CSCI-UA.0480-051: Parallel Computing
Practice Exam (October 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 24 hours to complete this exam.

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

• Your answer sheet must be organized as follows: The very first page of your answer must contain only: Your Last Name, Your First Name, Your NetID, and the honor code (shown below).

• In your answer sheet, answer one problem per page.

• Your answers can be typed or written by hand (but with clear handwriting). It is up to you. But you must upload one pdf file containing all your answers.

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

"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."

Problem 1

a. [10] Explain the difference between shared memory and distributed memory parallel programming paradigms. Provide an example application suitable for each.

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b. [10] What is Amdahl's Law? Explain its significance in parallel computing and provide a simple example illustrating its effect.

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Problem 2

[20] A program has a sequential portion that takes 20 seconds to execute and a parallelizable portion that takes 40 seconds to execute sequentially. If we use 4 processors, what is the speedup assuming perfect parallelization? What is the efficiency? Show your calculations.

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Problem 3

[20] Describe the concept of a race condition in parallel programming. Explain how to prevent race conditions using mutexes or semaphores. Provide a code example (pseudocode is acceptable) illustrating a race condition and its solution.

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Problem 4

[15] What are the advantages and disadvantages of using threads versus processes for parallel
programming? In what scenarios would you prefer one over the other?

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Problem 5

a. [10] Briefly describe the following parallel programming concepts: Deadlock, Starvation, and
Livelock.

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b. [5] Explain the concept of a "critical section" in concurrent programming. Why are they important?

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