

CSE 5311.004: ADVANCED ALGORITHMS

Fall 2004: TTh 10:30-11:50 am, Woolf Hall 308

Instructor: Gautam Das, Associate Professor
Office: 302 Nedderman (gdas@cse.uta.edu, <http://reptar.uta.edu/~gdas>)
Hours: Th 12:00 noon – 1:00 pm or by appointment

GTA: Ashish Chawla
Office: 117 Engineering Annex West Building
Email: chawla@cse.uta.edu
Hours: T-Th 2:00 pm – 3:30 pm or by appointment

Prerequisites: Algorithms & Data Structures (CSE 2320)
Theoretical Computer Science (CSE 3315)

Course Description and Goals:

This course is designed to teach you, at the graduate level, algorithm design and analysis paradigms, advanced data structures and their use in efficient algorithms, graph algorithms, the theory of NP-completeness, and some specialized topics (to be determined based on student input).

At the end of the semester you should:

- be familiar with the algorithms and algorithmic techniques covered,
- be able to argue correctness and analyze the running time of a given algorithm,
- be able to design new algorithms for new situations, using as building blocks the algorithms and techniques learned,
- be able to prove a problem is NP-complete using reduction.

Textbook:

- Cormen, Leiserson, Rivest, Stein, *Introduction to Algorithms, 2nd ed.*, MIT Press, 2001.

References:

- The Design and Analysis of Algorithms 1974, AV Aho, JE Hopcroft and JD Ullman, Addison-Wesley Publishing Company
- Introduction to Algorithms: A Creative Approach, Reprinted 1989, Udi Manber, Addison-Wesley Publishing Company
- Introduction to Algorithms, 1982, Sedgewick, Addison Wesley Publishing Company
- Graph Algorithms, 1979, Shimon Even, Computer Science Press
- Introduction to the Theory of Computation, 1992, Michael Sipser, PWS Publishing Company
- The Art of Computer Programming, Vols. 1 and 3, Knuth, Addison Wesley Publishing Company

Evaluation: Your grade will be based on the following weights:

- **Midterm: 25%**
 - There will one midterm exam during the semester (non comprehensive).
 - There will be no make up exams!

- **Quizzes: 15%**
 - There will be a few short quizzes during the course which will help to test your understanding of the concepts taught.
 - Quizzes will generally be allotted 15-20 minutes at the end of the class period. Quizzes will be announced at least a week in advance.

- **Project: 25%**
 - Students will have a choice of two types of projects:
 - **Programming project:**
 - Students will be assigned a programming project in which they can prove that they have understood a specific part of the curriculum. Projects may either be done solo or in teams of two students each.
 - The programming tasks should be chosen by consultation with the Instructor. Students are encouraged to approach the Instructor with proposals on the programs they envision.
 - Students will be encouraged to demo their programming projects to the instructor and the GTA.
 - Programs have to be turned in to the GTA by the last due day after which late penalty may be applied.
 - **Research paper and presentation:**
 - Students will be required to write a research paper (around 10 pages) on a specific topic or problem and present it to the rest of the class in 15-20 minute seminars. These projects may either be done solo or in teams of two students each.
 - The paper's topic should be chosen by consultation with the Instructor. Students are encouraged to approach the Instructor with proposals on the topics of their papers.
 - Papers have to be turned in to the Instructor at least a week before the presentation. Scheduling presentations will be done during the semester by consulting with the Instructor.
 - Students may also decide to undertake ambitious projects that combine substantial research efforts along with a programming component. The final exam may be waived for such students.

- **Final: 25%**
 - There will one comprehensive final exam at the end of the semester but it can be waived off depending upon your performance in class and creative ideas and presentation of the research papers.
 - There will be no make up exams!

- **Class participation: 10%**
 - Although no attendance catalogue will be kept, students are expected to attend classes and arrive on time, and to interact during the debate section of the seminars of their fellow students.

Make-ups:

Make-ups for (non-exam) graded activities may be arranged if your absence is caused by illness or work/personal emergency. A written explanation (including supporting documentation) must be submitted to your Instructor. If the explanation is acceptable, an

alternative to the graded activity will be arranged. Make-up arrangements must be arranged prior to the scheduled due date.

Policies:

1. Attendance is not required, but is highly encouraged. Consult me in advance if you must miss class for a good reason.
2. You are expected to have at least skimmed the new material by the day we start that material in class. The material will be covered in the order given later.
3. Active class participation will prepare you for Quizzes and Exams. I would encourage active interaction during lectures.
4. **CHEATING - YOU ARE EXPECTED TO KNOW UNIVERSITY POLICIES.** All cases of plagiarism will be processed through University channels outside the CSE department.

a) **Academic Integrity Policy:** It is the policy of the University of Texas at Arlington to uphold and support standards of personal honesty and integrity for all students consistent with the goals of a community of scholars and students seeking knowledge and truth. Furthermore, it is the policy of the University to enforce these standards through fair and objective procedures governing instances of alleged dishonesty, cheating, and other academic/non-academic misconduct.

You can assume responsibility in two ways. **First**, if you choose to take the risk associated with scholastic dishonesty and any other violation of the Code of Student Conduct and Discipline, you must assume responsibility for your behaviors and accept the consequences. In an academic community, the standards for integrity are high. **Second**, if you are aware of scholastic dishonesty and any other conduct violations on the part of others, you have the responsibility to report it to the professor or assistant dean of students/director of student judicial affairs. The decision to do so is another moral dilemma to be faced as you define who you are. Students who violate University rules on scholastic dishonesty are subject to disciplinary penalties, including the possibility of failure in the course and dismissal from the University. Since dishonesty harms the individual, all students, and the integrity of the University, policies on scholastic dishonesty will be strictly enforced.

b) **Statement on Ethics, Professionalism, and Conduct of Engineering Students:**

The statement is attached. Continued failure to sign the statement will result in 1) late penalty on programming assignments and 2) failure on exams.

5. Any request for special consideration must be appropriately documented in advance. (Special consideration does not include giving a higher grade than has been earned.)
6. The Instructor reserves the right to modify course policies, the course calendar, and assignment or project point values and due dates.
7. Please subscribe to the class mailing list CSE5311_GDAS, so that any important announcement for the class can be conveyed to you on time. Further details about the course can be found from the class mailing list or from the class website at (<http://ranger.uta.edu/~gdas>). To subscribe, send a message to LISTSERV@LISTSERV.UTA.EDU with the command `SUBSCRIBE CSE5311_GDAS` in the body of the message. To leave the list, send `SIGNOFF CSE5311_GDAS` in the body of the message.

8. Please email the following information to chawla@cse.uta.edu by Wednesday, September 9, 2004:
 - a) Name (as listed by the university).
 - b) Student ID Number
 - c) Additional email addresses.
 - d) Special circumstances affecting your performance.
 - e) What books were used in your previous course(s) in algorithms and data structures?
 - f) (Optional) What do you hope to gain from this course?
9. The teams would be finalized by **September 15, 2004**.
10. Research presentation topics will be posted online soon. Innovative/Creative ideas are welcome.
11. Please decide on your research topic by **October 15, 2004**.
12. Every Thursday, 1st half of the class would be lecture and the remaining would be problem discussions.
13. Tentative schedule for exams and quizzes will be posted soon.

Course Outline (Tentative)

- Review of Asymptotic Analysis and Growth of Functions; and Trees and Heaps
- Recurrences and Sorting Algorithms
- Graph Algorithms and Maximum Flow Networks
- Greedy Algorithms and Dynamic Programming, and Amortized Analysis
- Algorithms for String Matching and Computational Geometry
- Matrix Operations and Linear Programming
- NP Completeness and Approximation Algorithms
- Special Topics: Applications of Algorithms in
 - Databases
 - Information Retrieval and Web Searching
 - Data Mining and High-Dimensional Computational Geometry

Statement of Ethics - Student Confirmation
(CSE 5311, Fall 2004)

The following is an excerpt from the College of Engineering's statement on Ethics, Professionalism, and Conduct of Engineering Students. The notes are modifications appropriate for Computer Science and Engineering courses. Read the statement carefully, sign it, and return it to your instructor. Additional copies of this statement can be obtained from the course web page.

Statement on Ethics, Professionalism, and Conduct of Engineering Students
College of Engineering
The University of Texas at Arlington

The College cannot and will not tolerate any form of academic dishonesty by its students. This includes, but is not limited to 1) cheating on examination, 2) plagiarism, or 3) collusion.

Definitions:

A. **Cheating on an examination** includes:

1. Copying from another's paper, any means of communication with another during an examination, giving aid to or receiving aid from another during an examination;
2. Using any material during an examination that is unauthorized by the proctor;
3. Taking or attempting to take an examination for another student or allowing another student to take or attempt to take an examination for oneself.
4. Using, obtaining, or attempting to obtain by any means the whole or any part of an unadministered examination.

B. **Plagiarism** is the unacknowledged incorporation of another's work into work which the student offers for credit.

C. **Collusion** is the unauthorized collaboration of another in preparing work that a student offers for credit.

D. Other types of **academic dishonesty** include using other student's printouts from the ACS labs or students' disk, etc.

1. The use of the source code of another person's program, even temporarily, is considered **plagiarism**.
2. Allowing another person to use your source code, even temporarily, is considered **collusion**.
3. Use of another person's source code with your modification is considered **plagiarism**.
4. Taking material verbatim (without quoting the source) for reports and/or presentations is considered **plagiarism**
5. For this class, the specific exceptions given below are not considered scholastically dishonest acts:
Discussion of the algorithm and general programming techniques used to solve a problem

The penalty assessed for cheating on a given assignment will be the entire weight of the assignment and will include notification of the proper authorities as stipulated in the **UTA Handbook of Operating Procedures** and on the web at <http://www2.uta.edu/discipline>

You may be entitled to know what information UT Arlington (UTA) collects concerning you. You may review and have UTA correct this information according to procedures set forth in UT System BPM #32. The law is found in sections 552.021, 552.023 and 559.004 of the Texas Government Code.

I have read and I understand the above statement.

Student's signature: _____

Student's name (printed): _____

Student's ID number: _____