

# Quantum Information and Computing

## Assignment 1 (due in two weeks)

October 18, 2022

**Slides template** By the due date, please submit a report on the assignment in the form of a presentation including six slides at most. The presentation includes:

- First slide: header with your name, date, assignment number, course name and year.
- Different sections, such as (if applicable):
  - Theory: very briefly explanation of the theory your solution is based on.
  - Code development: strategies, tests, and debugging problems, compilations options.
  - Results: presentation of the data and results discussion.

Upload the report in Moodle under the correspondent assignment. File names must include your name, assignment number and codewords SLIDES, and CODE. Example: Ex1-Rossi-SLIDES.pdf

### 1. Setup

- (a) Create a working directory.
- (b) Open a code editor - i.e. emacs, Vim, Visual Studio editor, Atom - and write your first program in FORTRAN.
- (c) Submit a test job.
- (d) (Optional) Connect to CloudVeneto cluster via ssh and repeat the execution. (registration [here](#))

### 2. Number precision: Integer and real numbers have a finite precision. Explore the limits of INTEGER and REAL in Fortran.

- (a) Sum 2.000.000 and 1 with INTEGER\*2 and INTEGER\*4.
- (b) Sum  $\pi \cdot 10^{32}$  and  $\sqrt{2} \cdot 10^{21}$  with single and double precision.

### 3. Performance testing Matrix-matrix multiplication is many times the bottleneck of linear algebra computations.

- (a) Write explicitly the matrix-matrix multiplication loop in two different orders.
- (b) Use the FORTRAN intrinsic function.
- (c) Increase the matrix size and track the code performance using FORTRAN basic date and time routines (i.e. CPU\_TIME).
- (d) Use different optimization flags available with the compiler and compare the performance with increasing matrix size.