Parallel Computing

Practice Exam

Difficulty: medium

CSCI-UA.0480-051: Parallel Computing

Practice Exam (October 26th, 2023)

Total: 50 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 to complete this exam.
• 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, etc).

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

• Your Last Name
• Your First Name
• Your NetID

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. Do not try 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.

Problem 1: Amdahl's Law and Speedup (50 points)

A program consists of two parts: a parallelizable portion (P) that takes 70% of the execution time and a serial portion (S) that takes the remaining 30%.

a. [15 points] Using Amdahl's Law, calculate the theoretical speedup for this program if we use 4 processors. Show all your calculations.

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b. [15 points] If we improve the efficiency of the parallelizable portion (P) such that it now only takes 50% of the total execution time, while the serial portion remains at 30%, how will this affect the speedup with 4 processors? Calculate the new speedup and explain any differences compared to part (a).

c. [20 points] Discuss the limitations of Amdahl's Law. What factors does it not consider that might impact the actual speedup observed in practice? Give at least two examples.