

Parallel Computing

Practice Exam

Difficulty: medium

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 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
- 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)

"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 or any communication tools to collaborate with other humans.

Problem 1: Scheduling and Parallelism (100 points)

a. [30 points] Consider a parallel program with five tasks (A, B, C, D, E). The dependencies between tasks are as follows: A must complete before B and C can start; B must complete before D can start; C must complete before E can start; D and E must complete before F can start. Each task's execution time is as follows: A (5ms), B (3ms), C (7ms), D (2ms), E (4ms), F (6ms).

i. Draw a directed acyclic graph (DAG) representing the task dependencies.

ii. Determine the critical path(s) in the DAG and calculate the minimum execution time. Show your work.

iii. If you have two processors available, design a schedule to minimize execution time. What is the resulting execution time? Show your schedule and calculations.

b. [30 points] Describe three common challenges encountered when developing parallel programs and propose solutions for each challenge.

c. [40 points] Explain the concept of Amdahl's Law. How does it relate to the limits of parallel speedup? Provide a numerical example illustrating its impact.

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