New Jersey's Science & Technology University

A. V. Gerbessiotis
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Course Information

CS 667-101
Spring 2012
Handout 1

Sequential and parallel algorithms for numerical and combinatorial problems will be discussed. The use of randomization in the solution of algorithmic problems will be explored. Applications to be considered will include string matching, polynomials and FFT algorithms, sorting networks, algebraic computations and primality testing and factoring, matrix operations, randomized algorithms for sorting and selection, and data compression. Search-indexing data structures (inverted lists) will be examined. Web ranking algorithms such as Google's PageRank, and Kleinberg's HITS will also be discussed. Topics in computational geometry will be examined.

1.1 Contact Information

Instructor:	Alex Gerbessiotis	E-mail:	`alg667@cs.njit.edu`
Office:	GITC 4213, 4th floor	Tel:	(973)-596-3244
Office Hours:	Tue 4:00-5:30pm, Thu 4:00-5:30pm		
Office Hours:	By appointment some other time on Tue/Wed/Thu		
Class Hours:	Tue 6-9:05pm, Room CKB 212		
Web Page:	`http://www.cs.njit.edu/~alexg/courses/cs667/index.html`		

1.2 Course Administration

Prerequisites CS 610 or an undergraduate course on algorithms equivalent to CS 435.

Textbook T.C.Cormen, C.E.Leiserson, R.L.Rivest, and C. Stein. "Introduction to Algorithms", third edition, MIT Press, 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: Five homeworks HW1 to HW5 each one worth 250 points. The best 4 of 5 only count, so you can miss one. Programming problems related to the material covered in class will be given; you can substitute points gained from programming for regular points. Bonus points can also be gained.

Grading scheme: 1000 points is the target maximum. You are to be given at least a C if you collect at least 500 points, and an A if you collect at least 850 points. If more points are given, scale accordingly.

Exams There are no exams.

Extra work Bonus points, when assigned.

Due Dates Written homeworks are due by the beginning of a class. Programs **must be received by email by midnight the same day.**

Late work 25% per day starting from 6:05pm for homeworks and 00:05 for programming assignments. No exceptions (only 4 of the 5 count towards the final grade). No emailing of late homeworks!

Tentative Course Calendar

Spring 2012				
Week	Tue	HW out	HW in	Comments
W1	1/17			
W2	1/24	HW1 out		
W3	1/31			
W4	2/73	HW2 out	HW1 in	
W5	2/14			HW1 returned
W6	2/21	HW3 out	HW2 in	
W7	2/28			HW2 returned
W8	3/6	HW4 out	HW3 in	
W-	3/13			Spring Break!
W9	3/20			HW3 returned
W10	3/27		HW4 in	
W11	4/3	HW5 out		
W12	4/10			HW4 returned
W13	4/17		HW5 in	
W14	4/24			HW5 returned
W-	5/1	no class		Friday schedule
W15	5/8	-		

The following describes 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 demand and circumstances (eg. weather).

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AL3 : Fundamental Computing Algorithms  (15 hours)
AL8 : Advanced Algorithmic Analysis     (13 hours)
AL6 : Complexity                        ( 3 hours)
AL9 : Cryptographic Algorithms          ( 5 hours)
AL11: Parallel algorithms               ( 6 hours)
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Topics to be covered

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T1 : AL3   : Representation of Polynomials, Polynomial evaluation with and without preprocessing.
             Lower bounds for polynomial evaluation. Exponentiation. Polynomial algorithms for multiplication (Karatsuba's Algorithm).
T2 : AL8   : Polynomial Interpolation and Convolution. DFT and FFT and FFT implementations. Applications to information hiding.
T3 :AL8/9  : Arithmetic algorithms (eg. Euclid's algorithm) and the bit model, solution of modular equations,
             Chinese Remainder Theorem, Power raising through repeated squaring, primality testing (Miller-Rabin algorithm),
             Pollard's rho method for integer factorization.  Public key cryptography and the RSA cryptosystem.
T4 : AL11  : Comparison networks, zero-one principle for sorting, bitonic and odd-even merge sort.
T5 : AL11  : The PRAM model for parallel computation. Parallel algorithms for arithmetic problems and sorting. Parallel prefix.
T6 : AL3   : Matrix operations, Strassen's algorithm for matrix multiplication, boolean matrix multiplication,
             solution of linear equations and matrix inversion. Complexity Results.
T7 : AL3   : Algorithms for string matching. Rabin-Karp. Knuth-Morris-Pratt. Boyer-Moore.
T8 : AL9   : Randomization and its application: Sorting, Selection and Number Theory
T9 : AL3   : Data Compression (Huffman coding).
T10: AL8   : A quick overview on hashing.
T11: AL6   : Complexity classes (P,NP,RP,BPP,ZPP)
T12: AL10  : Geometric Algorithms
T13: AL8   : Google's PageRank and Kleinberg's HITS algorithms; Inverted Indexes.
```

Any modifications or deviations from the posted 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.

Grading Written work will be graded for conciseness and correctness. Use formal arguments. Be brief and to the point. Label solutions with problem/subproblem number clearly. Programming problems will be graded based on test instances decided by the grader on a test platform of his choice (most likely, an AFS machine). Do not expect partial credit if your code fails to run on all test instances, and you do not provide a bug report.

Written Work Handwritten or typed solutions must be readable, clear, concise and complete for the homeworks. DO NOT USE pencils to write down your solutions; if you decide to use a pencil do not complain about grading.

Programs Code must be ANSI C/C++ compliant and compile on the test platform/compiler; for Java the AFS environment should compile your code. For Java, do not use packages that are not available on AFS.

Extension policies Discussed on page 1. Note that 4 out of 5 homeworks only count.

Grade questions Check the marks in a written work and report errors promptly. **Make sure you report such problems to the grader or the instructor within two weeks from receipt** but **no later than the Reading Day**.

Final Grade The final grade is decided based on a 0 to 1000 point performance with an adjustment made based on programming assignment performance. A student who collects at least 500 points should expect a passing grade (C). At least 850 or so points may be needed for an A. The instructor reserves the right to push a student's grade up based on that student's quality of his/her effort and/or quality of homework solutions.

Collaboration Students who turn in solutions (programming or otherwise) that are derived from solution outlines of past assignments/homeworks, were obtained through the Internet, or are a product of another student's work, risk severe punishment, as outlined by the University. The work you turn in MUST BE your own personal work, composed and written by you. If you talk a problem with a fellow student cite this clearly in your homework (name the fellow student before the solution of the problem in question). Your work will then be compared to the other student's work to verify that your solution was written by you and reflect your own personal effort. If you don't report it, it will be considered a violation of the course rules. You are not allowed to exchange code for the programming part of a homework.

Mobile Devices Mobile phones/devices and/or laptops/notebooks MUST BE SWITCHED OFF during class or be made noise-free.

Email/SPAM Send email from an NJIT email address. NJIT spam filters or us will filter other email address origins. Do not send course email to the instructor's email address unless there is a good reason (eg. you don't want the grader to read the email). Include `CS 667` in the subject line then. ■.

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!