Course Syllabus

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Class Times	MWF 11:10AM–1:00PM, Room 14-255
Office Hours	Monday: 2–3 PM Wednesday: 2–3 PM Thursday: 1–4 PM Or by appointment

Course Objectives

1. Analyze applications that benefit from massive amounts of parallelism.
2. Become familiar with contemporary parallel programming paradigms and the systems on which they are used.
3. Become familiar with massively parallel computing hardware and programming models, with specific emphasis on NVIDIA's CUDA architecture.
4. Analyze and measure performance of modern parallel computing systems.
5. Analyze the impact of communication latency and resource contention on throughput.
6. Be able to design, develop, implement, test and instrument massively parallel programs, and apply those skills to a real-world application.

Application

For approximately two weeks of the quarter we will meet jointly with CSC 556 (Graduate Computer Security). During these weeks, students from the two courses will work jointly on implementation and design of a massively parallel application in the cybersecurity domain. Students in CPE 419 do not need any prior security background to be successful in this project.

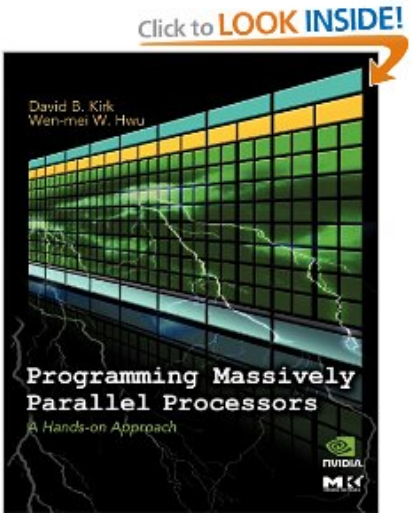
There will be a final project of significant weight where students will work in small teams on a large application. Applications must focus on massively parallel computing. Any system that supports large-scale parallelism is welcome, including languages and programming models other than those emphasized in the course lectures. Unless prior arrangements are made, groups should consist of at least two but not more than three team members.

Prerequisites

CPE 357 (or equivalent) or consent of the instructor.
Thorough knowledge of the C and/or C++ programming language and the corresponding Linux development environment including editors, compilers, debuggers, and some profiling tools is *required* for this course. Students should have the ability to implement large programs with relative ease, including systems-level programs. You will be expected to have direct experience writing programs that use dynamic memory allocation, system-level timers, and asynchronous system calls (e.g., interrupt handlers).

Some understanding of computer architecture (as covered in CPE 315) is beneficial for this course, but not required. Specifically, you will benefit from an understanding of registers, caches, and memory transactions.

Readings and Course Material



The required textbook for the course is *Programming Massively Parallel Processors: A Hands-on Approach*, Second Edition, by David Kirk and Wen-mei Hwu [`http://amzn.com/0124159923`]. It is quite important that you get the second edition.

You will also be expected to read relevant documents from NVIDIA's Developer's site [`http://docs.nvidia.com/cuda/index.html`]. Specifically, you'll want to download or bookmark the following documents.

- CUDA Getting Started Guide (Linux)
- Getting Started With CUDA SDK Samples
- CUDA C Programming Guide
- CUDA C Best Practices Guide
- CUDA Occupancy Calculator
- CUDA-Gdb Debugger User Manual
- Compute Command Line Profiler User Guide

Electronic Resources

All course material, including an electronic version of this syllabus, course reading list, supplemental program files, and your grades, are available through the course website: `https://users.csc.calpoly.edu/~clupo/teaching/419/winter14`. If prompted to authenticate, use your Cal Poly username and password (e.g., the credentials you use to login to the portal) to access the site.

All course materials will be posted on my website. You are strongly encouraged to check the course website often, as all assignments, readings, and important dates will be posted there. You will be responsible for all material presented in the lectures. Please also plan to check your `calpoly.edu` email account often (daily) for announcements related to the course.

Grading

This course will be primarily project based, with several medium to large projects to be completed throughout the quarter. Projects will be done in teams of two or three students, with final reports and/or presentations by each team for each project.

Attendance and participation in lecture is expected. There is value in group discussion, especially when evaluating methods to obtain performance improvement in parallel programs.

There will also be 4–5 quizzes to assess comprehension of the material.

Weighting (subject to change)

60% – **Projects**. Your project scores will consist of the following components.

- **Demo**: A working project solves the problem and handles every test case correctly. Demos may or may not be done in person (e.g., I may demo them on my own).
- **Documentation**: I must be able to follow your code, and clearly determine which portions are running on the GPU.
- **Write-up**: Write-ups will be small and will generally require you to answer a few questions about your design, performance and the architecture. Write-ups are due at the same time as the rest of the project. *All write-ups must be submitted in either plain text or PDF format.*
- **Lab Participation**: You should be present for most lab times and actively engaged in class discussions. You are expected to contribute in every aspect of every team assignment.

20% – **Quizzes**, lowest quiz score will be automatically dropped.
20% – **Midterm**

Grade curving, if any, will be based on the overall course outcomes, not individual exams, labs or programs.

There will not be a final exam, as the focus of this course will be on hands-on applications and project related topics including final presentations.

Important Dates

Monday 1/20 - Martin Luther King Holiday, No Classes
Tuesday 1/21 - Virtual Monday, classes follow Monday schedule
Weeks 4 and 5, 1/27–2/7 (tentative) - Joint Lectures/Labs with CSC 556
Monday 2/17 - President's Day Holiday, No Classes
Friday 2/28 (tentative) - Midterm
March 24–27 - GPU Technology Conference (GTC 2014), Spring Break, Special discounts for Cal Poly students.

Course Policies

Electronic Etiquette

Computing equipment is an essential part of this course. However, you should refrain from using computers (inluding phones and tablets) for any purpose other than taking notes during lectures and presentations. Please show your respect for the time and effort that I and your classmates have invested in preparing lectures and presentations by actively listening. Save texting and social networking for times other than during lectures and presentations.

Lateness

Each of you get three bonus days.

- A bonus day is a no-questions-asked one-day extension that can be used on most assignments (not the final project).
- You cant turn in multiple versions of a team assignment on different days; all of you must combine individual bonus days into one team bonus day.
- You can use multiple bonus days on the same thing.

- Weekends/holidays don't count for the number of days of extension (Something due Friday turned in on Monday is a one-day extension).

These are intended to cover illnesses, interview visits, just needing more time, etc. There will be little, if any, credit for items turned late once your bonus days have been used.

Right to Change Syllabus

I reserve the right to make any changes to this syllabus at any time during the course. If I do make changes, you will be notified, and the changes will be posted.

Cheating

Cheating or any other form of academic dishonesty will not be tolerated in this course. Students caught cheating will be referred to Student Affairs, and will have the maximum penalty imposed. You are responsible for making yourself aware of Cal Poly's cheating policy, which can be found at:
`http://academicprograms.calpoly.edu/academicpolicies/Cheating.htm`

Students with Learning and/or Physical Disabilities

Any student with a learning and/or physical disability who needs accommodations or assistance in this course should meet with me as soon as possible.

Cell Phones and Other Personal Communication Devices

Cell phones and other personal communication devices (i.e. laptops, tablets etc.) are strictly prohibited during exams and quizzes. No, they cannot be used as calculators. If you are identified using such a device during an exam or quiz, you will receive a zero on that exam/quiz. During class time please be respectful of everyone else's learning environment, and turn your device to silent mode.

Exams

No makeups will be given for quizzes or exams, no exceptions.

Classroom Civility

Discussion, even heated debate, is encouraged in the course as long as the topic is related to some aspect of parallel computing. Even in the most intense debates, you are expected to behave professionally and respectfully to both the instructor and your classmates.

FERPA

I will respect your FERPA rights. My policy is to discuss your grades only with you, and only in person. No grades will be given over the phone or by email. No person other than yourself will be allowed to pick up assignments or exams. To facilitate the class, I may call on you by name. If this is a problem, it is your responsibility to notify me by the end of the first week.