CSE 6220 / CS 4225: Introduction to High-Performance Computing

Prof. Richard (Rich) Vuduc, Spring 2013 – Tu-Th 3-4:30 in Klaus 2443

ANNOUNCEMENTS

GT CSE 6220
gtcse6220

gtcse6220 Still trying to get an override? If so, request it officially through OSCAR *and* email Prof. Vuduc *with your GT ID* so he can approve it
18 days ago · reply · retweet · favorite

gtcse6220 Slides and handwritten notes from class 1 now available on the schedule at hpcgarage.org/cse6220
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gtcse6220 In CSE 6220 / CS 4225, we'll aim to cover parallel algorithm design techniques relevant to next-gen systems, e.g., engadget.com/2013/01/06/nvi...
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gtcse6220 Although the class looks full,

Join the conversation

CLASS FORUM: PIAZZA

We will use Piazza for class discussion: hhttps://piazza.com/gatech/spring2013/cse6220.

The system enables you to get help quickly and efficiently from classmates and instructors. Rather than emailing questions to the teaching staff, post your questions on Piazza. If you have any problems or feedback for the developers, email team@piazza.com.

OFFICE HOURS

- Prof. V (richie at cc) — W & Th 4:30-5:30pm in Klaus 1334
- TA 1: Anita Zakrzewska (azakrzewska3 at gatech) — M 1:30-2:30 in Klaus 1335 — email for appointment first!
- TA 2: Tuan-Anh Nguyen (tuananh at cc) — Tu 11-12 in Klaus 1335 — email for appointment first!

SCHEDULE

The detailed schedule is up for grabs at the time of this writing, but we can say that the core topics include (but are not limited to):

- Algorithms in the work-depth model for shared memory systems
- Distributed memory algorithms
- I/O complexity, cache-oblivious algorithms, and communication-avoidance
- Techniques: balanced trees, pointer jumping, symmetry breaking, randomization
- Problem areas: list/tree/graph algorithms, sorting, linear algebra, n-body, FFTs
- Survey of research topics, such as algorithmic resilience under faults, advanced programming models, time/energy/power modeling

OVERVIEW

The goal of this course is to give you solid foundations for developing, analyzing, and implementing parallel and locality-efficient **algorithms**. This course focuses on theoretical underpinnings, in contrast to CSE 6230: HPC Tools & Apps, which emphasizes deep, hands-on, low-level programming experience. To give a practical feeling for how algorithms map to and behave on real systems, we will supplement algorithmic theory with hands-on exercises on modern HPC systems, such as Cilk Plus or OpenMP on shared memory nodes, CUDA for graphics co-processors (GPUs), and MPI and PGAS models for distributed memory systems.

TEXTBOOKS

- [**REQUIRED**] *Introduction to Parallel Computing*, by A. Grama et al., Addison-Wesley, 2003. Woo hoo -- this book is available online *pro bono* for GT students through the library: [www]
- [*OPTIONAL*] Introduction to High Performance Computing for Computational Scientists and Engineers, by Georg Hager and Gerhard Wellein. ISBN: 978-1-4398-1192-4, CRC Press, 2010.

GRADING

This course is taught under the Georgia Tech Honor Code. In the context of this course, this means that all work that a student submits for

CSE 6220 Schedule : Fall 2012

Week	Topic(s)	Tu	Th	Reading, other assignments, n	
1: Jan 7-11	* Intro; work-depth	PDF slides [10 MiB]		* CLRS Intro to Algs Chap 27	
	* Basic algorithms: mergesort, merging	PDF notes [725 KiB]	PDF notes [1 MiB]	* Assigned: HW#1	
2: Jan 14-18	* Par-for * Parallel prefix / scan * Cilk Plus	PDF notes [779 KiB]		HW#1 due on Th	HW#2 a
	* Data parallel operations * First-order recurrences * Segmented scans * Quicksort	PDF slides [1.3 MiB]	PDF notes (data parallel notation) [259 KiB]	* Reading: Blelloch prefix scans	
3: Jan 21-25	* Operations on lists, trees, and graphs * Euler tours * Randomization * Work-optimal list ranking	PDF notes [741 KiB]			
4: Jan 28-Feb 1				HW#2 due	
5: Feb 4-8					
6: Feb 11-15				HW#3 due	
7: Feb 18-22		Midterm			
8: Feb 25-Mar 1				Drop deadline	
9: Mar 4-8				HW#4 due	
10: Mar 11-15				HW#5 due	
11: Mar 18-22		*No class – spring break*			
12: Mar 25-29					
13: Apr 1-5				HW#6 due	
14: Apr 8-12					
15: Apr 15-19					
16: Apr 22-26			Review for final	Term projects due	
Tu Apr 30, 11:30am-2:20pm		**Final exam**			
Key					
No class					
Exam					

individual assignments and exams will be his or her own work. For group assignments, project submissions, or of projects that are part of a larger on-going project, the final report has a required section in which each student must detail which portions of the work were completed individually and which portions were the work of others.

Assignments and exams will be weighted as follows:

- Homework and paper summaries: 40%
- Midterm: 20%
- Term project: 20%
- Final exam: 20%

Assignment due dates and times are **strictly enforced**, and no late assignments will be accepted. Every semester, students seem to misunderstand this policy, so please repeat after me: **Assignment due dates and times are *strictly enforced*, and no late assignments will be accepted.** Exceptions to this policy will be made at the discretion of the instructors.

PREREQUISITES

Students should know algorithms and data structures at the level of a junior-level undergraduate computer science course. Students should be comfortable with sequential programming in "mainstream" general-purpose compiled languages, such as Fortran, C, C++, or Java. A non-graded "calibration" quiz will be given on the first day of class to help students assess their current skill level.

CROSS-LISTING

Because life is needlessly complex, there are two sections but just one class: the *graduate* CSE 6220 section and the *undergraduate* CS 4225 section. However, we will grade assignments from the undergraduate section differently.

AUDITORS

Auditors must obtain permission of the instructor. If granted, the auditor must enroll in the course, complete all of the same assignments and exams, and earn a passing grade.

NEED MORE INFORMATION?

If you have any questions about logistics or participation, ask on Piazza!

PRIOR OFFERINGS

6220, Spring 2012 – Vetter
4225, Spring 2012 – Vuduc
6220/4225, Spring 2011 – Biros
6220/4225, Spring 2010 – Biros

RELATED COURSES

Blelloch: 15-499
Demmel/Yelick: CS 267
Pueschel: CS 263
Whaley: CS 6463

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