CSCI-UA.0480-051: Parallel Computing
Practice Exam (Oct 26th, 2023)
Total: 100 points

Important Notes- READ BEFORE SOLVING THE EXAM

• If you perceive any ambiguity in any of the questions, state your assumptions clearly and solve the problem based on your assumptions. We will grade both your solutions and your assumptions.

• This exam is take-home.

• You have up to 2 hours from the start time to submit your answers.

• Your answers must be very focused. You may be penalized for wrong answers and for putting irrelevant information in your answers.

• You must upload a pdf file.

• Your answer sheet must have a cover page (as indicated below) and one problem answer per page (e.g. problem 1 in separate page, problem 2 in another separate page, etc).

The very first page of your answer is the cover page and must contain:

-Your Last Name

-Your First Name

-Your NetID

-Honor code (copy and paste to the first page of your exam)

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"I understand the ground rules and agree to abide by them. I will not share answers or assist another student during this exam, nor will I seek assistance from another student or attempt to view their answers."

You may use the textbook, slides, and any notes you have. But you may not use the internet. You may NOT use communication tools to collaborate with other humans.

Section 1: Multiple Choice (20 points, 2 points each)

1. Which of the following is NOT a benefit of parallel computing?

a) Increased speed

b) Reduced cost

c) Increased complexity

d) Improved scalability

2. What is Amdahl's Law used to calculate?

a) Speedup of a parallel program

b) Efficiency of a parallel program

c) Communication overhead

d) Number of processors needed

3. What is a race condition?

a) A type of deadlock

b) An error in parallel programming where the outcome depends on unpredictable order of operations.

c) A performance bottleneck in a parallel system

d) A scheduling problem

4. What is the purpose of a barrier synchronization?

a) To ensure all processes reach a specific point before proceeding

b) To prevent deadlocks

c) To optimize communication

d) To reduce overhead

5. Which parallel programming model uses shared memory?

a) Message Passing Interface (MPI)

b) OpenMP

c) CUDA

d) Both a and b

Section 2: Short Answer (30 points, 5 points each)

6. Briefly explain the concept of load balancing in parallel computing.

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7. Define speedup and efficiency in the context of parallel computing.

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8. Describe one advantage and one disadvantage of using threads over processes.

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9. Explain the difference between strong and weak scaling.

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10. What are some common challenges in parallel programming?

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Section 3: Problem Solving (50 points)

11. [25 points] A program has a sequential portion that takes 20 seconds and a parallelizable portion that takes 100 seconds when run sequentially. If we have 10 processors, what is the speedup achieved? Show your work.

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12. [25 points] Consider a parallel program with 4 processes. Each process needs to perform three tasks: Task A (10ms), Task B (5ms), Task C (15ms). Draw a task graph showing a possible execution order if each process can only perform one task at a time. Calculate the total execution time.

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