Politecnico di Milano

Dipartimento di Elettronica, Informazione e Bioingegneria

prof. Fabrizio Ferrandi

Parallel Computing– 1st mid-term test– Tuesday, November 8th 2022

Polimi ID _____ _____

Surname _____ _____ **Name** _____

- This is a closed-book examination. You cannot use computers, phones, or laptops during the exam.
- Paper will be provided, but you should bring and use writing instruments that yield marks dark enough to be read easily. Erasable pens can be used.
- Total available time: 1h:30m.

Exercise 1 (4 points) _____

Exercise 2 (4 points) _____

Exercise 3 (4 points) _____

Exercise 3 (4 points) _____

Exercise n. 1

Answer the following questions about PRAM models and briefly explain (without an explanation, the answer will be considered invalid)

A. Describe the main characteristics of a PRAM model.(2)

B. List the possible read and write types you may have in a PRAM.(1)

C. List where concurrent reads are going to happen when a prefix sum computation on a PRAM model is considered.(1)

Exercise n. 2

Answer the following questions about different forms of parallel executions and briefly explain (without an explanation, the answer will be considered invalid).

A. We have seen three types of different forms of parallel execution: Superscalar, SIMD, and Multi-core. Please summarize the main differences.(2)

B. How does multi-threading reduce memory access stalls?(1)

C. Please explain when an application is classified as a "Bandwidth bound application."(1)

Exercise n. 3

Answer the following questions about programming models plus CUDA and briefly explain (without an explanation, the answer will be considered invalid).

A. Please compare the "Shared address space" and the "Message passing" programming models.(1)

B. What is meant by the term Warp in CUDA? Is it part of the CUDA language? What relation has a Warp with the hierarchy of concurrent threads CUDA defines?(1)

C. Please describe how buffering/tiling could be implemented with CUDA through a simple example.(2)

Exercise n. 4

Answer the following questions about memory and heterogeneous systems and briefly explain (without an explanation, the answer will be considered invalid).

A. Please explain what memory coalesced accesses means. (1)

B. Please define what memory consistency means. (1)

C. Which of the four operations ordering a sequentially consistent memory system is relaxing? (1)

D. Please list the two ideas behind the introduction of heterogeneous systems.(1)