



Politecnico di Milano

Dipartimento di Elettronica, Informazione e Bioingegneria

prof. Fabrizio Ferrandi

Parallel Computing–I part–Tuesday, January 31st, 2023

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. Is it possible to derive the space complexity of a PRAM algorithm? Example? (1)

B. Assuming $P' < P$, is it possible to derive the slowdown factor when P' processors are used? How? (1)

C. What does it mean to have common concurrent writes in an algorithm? Example? (1)

D. Gustafson's law assumes that the problem has a fixed serial and parallel time. True/False? (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. Briefly describe the difference between Shared address space and Message passing programming models used for parallel programs. (1)

- B. Prefetching reduces stalls. True/False? Explain what is meant with prefetching and stall. (1)

- C. What is meant by SIMD processing? Are Intel processors supporting SIMD processing? (1)

- D. In a Superscalar processor, the parallelism is automatically discovered by the hardware. True/False? (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. On NVIDIA V100 a CUDA block could be executed on multiple SM units. True/False? (1)

- B. CUDA kernels may create dependencies between threads in a block. True/False? (1)

- C. Please elaborate on why tiling technique may improve the performance when is used with CUDA. True/False? When? (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 briefly describe what Memory coalescing means. (1)

B. DRAM Banking could reduce the dead time. True/False? Why?(1)

C. Please list the memory operation orderings in a sequentially consistent memory system. (1)

D. In Heterogeneous processing moving less data may give better power consumption. True/False? When? (1)
