COSC 462

Midterm Review

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Parallel Computing and Performance Models

- Speedup: Amdahl's and Gustafson's Laws
  - Be familiar with formulas
  - Nice question on Piazza
- Parallel vs. concurrent
- Dependencies & taxanomy
- PRAM, BSP

Threads

- Thread vs process
  - What is shared what is separate for each?
- Mutex
  - Mutex types
  - Mutex policies
- Conditional Variable
- Semaphores
- Atomics

MPI

- Starting and stopping
- Sending and receiving
  - Blocking, non-blocking
  - Standard, Buffered, Synchronous
  - Completion testing and waiting
- Data types
  - Standard-defined
  - User-defined
- Communicators and Groups
  - Intra vs. Inter
- Collectives
  - Classes

Parallel Algorithm Design

- 4 major phases
- Analysis
  - Computation-communication ratio
  - Amount of data coming in/out of a process
  - Total number local process steps
- Know how to apply each phase to basic algorithms from lectures and the textbook
- Consider dimensions in data and process arrangement
- Consider techniques for dealing with non-divisible dimensions, prime numbers, etc.
  - Unlikely to resolve all the implementation details on the spot

Problems from Homeworks

- Similar problems may occur on the exam
  - They will be simplified or
  - The answers will be allowed to be simplified
  - A correct solution may be a combination of faulty code and the discussion of all the problems it has
    - Scalability problems
    - Lack of parallelism
    - Too much communication
    - Problem with special problem sizes and process counts
- Please provide comments for your code!

Textbook Content

- Chapters covered in the exam
  - Chapter 3 Parallel algorithm design
  - Chapter 4 Message passing
  - Chapter 7 Performance analysis
  - Chapter 8 Matrix-vector multiplication
  - Chapter 11 Matrix multiplication
  - Chapter 12 Solving linear systems
  - Chapter 13 Finite difference methods
  - Chapter 14 Sorting
  - Chapter 15 Fast Fourier Transform
- The book covers more than the lectures
  - Stick to topics covered in lectures
  - Use the textbook for additional explanation of lecture topics

General Guidelines

- Show your work
- No calculators
  - Leave large/hard numbers plugged in
    - Estimate the answer if you needed for something else
      - Tell me it's an estimate (but be reasonable!)
      - You can answer based on how you estimated the answer
        - For example when comparing speedup1 with speedup2