CS 4000
Midterm Review

Dr. Shawn Ostermann

Ohio University Russ College of Engineering and Technology

March 3, 2025

OHIO
UNIVERSITY

1. Closed Book, no notes, no electronics
2. No calculators or phones — you won't need them (any math will be simple)
3. Covers material up to and including semaphores, locks, barriers, and deadlocks in Pthreads, C++, and OpenMP

Review for Midterm Exam

General Structure of the Exam:

- Short Answer/Definitions (10 - 20 %)
    1. Race condition
    2. Critical section
    3. Deadlock
    4. Process Synchronization (Barriers/Semaphore, etc.)
    5. Thread safety
    6. Amdahl's law
    7. Efficiency
    8. Speed up, ETC.
    9. OpenMP environment variables
    10. Concurrent Computing
        - Parallel Computing
        - Distributed Computing

OHIO
UNIVERSITY

Cont'd

- Application of Definitions/Concepts (15 – 25%)
  1. Speedup
  2. Efficiency
  3. Amdahl's law
  4. Use of parallel for loop optimizations
  5. Finding Race Conditions
  6. Identifying Deadlock

OHIO
UNIVERSITY

Exam Topics

- Parallel coding (Open MP/Pthreads/C++11 Threads) (15 – 25%)
  1. Which variables are shared/private to each thread
  2. Are there race conditions?
  3. Why is the code slower than it should be? (Impact of critical sections/etc., load balancing, etc.)
  4. What does this code do?

Midterm, cont'd

- Parallel Programming Concepts — Applications
  1. How do you compile a parallel program (OpenMP vs. C++11)?
  2. Convert some code to run in parallel using (OpenMP/C++ 11 Threads).
  3. Etc.
- Parallel Algorithms (Design some algorithm to run in parallel on an abstract machine)
- Understanding Parallel Run Time
- Analysis? (Parallel Sorting/Parallel Prefix Computation)
- Synthesis... combining concepts that we've discussed

OHIO
UNIVERSITY

Fundamental Concepts

1. Where does all of the electricity that goes into a CPU chip go?
2. How much energy does it take to cool a CPU in a data center?
3. Why did CPU designers start dedicating transistors to multiple cores rather just one really fast core?
4. What is a CPU core?
5. What is a race condition
6. What is a critical section
7. How do the threads in an OpenMP program communicate?

OHIO
UNIVERSITY

Todo...

1. Read all of the book chapter sections that we've covered
2. Review all of the notes
3. Review all of the programs you've written and analyzed
4. Pay particular attention to all of the source code in the notes

OHIO
UNIVERSITY