

A. V. GERBESSIOTISJAN 10, 2011COURSE SYLLABUS: GENERAL INFORMATION

A course on algorithms and data-structures. Methods for the analysis of algorithms are introduced, algorithms for sorting, searching, and selection, and data structures that support fast and efficient information retrieval are presented (hashing, heaps and priority queues with applications to data compression, binary search trees, red-black trees). Arithmetic algorithms. Greedy algorithms and dynamic programming-based techniques are introduced in the context of graph algorithms, arithmetic algorithms and text compression. Graph algorithms for traversals (depth-first, breadth-first), shortest-path problems, and spanning tree algorithms are also introduced. String matching algorithms. Introduction to NP-completeness.

1.1 Contact Information

INSTRUCTOR:	DR: Alex Gerbessiotis		alg435@cs.njit.edu			
OFFICE:	GITC 4213, 4th floor	Tel:	(973)-596-3244			
OFFICE HOURS:	Tue $4:45-6:00\mathrm{pm}$ and Wed $10:00-11:30\mathrm{am}$					
OFFICE HOURS:	By appointment Tue/Wed/Thu					
Assistant:	TBA on course web-page					
CLASS HOURS:	Wed 6:00-9:05pm, Rm: TIER 112					
WEB PAGE: http://www.cs.njit.edu/ \sim alexg/courses/cs435/index.html						

Print Handout 1 from Web-page and compare the printout to this document! They must be identical.

1.2 Course Administration

Prerequisites CS 114, CS 241.

Textbook T.C.Cormen, C.E.Leiserson, R.L.Rivest, and C. Stein. "Introduction to Algorithms", 3rd edition, McGraw-Hill, ISBN-10 : 0262033844 (ISBN-13: 978-0262033848). We abbreviate it in class as CLRS. Note that a 2nd edition is also available; Differences between the two are minor, and mainly on page numbers.

CourseWork: 4 exams (including the final); programming assignments.

Grades: 1000 points = PA(134) + Ex1(100) + Ex2(333) + Ex3(100) + Ex4(333).

- PA1-3 3 programming assignments(PAs) will be handed out. Each one is worth 134 points. You get 134 points credit towards the final grade as long as you collect 134 or more points from any combination of the three PAs (you can do one, or two, or all, completely, or in part); 133 or fewer will gain you 0 points towards the final grade.
- PA Dates Programs **MUST be received by email before midnight of the day** indicated in the calendar. Submit early, do not wait until the very end; you might get sick, you might get called for jury duty. The indicated date is the last day we must receive your submission, and we will acknowledge it promptly by email. Follow Handout 2 for compliant forms of an email submission. No late work is accepted since one programming assignment can still satisfy the programming assignment requirement. Plan ahead of time, and submit early.
- Practice PSApproximately eight problem sets PS1-8 will be periodically posted along with their solutions.Exams 1 and 3 will draw from these problem sets for some or all of their problems.
- Exams Dates in Course Calendar. Exam 1 is closed-everything. The other three exams are open-textbook only. You may bring a copy of the textbook but you are not allowed to borrow one during the exam. For the final, you may also bring in class a clean copy of Handout 5 on red-black trees in addition to the textbook. Exam1 is on Wed Feb 16, 45min, 100 points. Exam2 is on Wed Mar 9, 90min, 333 points. Exam3 is on Wed Apr 13, 45mins, 100 points. Exam4 is on Wed May 11, 2hrs, 333 points.
- Exam Conflicts This is a high-numbered required course. In case of multiple exams on a same day, this exam has priority even if it is the last exam of the day.



A. V. Gerbessiotis

Jan 10, 2011

CS 435-102

Spring 2011

Course Syllabus: Course Objectives and Outcomes

Page 2

2.1 Course Objectives and Outcomes

- **Objective 1** Learn how to describe the asymptotic performance of algorithms and data structures.
- **Objective 2** Learn how to derive and determine the asymptotic performance of algorithms and data structures.
- **Objective 3** Learn how fundamental algorithms and data-structures operate, and understand their characteristics. Be able to choose among a variety of similar ones based on problem/program specification and requirements.
- **Objective 4** Learn how to compose more complex algorithms using as building blocks the fundamental algorithms introduced in class.
- **Objective 5** Learn how to compose more complex algorithms using the algorithmic design techniques introduced in class.
- **Outcome 1** Be able to asymptotically compare functions using $o, O, \omega, \Omega, \Theta$.
- **Outcome 2** Be able to solve recurrences using the master, the iteration/recursion tree, and the substitution method.
- **Outcome 3** Become familiar with a variety of sorting algorithms and their performance characteristics (eg, running time, stability, space usage) and be able to choose the best one under a variety of requirements.
- **Outcome 4** Be able to understand fundamental algorithms and data structures and be able to trace their operations for problems such as sorting, searching, selection, operations on numbers, polynomials and matrices, and graphs.
- **Outcome 5** Be able to identify the performance characteristics of fundamental algorithms and data structures for problems such as sorting, searching, selection, operations on numbers, polynomials and matrices, and graphs.
- **Outcome 6** Be able to understand fundamental algorithm design techniques and understand how to use them to solve a variety of algorithmic problems.
- **Outcome 7** Be able to use the fundamental algorithms introduced in class to design algorithms for more complex problems and analyze their performance.
- **Outcome 8** Be able to use the design techniques introduced in class to design algorithms for more complex problems and analyze their performance.

2.2 Topics to be covered

T1 : AL1(1)/AL2(1)/AL3(1):	Introduction, Algorithm Design Techniques (Incremental, Divide-and-Conquer)
T2 : AL1(2)/AL2(1) :	Sorting Algorithms (Insertion, Selection, BubbleSort, MergeSort) Asymptotic growth of functions
T3 : AL1(3) :	Recurrences
T4 : AL3(3) :	Brief Review on elementary data structures (Stacks,Queues,Trees,Lists)
T5 : AL2(2),AL8(1) :	HeapSort,PriorityQueues,Huffman Coding,and QuickSort(Worst-case and Average-case analysis)
T6 : AL3(2),AL8(1) :	Distribution-based sorting(Count/Radix/Bucket-Sort).Lower bounds on comparison-based sorting.
T7 : AL3(3) :	Selection. Selection in Linear Time.
T8 : AL3(3) :	Hashing, Balanced Binary Search Trees (Red-Black Trees).
T9 : AL2(2),AL3(1) :	Dynamic Programming and Chained Matrix Multiplication, Arithmetic problems
T10: AL3(2),AL8(1) :	Union Find Algorithms; Introduction to Graph Algorithms
T11: AL2(1)AL3(2) :	Depth First Search,Breadth First Search,Minimum Spanning Trees.
T12: AL3(3) :	Shortest path Algorithms (Dijkstra and Floyd-Warshall)
T13: AL6(3) :	NP-completeness.



Section 2.2 of the previous page contains a tentative list of topics that is intended to be covered in class. The code Ti refers to a topic. A topic may spread over one or more lectures. The code ALi refers to the ACM Computing Curricula 2001 topic description code. In parentheses, we provide an approximate number of hours per topic. Hour coverage may change depending on circumstances (eg. class pace, weather). Minimum time requirements of the topics covered are. AL1 (Basic algorithmic analysis):4, AL2 (algorithmic strategies): 6, AL3 (fundamental computing algorithms):12, AL6 (the complexity classes P and NP) optional.

Spring 2011							
Week**	Wed	PS with Solutions	PA	Comments			
W1	1/19	PS1*	PA1-3out	Due by corresponding exam			
W2	1/26	$PS2^*$		date			
W3	2/2	$PS3^*$					
W5	2/9	$PS4^*$					
W4	2/16	Exam1	PA1in				
W6	2/23	$PS5^*$					
W7	3/2	$PS6^*$					
W8	3/9	Exam2	PA2in				
W-	3/16			Spring Recess; no classes			
W9	3/23	$PS7^*$					
W10	3/30						
W11	4/6	$PS8^*$					
W12	4/13	Exam3	PA3in				
W13	4/20						
W14	4/27						
W15	5/4	Reading Day		5/5 - 5/11 is exam week			
W16	5/11	Exam4		5/11 is FINAL EXAM DAY			

3.1 Tentative Course Calendar

* Problem Sets (PS) with solutions are not for credit. ** In this calendar, a week starts on a Thursday

Any modifications or deviations from these dates, will be done in consultation with the attending students and will be posted on the course Web-page. It is imperative that students check the Course Web-page regularly and frequently.

3.2 Absenteeism

MISSING CLASS If you miss a class and there is no EXAM or PA due it's up to you to make up for lost time. MISSING PA There are three scheduled programming assignments and only one is needed to collect the 134

- points for the course. Plan ahead of time and submit early; do not wait until the last PA or the last moment to submit. No extensions are granted for any reason, medical or otherwise.
- MISSING EXAM If you miss an exam and there is a valid documentation for your absence, such documentation must be presented within 3 working days from the day the reason for the absence is lifted. The maximum accommodation will be the number of missing days to the exam date. If you miss Exam1 or Exam3, then the Exam2 or Exam4 grade will be used respectively in such a case; no makeup will be provided for Exams 1 and 3.

	A	A. V. Gerbessiotis	CS 435-102		
NII	J	AN 10, 2011	Spring 2011		
New J Techn	ersey's Science & C ology University	Course Syllabus: Course Policies	Page 4		
Programs	Code must be ANS 2 for more informat based on test instand Do not expect parti your code submission	I compliant and neither hardware-specific tion on the programming assignments. Pr ces decided by the grader on a test platform al credit if your code fails to run on all test on with a detailed bug report.	nor OS-specific. Check Handout rogramming problems are graded of the grader's choice (e.g. AFS). t instances unless you accompany		
Extensions	As stated earlier, no extension will be granted for the PAs for any reason. Therefore do no try to act opportunistically i.e skip PA1 and PA2 and aim at doing PA3 completely and correctly to collect 134 points. You might get sick for the period leading to PA3 or called for jury duty or something else might occur and we will grant you no extension for that, even if you have proper documentation.				
Grading	Written work will be to the point, and w and chapters of the can be used to boos write down your sol	e graded for conciseness and correctness. Use rite clearly. Material covered in class and designated textbook can be used without per t your course grade (we account them separ utions; if you decide to use a pencil do not	se formal arguments, be brief and l appearing in the relevant notes roof. Excess Programming points rately). DO NOT USE pencils to complain about grading.		
Grades	Check the marks in Ex1-Ex3 and PAT for the solution of a to the instructor (if back to you by reply a 0 to 1000 point so programming requir required for an A. T student's significant	written work and report errors promptly. I-3 no later than the Reading Day . If problem is not representative of your effort different). For programming assignments ring to the email submission of the PA. The ale. A student who collects at least 500 po rements should expect a grade of C or bette The instructor reserves the right to push a programming effort.	Resolve any issue related to you believe a grade you received t, talk to the grader first and then an email with your grade is sent a final grade is decided based on bints and completes the minimum er; 800 points or more are usually student's grade up based on that		
Incomplete	A grade of I (incom semester due to doc A student needs to and have satisfied p for the documented than an I.	nplete) is given in rare cases where work of umented long-term illness or absence (e.g., be in good standing (i.e. is passing the cou- programming requirements) and receives an lost time. Not showing up in the final w	can not be completed during the unexpected national guard duty). urse otherwise before the absence in I if there is no time to makeup rill probably get you an F rather		
Collaboration	Collaboration of turn in code obta person's/student work you submit	any kind is NOT allowed in the in- ained through the Internet or otherw 's work, risk severe punishment, as our must be the result of your own effort	-class exams. Students who vise, or is product of another tlined by the University. The t.		
Mobile Devices	Mobile phones/devi SILENCED) before	ces and/or laptops/notebooks MUST BE the class exams. Switch off noisy devices a	SWITCHED OFF (NOT JUST also before class.		
Email/SPAM	Send email from an origins. Do not send (e.g. you don't wan will respond faster).	NJIT email address. NJIT spam filters or l course email to the instructor's email add t the grader to read the email or it's urger Include CS 435 in the subject line then.	us will filter other email address ress unless there is a good reason nt and you believe the instructor		
	~				

The NJIT Honor Code will be upheld; any violations will be brought to the immediate attention of the Dean of Students. Read this handout carefully!