Eidgenössische Technische Hochschule Zürich
Swiss Federal Institute of Technology Zurich

High-Performance Computing Lab for CSE **2024**

Student: FULL NAME Discussed with: FULL NAME

Solution for Project 5

Due date: Monday 13 May 2024, 23:59 (midnight).

HPC Lab for CSE 2024 — Submission Instructions
(Please, notice that following instructions are mandatory: submissions that don't comply with, won't be considered)

- Assignments must be submitted to Moodle (i.e. in electronic format).
- Provide both executable package and sources (e.g. C/C++ files, Matlab). If you are using libraries, please add them in the file. Sources must be organized in directories called:
  Project_number_lastname_firstname
  and the file must be called:
  project_number_lastname_firstname.zip
  project_number_lastname_firstname.pdf
- The TAs will grade your project by reviewing your project write-up, and looking at the implementation you attempted, and benchmarking your code's performance.
- You are allowed to discuss all questions with anyone you like; however: (i) your submission must list anyone you discussed problems with and (ii) you must write up your submission independently.

1. Parallel Space Solution of a nonlinear PDE using MPI [in total 60 points]

1.1. Initialize/finalize MPI and welcome message [5 Points]

1.2. Domain decomposition [10 Points]

1.3. Linear algebra kernels [5 Points]

1.4. The diffusion stencil: Ghost cells exchange [10 Points]

1.5. Implement parallel I/O [10 Points]

1.6. Strong scaling [10 Points]

1.7. Weak scaling [10 Points]

1.8. Bonus [20 Points]: Overlapping computation/computation details

2. Python for High-Performance Computing [in total 40 points]

2.1. Sum of ranks: MPI collectives [5 Points]

2.2. Ghost cell exchange between neighboring processes [5 Points]

2.3. A self-scheduling example: Parallel Mandelbrot [30 Points]