CSCI-UA.0480-051: Parallel Computing

Midterm Exam (Mar 9th, 2023)

Total: 100 points

Important Notes- READ BEFORE SOLVING THE EXAM

•”–b •ou 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.

••F†—2 Pxam is take-home.

••F†R Pxam is posted on Brightspace, assignments section, at the beginning of the Mar 9th lecture.

•••ou have up to 23 hours and 59 minutes from the beginning of the Mar 9th lecture to submit on Brightspace (in the assignments section). That is, you must submit before 2pm Friday March 10th.

•••ou are allowed only one submission, unlike assignments and labs.

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

•••ou must upload a pdf file.

•••our 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.).

••F†—2 Pxam has 3 problems totaling 100 points.

••F†R `ery 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)

•••ou may use the textbook, slides, and any notes you have. But you may not use the internet.

•••ou may NOT use communication tools to collaborate with other humans. This includes but is not limited to G-Chat, Messenger, E-mail, etc.

•”Fò æ÷B G y to search for answers on the internet; it will show in your answer and you will earn an immediate grade of 0.

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

•™4’ VæFW'7F æB F†R pround 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. Explain the concept of load balancing in parallel computing and describe two common strategies used to achieve it. Consider the challenges involved in achieving optimal load balancing across a heterogeneous cluster of processors with varying computational capabilities. (30 points)

[Space for answer to question 1]

2. Compare and contrast the two main approaches to parallel programming: message-passing and shared memory. Provide specific examples of programming models or libraries used for each approach and discuss the advantages and disadvantages of each in relation to scalability and programming complexity. (35 points)

[Space for answer to question 2]

3. Describe Amdahl's Law and its implications for the potential speedup achievable through parallel processing. Give a practical example illustrating how Amdahl's Law limits the effectiveness of parallelization even with a large number of processors, and discuss strategies for mitigating this limitation in software design. (35 points)

[Space for answer to question 3]