
COSC 462

Final Exam Review

Piotr Luszczek

Overview

- Date and time decided by UT
 - Wed., December 13 @ 10:15am-12:15pm, Min Kao 524
- Final exam is cumulative
 - 30% of the grade
 - Look at review for Exam 1
- General guidelines
 - Show your work
 - No calculators
 - Leave hard numbers/fractions plugged in but don't calculate
 - Estimate the answer if needed for another calculation
 - $1/3 \sim 0.33$
 - $1/7 \sim 0.14$
- Questions to expect
 - Small programming assignments
 - Multiple choice
 - Some questions will be optional
 - Answer Q1 or Q2 but not both

OpenMP

- Parallel regions
 - How to open, close, what happens inside?
- Parallel loops
 - What are restrictions on C/C++ syntax for loops?
 - Runtime schedule
- Reductions
 - What is allowed?
 - What is the expected implementation in terms of efficiency?
- Pragmas for concurrency
 - Exclusion, locking, limiting thread access, atomics
- Runtime and environment
- Tasking syntax and semantics
 - Tied and untied tasks

OpenSHMEM

- PGAS concepts
 - Context, private, implementation language vs. runtime library
- RDMA
 - PE, remote, origin, target, source
- Basic put/get
 - Memory consistency and synchronization issues
 - Influence of fences
- Barriers, broadcast, reductions
 - Barrier, fence, quiet
- Remote atomics
 - Mutual exclusion, add, increment, fetch
- Locks
 - Set, free, query
- Data access queries

CUDA

- GPU hardware basics
 - From CUDA and OpenACC lectures
- Kernel programming
 - GPU-side syntax
 - Attributes, builtin variables
 - Host side invocation
 - Memory management
 - Host synchronization
- Thread organization
 - Grids
 - Blocks
 - Warps
 - Threads

MPI+CUDA

- Hardware topology
 - PCI Express 1, 2, 3, 4
 - Network cards
 - Synchronization and available operations
- What can be omitted in GPU-aware MPI?
 - Treatment of host and device pointers
- Programming simple MPI+CUDA examples
- How to tell if in a code snippet:
 - if MPI handles GPU reads/writes?

Advanced MPI

- Non-blocking communication
 - Eager vs Rendezvous mode
 - When, why, and consequences on portable code
 - Pipelining
 - Communication progress inside MPI library
- Topologies
- MPI Collectives
 - Basic
 - Neighborhood
 - Non-blocking

MPI One-Sided

- Concepts
 - Origin vs. Target
 - Epoch
 - Ordering
- Memory windows
 - Static vs. dynamic
 - Create, allocate, attach, detach
- Memory consistency
 - Synchronization
 - Locks: `lock()` and `lock_all()`
 - Fences
- Remote operations
 - Conflicts
 - Defined and undefined behavior
 - Accumulation
- RMA vs point-to-point puzzle
 - Create your own, post on Piazza

OpenACC

- Not included in the final exam
 - But GPUs and CUDA will be included

Good Luck!

- Questions?
 - Use Piazza
 - Email
 - Appointments by request