

Practical Assignment

Quantum Computation

Integrated Master degree in Physics Engineering
2018-2019

Objectives: The objectives of this work are the practice of the analysis, implementation and simulation of quantum simulations, using the tools and techniques learnt in classes. Evaluation: Individual work 40%, Group work 60% (Recall that the overall practical assignment is worth 35%) of the end grade.

Work description: The work to be undertaken has two main deliveries: an individual jupyter report about qiskit features, a runnable qiskit simulation about a chemistry problem

1. **Individual work** - *Due date: 20th June, 2017:* Based on the qiskit tutorials existent on qiskit prepare your own jupyter about qiskit features and programming language. The structure, the topics and size of the jupyter is at your discretion, nonetheless there are several topics you should explore:
 - (a) How to establish a connection with IBM backends
 - (b) How to create circuits and gates
 - (c) Include some features you finds interesting, or useful
 - (d) Provide examples of the latter points.
2. **Group work (6 people)** - *Due date: 20th June, 2017:*

Objective: Conceive a simulation of a quantum Hamiltonian relevant to chemistry. A starting point is the following Qiskit example: Chemistry on Qiskit

Deliverables: Report (minimum 10 pages) + Demonstrable Qiskit code.

Possible task specification (3 different teams?):

 - (a) **Theory:** Understand Hamiltonian mapping and evolution. Do the relevant calculations
 - (b) **Circuit design:** Conceive a circuit that implements the simulation algorithm
 - (c) **Qiskit Programming:** Implement and test the circuit on the qiskit environment
3. Evaluation of the group work: the evaluation of the group shall be calculated according to the following procedure:

- Define divisions according to the levels of contribution, for instance:
level 1: 0 - 25%,; level 2: 25% - 50%, level 3: 50% - 75%, level4: 75% - 100%
- Assign group elements to the levels (maximum 2 per level): level 1: element 1; level 2: element 3, element 2; level 3: element 4, element 5;level 4: element 6;
- The grade shall be calculated according to the distribution where the baseline grade (to be defined by teachers) is centered in 50%.