CSCI 432: Advanced Algorithm Topics

MWF, 15:10-16:00, Roberts Hall 218

Fall 2015

1 Course Instructors and Assistants

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2 Course Description

A rigorous examination of advanced algorithms and data structures. Topics include average case analysis, probabilistic algorithms, advanced graph problems and theory, distributed and parallel programming. PREREQUISITES: CSCI 246 and CSCI 232.

3 Course Objectives

This course is an advanced course on the analysis and design of algorithms. Upon completion of this course, students should be able to do the following:

- To describe an advanced algorithm at a level that a general computer scientist would understand.
- To articulate algorithms in writing.
To read and understand (to some extent) current research publications in the area of algorithms.

To prove correctness of an algorithm using inductive proofs and loop invariants.

To apply important algorithmic design paradigms and methods of analysis.

To analyze the asymptotic performance of algorithms, using worst-case and average-case analysis.

To explain the basic properties of parallel algorithms and methods for analyzing them.

To describe several algorithms of importance to different fields (such as computational geometry, GIS, big data, networks, ...).

4 Grades

The final grade will be comprised of the following elements:

1. Project: 35%.

2. Homework: 35%.

3. Exams: 30%.

Note: Each project/homework assignment and test question will be graded on some number of points, and all assignments are not given equal weight. The point value will be given next to the assignment / question.

5 Project

See the handout / course website for more details.

6 Homework

The homework assignments are designed to solidify your knowledge and give you practice in writing and programming. Some homework assignments will be problem solving/analysis assignments where you will turn in a document
for your solution. Others will be programming assignments where you turn in a program (or pseudo-code).

You are encouraged to typeset your homework in LaTeX. Word documents will not be accepted. If you choose to use Word to write your assignment, you must convert it to PDF before handing it in.

Homework is due at 23:59 on the due date. Late homework handed in within 24 hours of the due date will be penalized 25%; within 48 hours will be penalized 50%. Homework will not be accepted past 48 hours.

7 Extra Credit

Opportunities to earn extra credit by attending colloquia will be announced in class and posted on the course website. To earn the extra credit (5 points towards homework), you must attend the entire presentation and write a 1-2 page summary and reflection on the presentation(s).

Another option for earning extra credit will be to neatly type (in LaTeX) or handwrite the lecture notes from one class. You may work alone or with a partner. You may choose one class (or two if you work in partners) for which you wish to be the scribe, and let me know BEFORE the class so that there is at most one scribe / pair of scribes for each class. If you work in partners, you will split the points. The notes will be due one week after the lecture. The notes will be worth 15 points towards homework.

8 Readings

At least 24 hours before a class, the reading for that class will be posted. Before class, you are expected to skim through the assigned reading. After class, you are expected to read the section for understanding. Not all class meetings will have a required reading.

9 Collaboration Policy

Collaboration is encouraged on all aspects of the class, except where explicitly forbidden. Note:

- All collaboration (who and what) must be clearly indicated in writing on anything turned in, at the top of the first page.
Homeworks may be solved collaboratively except as explicitly forbidden, but solutions must be written up independently. Groups should be small enough that each member plays a significant role.

For the project, every collaborator must contribute significantly. How the work is divided is at the discretion of the group.

10 Academic Integrity

By participating in this class, you agree to abide by the student conduct code.