CS243: Advanced Compiling Techniques

Winter 2006

Course Info | Lecture Schedule | Lecture Notes | Assignments | Honor Code

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The class is officially over. The grades should be available on Axess soon. Have a great Spring break.

Course Personnel

Instructors		Jeffrey Ullman	Wei Li
	Office	Gates 433	Gates 305
	Phone	(650) 725-4802	(650) 725-3927
	Office hours	Mon 12:30-1:30	Mon 10-11AM
TAs		Ben Livshits	Hasan Imam
	Office	Gates 406	Gates B26b
	Phone	(650) 725-3720	(650) 736-1817
	Office hours	Wed 10-11AM	Thurs 1-2PM
Administrator		Darlene Hadding	
	Office	Gates 408	
	Phone	(650) 723-1430	

Course Logistics

Lectures	Mon/Wed 11:00 to 12:15 in Gates B01 (SITN channel E1)
Review sessions	An occasional optional review session will be held on Fri 9:00-9:50am Skilling Aud (SITN channel E3)
Prerequisites	CS143 (or equivalent); Java programming language experience
Textbook	There is an on-line version of new chapters of the Dragon book available from Addison-Wesley. The chapters are packaged with the Gradiance on-line homework service that will also be used in this class. The package can be purchased from www.aw-bc.com/dragonbook.
Class newsgroup	Unmonitored newsgroup su.class.cs243 has been set-up
Midterm	Wednesday Feb 15, 11:00 to 12:15 in class
	Monday Mar 20, 8:30 to 11:30 AM. Location: B01

Final exam	(regular classroom)
Grade distribution	Gradiance homework: 10%, Programming projects: 20%, Midterm: 25%, Final: 45% (*tentative*)

Schedule of Lectures

DATE	TOPIC	INSTRUCTOR	READING	LECTURE NOTES	ASSIGNMENT OUT	ASSIGN DUE
Jan 11 (Wed)	Compiler Intro	Jeff/Wei	Sect. 8.4, 9.1	PPT/PDF, PPT/PDF, PPT, PPT/PDF		
Jan 18 (Wed)	Data Flow (1)	Jeff	Sect. 9.2	PPT/PDF	HW 1	
Jan 23 (Mon)	Data Flow (2)	Jeff	Sect. 9.3, 9.6	PPT/PDF, PPT/PDF		
Jan 25 (Wed)	joeq/More Data Flow	Ben/Jeff		PPT/PDF	PA 1	HW 1
Jan 30 (Mon)	PRE	Jeff	Sect. 9.5	PPT/PDF		
Feb 1 (Wed)	ConstProp, IndVariables	Jeff	Sect. 9.4, 9.7, 9.8	PPT/PDF, PPT/PDF		
Feb 3 (Fri)						PA 1
Feb 6 (Mon)	SSA	Wei	Sect. 6.1.2 and paper	PPT/PDF	HW 2, HW 3	
Feb 8 (Wed)	Control Dependence	Wei	Sect. 10.2.5 and paper	PPT/PDF		
Feb 10 (Fri)	Review Session for Midterm	Hasan				
Feb 13 (Mon)	Register Allocation	Wei	Sect. 8.8	PPT/PDF		HW 2, H
Feb 15 (Wed)	Midterm		MT 1/soln, MT 2/soln, MT 3	Midterm with Solutions	PA 2	
Feb 17 (Fri)	Review Session for PA 2	Hasan				
Feb 22 (Wed)	Garbage Collection	Jeff	Sect. 7.5 - 7.7	PPT/PDF		
Feb 27 (Mon)	Data Dependences and Parallelization	Wei	Sect. 11.1-11.4, 11.6	PPT/PDF	HW 4	
Mar 1 (Wed)	Loop Transformations and Locality	Wei	Sect. 11.1-5, 11.7	PPT/PDF		
Mar 3 (Fri)						PA 2
Mar 6	Data Prefetch and Software	Wei	Sect.	PPT/PDF	HW 5	HW 4

(Mon)	Pipelining		11.5, 10.5			
Mar 8 (Wed)	Instruction Scheduling	Jeff	Ch. 10	PPT/PDF		
Mar 13 (Mon)	Pointer Analysis and IPO	Jeff		PPT/PDF	HW 6	HW 5
Mar 15 (Wed)	Building a Production Compiler	Wei		PPT/PDF		
Mar 17 (Fri)	Review Session for Final	Ben/Hasan				HW 6
Mar 20 (Mon)	Final (8:30-11:30am)		FL 1, soln, FL 2/ soln, FL 3	Final with Solutions		

Lecture Notes

1. For 1/11/06 lecture:
   - Introduction and Motivation (Jeff). PDF Version.
   - Some Basics (Jeff). PDF Version.
   - Compiler optimizations for performance (Wei).
   - Compiler technology for security (Ben). PDF Version.
2. For 1/18/06 lecture:
   - Data-Flow Analysis (Jeff). PDF Version.
3. For 1/23/06 lecture:
   - Data-Flow Frameworks (Jeff). PDF Version.
   - Flow Graphs (Jeff). PDF Version.
4. For 1/25/06 lecture:
   - Introduction to joeq (Ben). PDF Version.
5. For 1/30/06 lecture:
   - Partial-Redundancy Elimination (Jeff). PDF Version.
6. For 2/1/06 lecture:
   - Constant Propagation (Jeff). PDF Version.
   - Induction Variables (Jeff). PDF Version.
7. For 2/6/06 lecture:
   - SSA (Wei). PDF Version.
8. For 2/8/06 lecture:
   - Control Dependence (Wei). PDF Version.
9. For 2/13/06 lecture:
   - Register Allocation (Wei). PDF Version.
10. For 2/22/06 lecture:
    - Garbage Collection (Jeff). PDF Version.
11. For 2/27/06 lecture:
    - Data Dependences and Parallelization (Wei). PDF Version.
12. For 3/1/06 lecture:
    - Loop Transformations and Locality (Wei). PDF Version.

13. For 3/6/06 lecture:
    - Data Prefetch and Software Pipelining (Wei). PDF Version.

14. For 3/8/06 lecture:
    - Instruction Scheduling (Jeff). PDF Version.

15. For 3/13/06 lecture:
    - Pointer and Interprocedural Analysis (Jeff). PDF Version.

16. For 3/15/06 lecture:
    - Performance Impact of Optimizations (Wei).
    - Parallel Software 2.0 (Wei).

Assignments

Homework will consist of both programming assignments and on-line (Gradiance) homework. Gradiance homework will normally be assigned on Mondays and due the second Wednesday after that. You are encouraged to work on the programming assignments in groups of two, but you must do the Gradiance homework by yourself. In general, no late assignments are accepted. However, you have TWO grace days for the entire quarter that may be used for the programming projects ONLY (not for Gradiance work, which already has a generous deadline. That means you can be late by one day for two project parts, or use the two days up for one part. The project assignments are due at 5PM on the due date.

Some points to remember about Gradiance:

- After obtaining your account at www.aw-bc.com/dragonbook, you never need to return there for Gradiance assignments (you do go there to acces the text). Rather, go to www.gradiance.com/pearson and enter the login/password you created at the AW-BC site.
- The first time at the Gradiance site, you will need to join the CS243 class. The class token (code) to enter is (omitted --- no longer active). If you return to your home page, you will find CS243 on your list of courses, and can enter it by clicking on the number.
- For help navigating the site, there is a manual at www.gradiance.com/pub/stud-guide.pdf. However, this guide refers to several old sites that no longer exist. Start with the directions above and Section 1.2 of the guide.
- Gradiance homework *looks like* multiple choice, but it isn't. Rather, you should solve the problems stated in their entirety, and then fill out the multiple-choice buttons to verify you have solved the problems. If you get one or more problems wrong, you will get hints about the problem and a place in the book to read for more information.
- You get as many tries as you like to answer a Gradiance assignment, and only the last score counts. So it is fine to learn from any mistakes and try again. Note, however, that you can only open the homework once per 10 minutes, so rapid-fire guessing won't work.

Honor Code

You are free to discuss the assignment and solutions with others. However, you must write your own assignment, and must not represent any portion of others' work as your own. Anybody violating the honor code will be referred to the Judical-Affairs Office. If convicted, the normal penalty is a quarter suspension or worse.