Syllabus: CS 5114
Theory of Algorithms
Spring, 2000

`http://courses.cs.vt.edu/~cs5114`

Instructor: Lenwood Heath

- **Office:** 638 McBryde Hall
- **Office Hours:** Wednesdays, 10–12; Fridays, 9–11
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Graduate Teaching Assistants:

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Class Meets: McBryde 210, TTh 12:30–1:45

Exams: Saturday, May 6, 1:05-3:05

Midterm Exam	Thursday, March 2, 12:30–1:45 PM
Final Exam	Saturday, May 6, 1:05-3:05

Index Number: 1400

Prerequisite:

- CS 4104, Data and Algorithm Analysis, or equivalent is preferred, but not required

Textbook:

- *Introduction to Algorithms,* Cormen, Leiserson, and Rivest **(CLR)**

On Reserve:

For current list, see class web site.

- **(QA76.6 A36)** *The Design and Analysis of Computer Algorithms,* Aho, Hopcroft, and Ullman

- **(QA273 A46 1990)** *Probability, Statistics, and Queueing Theory with Computer Science Applications,* Allen
- **(QA76.6 C662 1990)** *Introduction to Algorithms,* Cormen, Leiserson, and Rivest
- **(QA76.6 G35)** *Computers and Intractability: A Guide to the Theory of NP-Completeness,* Garey and Johnson
- **(QA76.9 D35 M36 1989)** *Introduction to Algorithms: A Creative Approach,* Manber
- **(QA164 R6 1984)** *Applied Combinatorics,* Roberts

Description

This course emphasizes the **computational complexity** of a problem, the **efficiency** of an algorithm for solving a problem, **techniques** for designing algorithms, and the **inherent intractability** of certain problems. Skills that the student will take away from this course include: (1) determining whether a problem is NP-complete, (2) analyzing the time complexity of an algorithm, and (3) applying techniques for designing efficient algorithms.

Ethics

The Honor Code applies. All work submitted must be the student's own work. Students may solicit help only from the instructor or the teaching assistant.

Announcement

If any student needs special accommodations because of a disability, please contact the instructor during the first week of classes.

COURSE SCHEDULE

DATE	SIGNIFICANT EVENT	TOPIC
1/18	Read Chapters 1 through 6	Problems, Algorithms, Computational Complexity, Analysis, Asymptotic Notation, Master Theorem on Recurrences, Merge Sort
1/20	LaTeX Workshop	Review of LaTeX basics, with emphasis on use of LaTeX in CS 5114
1/25	Read Chapters 8 and 10	Divide and Conquer, Quicksort, Expected Time Complexity; Order Statistics, Getting Linear Time out of Divide and Conquer
2/1	Read Chapter 16 and 23	Dynamic Programming: An Extension of Divide and Conquer
2/8	Read Chapters 17 and 24	Greedy Algorithms: Cheap and Effective; Matroids; Minimum Spanning Trees
2/15	Read Chapter 25	Single-Source Shortest Paths
2/22	Read Chapter 26	All-Pairs Shortest Paths
2/29	Read Chapter 27	Maximum Flow
3/2	Midterm Exam	
3/7	Read Chapter 34	String Matching
3/10	Spring Break	
3/21	Read Chapter 35	Computational Geometry
3/28	Read Chapter 31	Matrix Operations, Strassen's Algorithm, LUP Decomposition, Matrix Inversion
4/4	Read Chapter 32	Polynomials and the FFT
4/11	Read Chapter 33	Number-theoretic algorithms
4/18	Read Chapter 36	P, NP, NP-completeness, NP-hardness; Polynomial-time Reductions; Satisfiability, Cook's Theorem; Paradigm for Proving NP-completeness
4/25	Read Chapter 37	Approximation algorithms
5/2		Last Day of Class
5/6	Final exam—1:05-3:05	

Announcements

Email and ListServe. There is a CS 5114 listserve named `CS5114_1400@listserv.vt.edu`. Every student is expected to be a member of that list-serve to receive announcements and class discussion.

WWW Access. The course will have a WWW home page at:

`http://courses.cs.vt.edu/~cs5114`

This is primarily a repository for handouts, which may be found in LaTeX, postscript, and PDF forms.

Homework and Project Submission. Preparation of your homework assignments and project components must be done in LaTeX. Work is typically submitted in printed form by noon on the date due. The submission procedure will be included in each assignment.

Readings. For most weeks, there is a reading assignment to be completed by class time Tuesday. Each reading assignment consists of chapters in one of the texts.

Grading Policy

Grading for the course is on a 1000-point scale, with the points distributed as follows:

Homework assignments—8 at about 50 points each	400
Project	300
Proposal	50
Literature review	50
First draft of project paper	50
Second draft of project paper	50
Final draft of project paper — May 3, Noon	100
Midterm exam—March 2, 12:30-1:45	100
Final exam—May 6, 1:05-3:05	200

A typical homework assignment consists of 2 or 3 problems, some from the text and some not. Homework is due at noon on the due date (see course calendar). **No late homework will be accepted.**