Incorporating Parallel & Distributed Computing Across a Liberal Arts Computer Science Curriculum

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Goals and Challenges

Expose all students to Parallel & Distr Computing

Focus on teaching “Parallel Thinking”

Early: in intro sequence

Often: see in multiple contexts in many courses

Breadth: theory, systems and applications

Depth: focused and advanced P&D coverage

Constraints due to small Liberal Arts college:

• Can’t have deep pre-requisite structure

• Upper-level: diverse student CS preparations
Our Approach

1. Add new required intermediate level course: Introduction to Computer Systems
   - Intro systems & shared memory parallelism
   - Pre-req for ½ of upper-level courses

2. Restructure curriculum to ensure breadth and depth of P&D topics
   - Three Groups: Systems, Theory, Applications
   - P&D in all of Systems group, and in some of others

3. Upper-level courses blend in P&D topics
   - Integrated: don’t solely isolate study of parallelism
   - Room to add: new pre-req contains common intro
Introduction to Computer Systems

- Memory hierarchy, multicore, SMP, threads, pthreads, synchronization

CS1: Intro to Computer Science

CS2: Data Structures and Algorithms

Systems
- OS
- Networking
- Databases
- Compilers
- Cloud Computing
- Parallel & Distrib Computing

Applications
- PL
- AI
- NLP
- Robotics
- BioInformatics
- SW Engin
- Info Retrieval
- Graphics

Theory
- Algorithms

Intermediate level

Upper level

At least 1 class from each group

Introductory level

* added P&D topics

P&D topics only
Our Thoughts:

Adding the new Intro to Systems course was key to the success of this effort

+ Gives all students common background in systems, machine organization, C programming
+ Allows us to remove intro content from many upper level courses, making room for adding P&D
+ All students see parallelism in intro sequence

- Arbitrary ordering with CS2 means more diversity in student backgrounds in Intro Systems and CS2
  • necessary for maintaining shallow req. hierarchy
  • less of an issue than we anticipated
More Thoughts:

Grouping of upper-level courses into 3 Sets

+ All students get more breadth in CS major
+ All students exposed to advanced P&D content
  • Breadth: see in different contexts
  • Depth: advanced exposure
  • Prepare students for P&D research
+ Flexibility in how to add P&D
  • Add content into existing courses
  • New P&D courses easily added into a group
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Course Webpages

www.cs.swarthmore.edu:~newhall/eduHPC14/