ETH zürich

High-Performance Computing Lab for CSE **2021**

Student: FULL NAME Discussed with: FULL NAME

Solution for Project 6

Due date: May 20, 2021, 12pm (midnight)

HPC Lab for CSE 2021 — 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 35 points]

1.1. Initialize and finalize MPI [5 Points]

1.2. Create a Cartesian topology [5 Points]

1.3. Extend the linear algebra functions [5 Points]

1.4. Exchange ghost cells [10 Points]

1.5. Scaling experiments [10 Points]

2. Python for High-Performance Computing (HPC) [in total 50 points]

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

2.2. Domain decomposition: Create a Cartesian topology [5 Points]

2.3. Exchange rank with neighbours [5 Points]

2.4. Change linear algebra functions [5 Points]

2.5. Exchange ghost cells [5 Points]

2.6. Scaling experiments [5 Points]

2.7. A self-scheduling example: Parallel Mandelbrot [20 Points]

3. Task: Quality of the Report [15 Points]

Each project will have 100 points (out of which 15 points will be given to the general quality of the written report).

Additional notes and submission details

Submit the source code files (together with your used `Makefile`) in an archive file (tar, zip, etc.), and summarize your results and the observations for all exercises by writing an extended Latex report. Use the Latex template provided on the webpage and upload the Latex summary as a PDF to Moodle.

- Your submission should be a gzipped tar archive, formatted like project_number_lastname_firstname.zip or project_number_lastname_firstname.tgz. It should contain
  - all the source codes of your solutions;
  - your write-up with your name project_number_lastname_firstname.pdf.
- Submit your .zip/.tgz through Moodle.