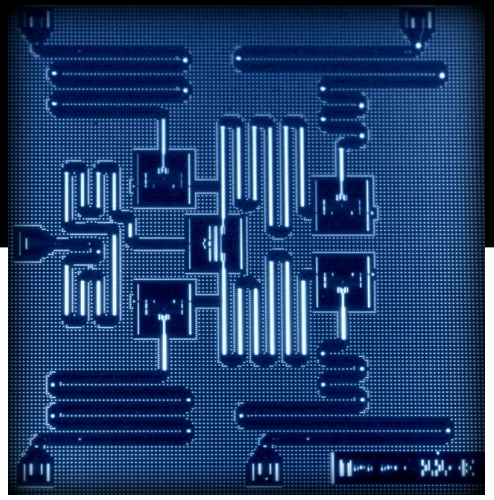
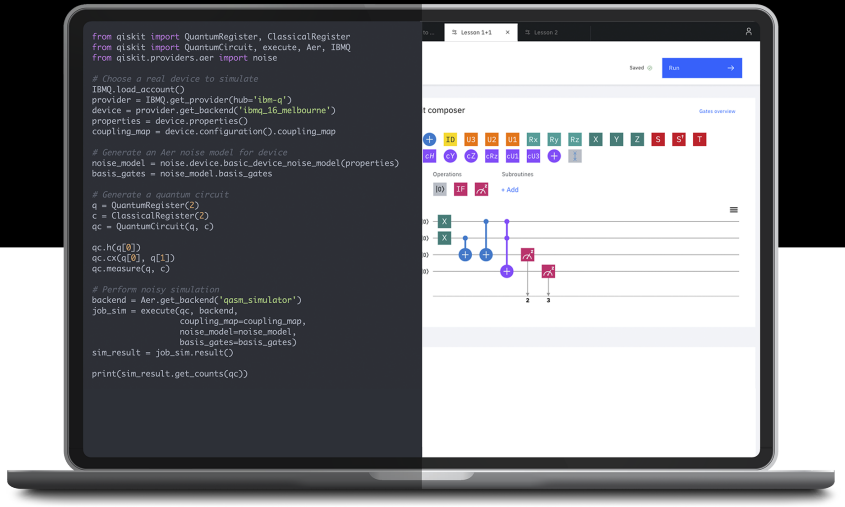
'Hello Quantum World !'





A hands-on coding approach to quantum computing

Bruno Fedrici, PhD | CPE Lyon - Spring 2020

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Bruno Fedrici, PhD

Your servant

PhD in Quantum Information Science with a university certificate in Digital Transformation, I actively contribute to the public and business awareness of science and quantum technologies by providing a bridge between higher education, research and industry.

2018 – Today | Scientific advisor & Lecturer, Freelance - Quantum Technologies, Statistical & Numerical methods

2018 | Degree - Digital Transformation, Université de Lyon

2014 – 2017 | PhD - Physics, Université Nice Sophia Antipolis

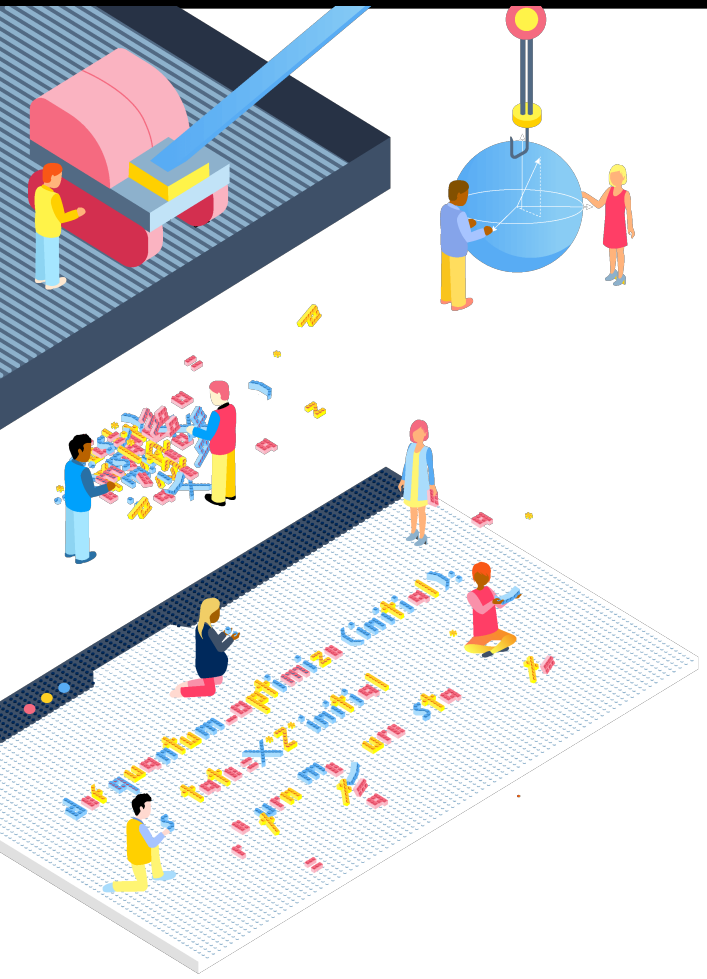
Ch0: Course Overview

Quantum computer

A system based on the principles of quantum mechanics that for certain problems could enable much faster computation than conventional computers.

As the technology is starting to shift from theory into practice, multiple potential use cases for quantum computing exist across sectors:

- Pharma/Chemistry (e.g. drug discovery)
- High-tech (e.g. model training in machine learning)
- Industrial goods (e.g. routing)
- Finance (e.g. portfolio management)
- Energy (e.g. smart grid management)



Course content

This course is an introduction to modern quantum programming for students who want to familiarize with quantum computing technologies and learn about a new paradigm of computation.

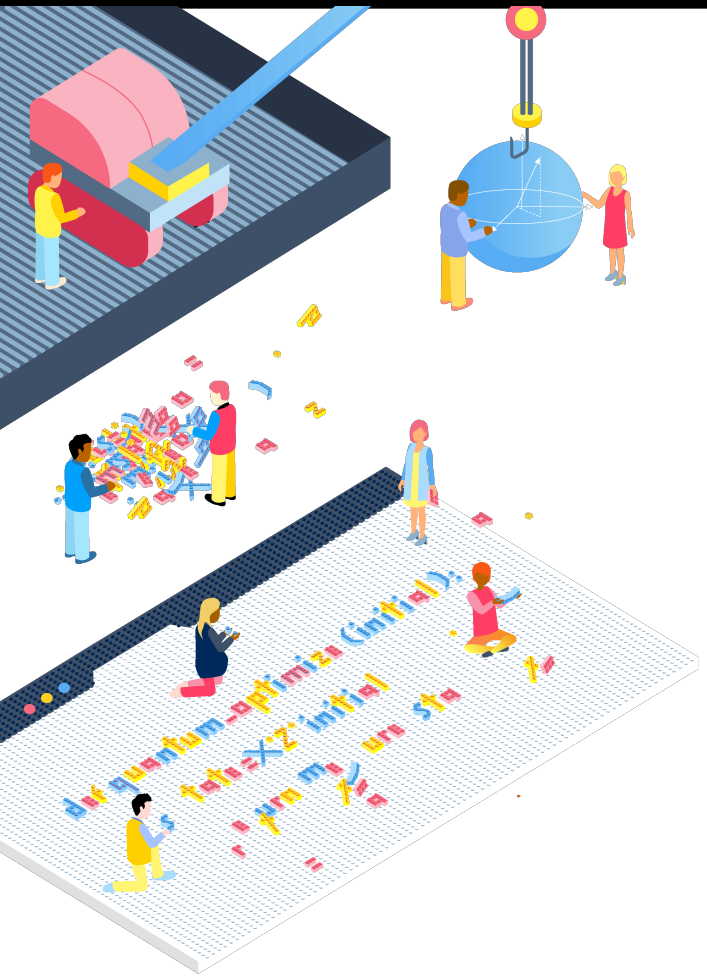
We will review:

- Quantum mechanics basics
- Circuit model of quantum computation
- Quantum programming languages
- Quantum algorithms for long-term applications
- Quantum algorithms for mid-term applications
- Benchmarking QPUs

Prerequisites

A physics and quantum mechanics background is not required, but you will need an understanding of linear algebra at the level of the intro courses.

Moreover, you will need some familiarity with computer programming as this course is hands on using open source Python packages for working with publicly available quantum processors.



Course schedule

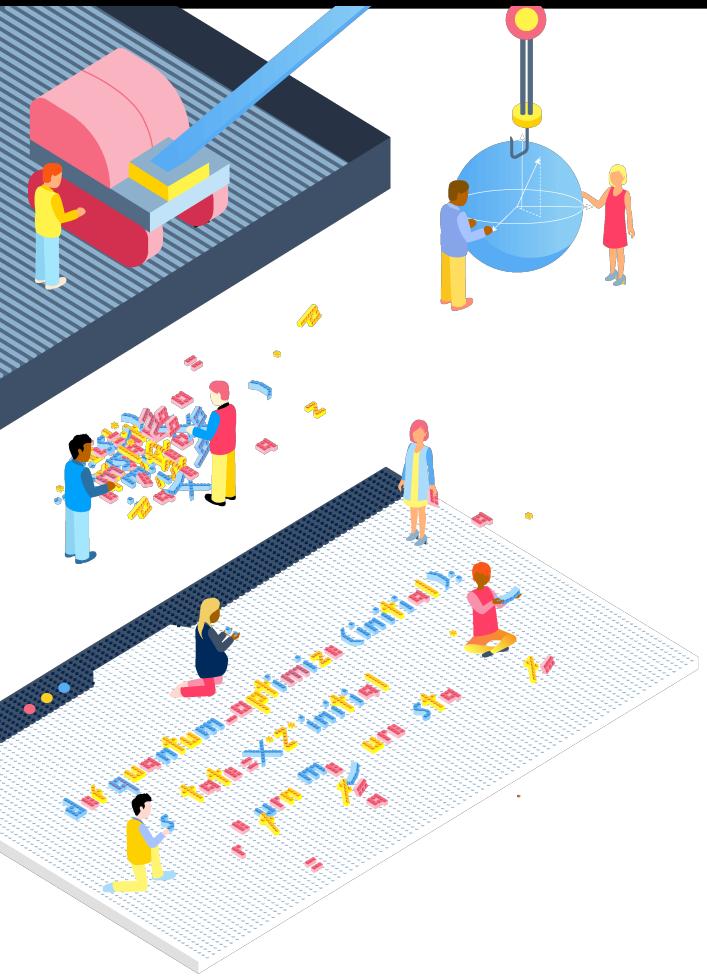
One lecture per week. 8:00 – 12:00, Friday:

- 21-28/02/20
- 13-20-27/03/20
- 3-10-17-24/04/20

Textbook and readings

Quantum Computation and Quantum Information: 10th Anniversary Edition by Michael A. Nielsen and Isaac L. Chuang

Complementary readings will be posted online with the syllabus for each lecture. These are critical.



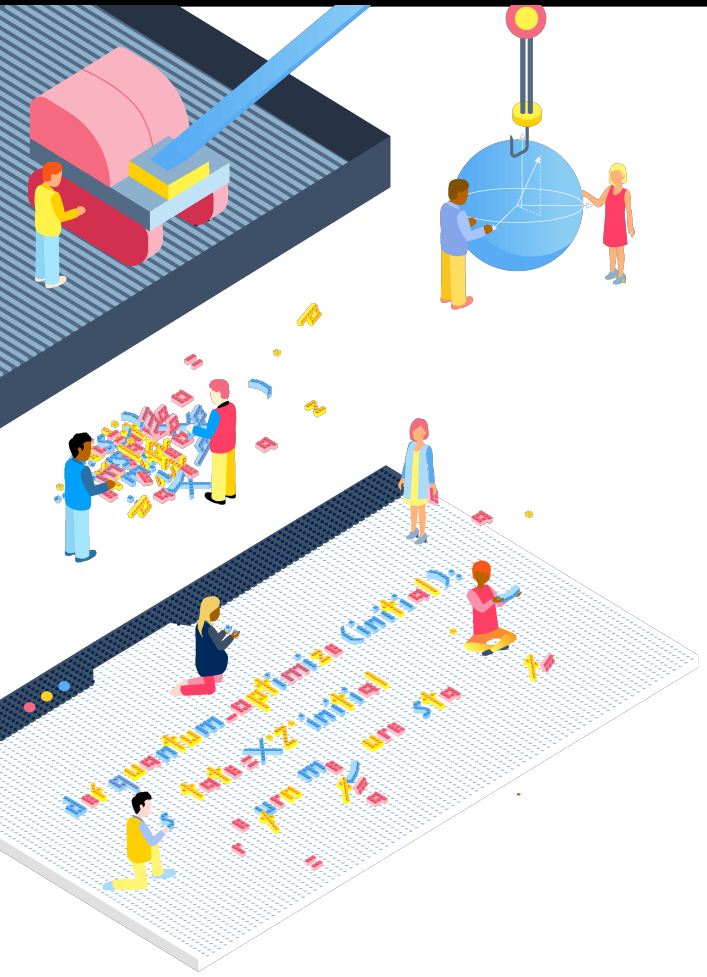
Homework assignments

There will be one written problem set, three programming projects and one final programming project.

Halfway through the course a 1 page design document for your choice of final project will be due.

Exams

There will not be a final or midterm exam. Your final programming project will be your final evaluation.



Grading

Final placement in the class will be determined by the following formula:

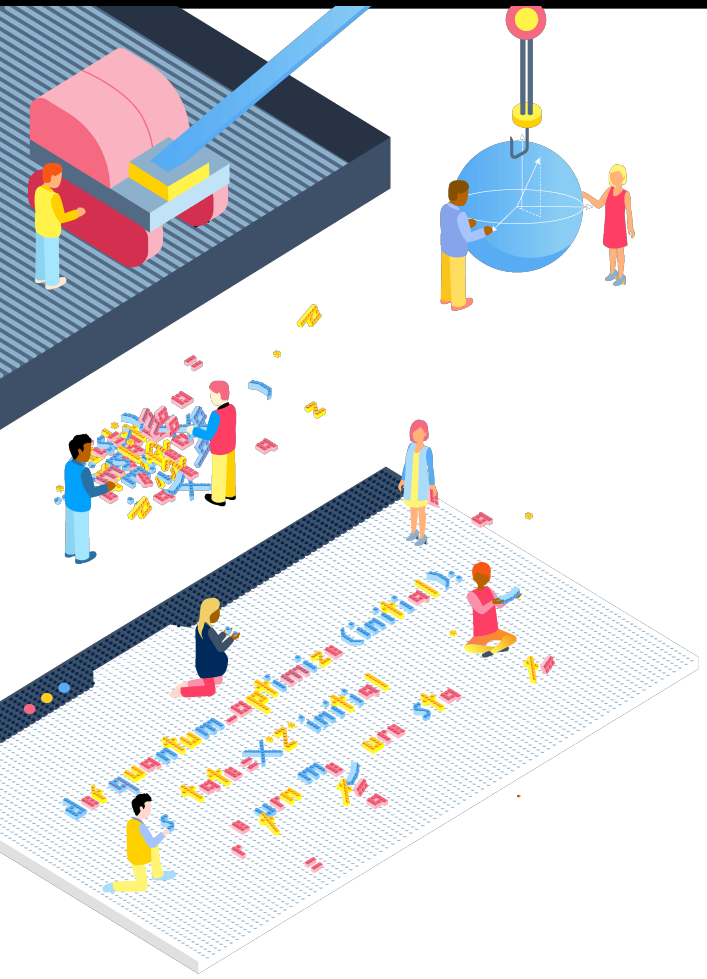
$$0.15\ H + 0.6\ P + 0.25\ FP$$

- H is your score on the first written homework assignment.
- P is the weighted average grade on the three programming projects.
- FP is the score on your final project.

Online support

Github: https://github.com/bfedrici-phd/QC-2020-CPE

Slack: https://qc-2020-cpe.slack.com



Conclusion

Friendly reminder that you live in an age in which...

...you can access a quantum computer...

...on the other side of the world...

...from your classroom...

...for free.

JUST TRY IT !