how to solve specific questions in homeworks. Do not discuss assignments with students that are not currently taking the class.

A severe penalty will be given to any assignment which indicates collusion or cheating. The usual penalty for cheating on an assignment or an exam is failure in the course. At a minimum your participation grade will be influenced negatively. Stealing another team's listing or having another person "ghost write" an assignment will be considered cheating.

Turning in work without properly citing the sources of the content included in your work is plagiarism. All kinds of sources are included in this definition, even those downloaded from the web, in which case an operable link must be cited. Plagiarism from the web or other sources is considered cheating and has the same effects. Even with a reference, submitting an answer to a homework question, verbatim from any source and without any contribution on your part, draws zero credit.

You should carefully study the website of Rutgers University on Academic Integrity and the corresponding policy, as well as the corresponding website from the department of Computer Science. Links are available through the course website. Your continued enrollment in this course implies that you have read these policies, and that you subscribe to the principles stated therein.