

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.

## Contact Information

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OFFICE HOURS: Mon 4:30-5:30pm, Wed 11:30-1:00pm, 4:30-5:30  
OFFICE HOURS: By appointment some other time on Mon,Tue,Wed  
ASSISTANT: TBA on course web-page  
CLASS HOURS: Mon 6-9pm, Room TBA  
COURSE WEB PAGE: <http://www.cs.njit.edu/~alexg/courses/cs667/index.html>

The following also works. <http://web.njit.edu/~alexg/courses/cs667/index.html>

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

## Course Administration

Prerequisites CS 610.

Textbook T.C.Cormen, C.E.Leiserson, R.L.Rivest, and C. Stein. "Introduction to Algorithms", second edition, McGraw-Hill, ISBN : 0-07-013151-1. *We abbreviate in class this second edition as CLRS.*

Other R. Motwani and P. Raghavan. "Randomized Algorithms", Cambridge University Press.

**CourseWork:** Six homeworks HW1 to HW6 each one worth 200 points. The best 5 of 6 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.

Exams There are no exams.

Extra work Bonus points and programming assignments can be used.

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 5 of the 6 count towards the final grade). No emailing of late homework!

### Tentative Course Calendar

Fall 2006				
Week	Thu	PS with Solutions	PA	Comments
W1	9/11			
W2	9/18	HW1 out		
W3	9/25			
W4	10/2	HW2 out	HW1 in	
W5	10/9			HW1 returned
W6	10/16	HW3 out	HW2 in	
W7	10/23			HW2 returned
W8	10/30	HW4 out	HW3 in	
W9	11/6			HW3 returned
W10	11/13	HW5 out	HW4 in	
W11	11/20	HW6 out		HW4 returned
W12	11/27		HW5 in	
W13	12/4		HW6 in	HW5 returned
W14	12/11			HW6 returned
W15	12/18			

The following describes a tentative list of topics that is intended to be covered in class. The code  $T_i$  refers to a topic. A topic may spread over one or more lectures. The code  $AL_i$  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).

AL3 : Fundamental Computing Algorithms (15 hours)  
 AL8 : Advanced Algorithmic Analysis (10 hours)  
 AL6 : Complexity (3 hours)  
 AL9 : Cryptographic Algorithms (5 hours)  
 AL10: Geometric algorithms (3 hours)  
 AL11: Parallel algorithms (6 hours)

### Topics to be covered

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.

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- 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 compliant and compile on the test platform/compiler, otherwise the assigned grade will be 0. Check relevant handout for more information on the programming assignments.
- 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 (Windows PC or Unix machine) of his choice. Do not expect partial credit if your code fails to run on all test instances. Do not expect partial credit if your code does not compile.
- Extension policies** Discussed on page 1. Note that 5 out of 6 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.** If you believe a grade you received for the solution of a problem is not representative of your effort talk to the grader first and then to the instructor (if different).
- Final Grade** The final grade is decided based on the 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. A student who collects at least 850 points will definitely get an A. The instructor reserves the right to push a student's grade up based on that student's quality of his/her programming effort.
- 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!**