

CSCI-UA.0480-051: Parallel Computing

Midterm Exam (Practice - Mar 9th, 2024)

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.

• Final Exam is take-home.

• You have up to 23 hours and 59 minutes from the beginning of the Mar 9th lecture to submit.

• You are allowed only one submission.

• 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.).

• Final Exam has 3 problems totaling 100 points.

• Every first page of your answer is the cover page and must ONLY contain:

- Your Last Name

- Your First Name

- Your NetID

- Copy and paste the honor code showed in the rectangle at the bottom of this page.

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

• 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. This includes but is not limited to G-Chat, Messenger, E-mail, etc.

• If you go to search for answers on the internet; it will show in your answer and you will earn an immediate grade of 0.

• Anyone found sharing answers or communicating with another student during the exam period will earn an immediate grade of 0.

"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."

1. Describe the trade-offs involved in choosing between different parallel programming models, such as message passing (MPI) and shared memory (OpenMP), for a specific application. Consider factors like programming complexity, scalability, and the nature of the data being processed. (30 points)

2. Explain how Amdahl's Law limits the speedup achievable through parallelization, even with an infinitely large number of processors. Provide a concrete example illustrating how a small portion of inherently sequential code can significantly constrain overall performance gains. (30 points)

3. Discuss the challenges of debugging and performance tuning parallel programs. What specific tools and techniques are available to identify and resolve issues such as race conditions, deadlocks, and load imbalances in a parallel application? (40 points)