# Foundations of
# High Performance Computing

## I N S T R U C T I O N S   F O R   U S A G E

"**Foundation of HPC**" course

DATA SCIENCE &

SCIENTIFIC COMPUTING

2020-2021    @ Università di Trieste

# Important notices

Some of you have not been definitely enrolled into UniTS, for diverse reasons,
Or, belonging to other institutes, are not in UniTS at all.

That means that:

(a) you will have to wait for us to admit you in the room; of course we will,
 do not worry  :-)

(b) you will not be able to reach the recorded lectures, that are inside
 Teams. However, we will download the videos from Teams and put
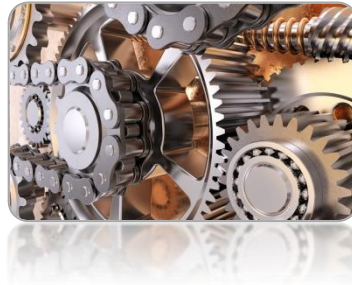 them in the repository to which all of you have access.
 It may not be
  github https://github.com/Foundations-of-HPC/Foundations_of_HPC_2020
 because they would be public. We'll let you know asap.

# Outline



What you
will learn

How it
works

Some
common
rules & principles

# What is High Performance Computing

Tools, basic and not-so-basic concepts

# Modern computer architecture

Why is it there and what will be next

How, and why, to «optimize» a code for such an architecture

# Parallel programming

Why & how
Grow-up and use large HPC facilities to tackle
large (and complex) problems

# Attitude

Don't be (only) a user of pre-cooked tools that you consider as black-boxes

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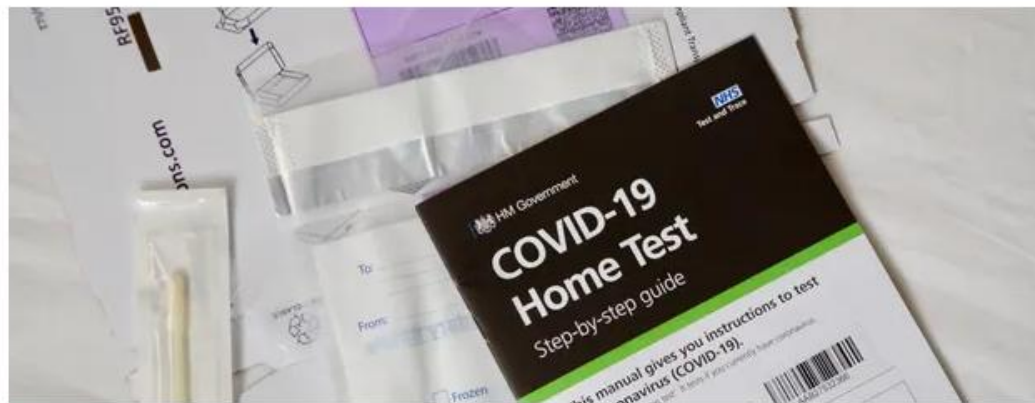Don't be (only) a user of pre-cooked tools that you consider as black-boxes

## Covid: how Excel may have caused loss of 16,000 test results in England

▲ More than 50,000 potentially infectious people may have been missed by contact tracers after 15,841 positive tests were left off the daily figures. Photograph: Simon Leigh/Alamy

A million-row limit on Microsoft's Excel spreadsheet software may have led to Public Health England misplacing nearly 16,000 Covid test results, it is understood.

The Guardian

6/10/2020

https://www.theguardian.com/politics/2020/oct/05/how-excel-may-have-caused-loss-of-16000-covid-tests-in-england

The baseline is:

1) **lectures**: we prepare slides and examples and we expose them.

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1) **lectures**: we prepare slides and examples and we expose them (materials will be uploaded before each lecture).

2) **questions**: you ask what you want whenever you want; if we say something wrong or stupid, you raise your hand and make a point.

3) **discussions**: you ask to discuss much deeper some aspects or topics from previous/future lectures; you read other materials and bring them into the discussions.

The baseline is:

1) lectures

2) questions

3) discussions

The, let's find together something more and (possibly) unexpected

# Common rules & principles

1) Don't be shy, every question is legitimate and useful; ask what you do not understand (or we explain poorly), comment what you want to explore.

2) Our main focus is that you learn, not to grade you.

3) Learning is a process, not a result; we're interested in both your learning process *and* in your final level.

4) This course is gonna be tough for many, if not all, of you; it is because we'll challenge you to go beyond your (supposed) limits, and we'll consider you as intelligent adults not as *poor students*.

5) We (you and us) will be honest in all respects (giving/doing assignments, in the mutual relationships, … ).

6) Nobody is perfect or always right: errors and mistakes are natural; whats matters is what follows them.

7) We're not the guardians of your life: you decide how much you want to learn and how much to profit from opportunities (among them there is following this course).

8) We believe in sharing and commons. We also believe that learning is a process in our personal brain, not in others' one.
*Open source* is among the greatest achievements in this field.
We all have learnt from other people's codes, but we all have learnt even more from our own mistakes and efforts.

We encourage you to clash with your limits long before you decide to take inspiration from available code (for sure you may find something useful for the assignments) online.

*It will be dangerous supposing that at the examination we will be unable to spot whether you fully understand the code you have submitted..  :-)*

Eventually, this journey ends (also) with an exam and an evaluation of your level of comprehension and acquired skills.

You will be allowed to repeat the exam without any constraint: however, please

(i)    do not try multiple times in a short time span ( save our time and take yours to digest better )

(ii)   self-organize with your peers so to have groups of you that ask for an exam

Here is what ideally you should expect as final grade:

*Note for non-italian students:*
*marks range from 0 to 30, 18 being the threshold to pass the exam*

| | |
|---|---|
| **18–20** | Too embarassing to mention |
| **21–23** | You got a basic understanding of the matter; slightly more advanced topics or unexpected facts put you in trouble |
| **24–26** | You have a robust understanding of the matter, upon thinking you can explore rough terrain |
| **27** | You have a firm comprehension of the matter, you sense the right direction and solution |
| **28** | Like 27 + you *see* the solution; some added shining |
| **30** | Like 28, but with shining |
| **30***cum laude* | Like 30, but you really surprise us |
| **29** | Some accident happened along the route to 30 |

# Basic principle

Learning is a process that happens only together, among human beings.

Racism, sexism, homophobia, culturalism, discrimination in every sense are not allowed and definitely rejected.

Help us in building a better milieu and a wonderful experience in sharing this journey together.

# Questions, comments, doubts, fears, … ?

Now is the time.

But, if you'll have *l'esprit de l'escalier* later on, you can still contact us:

luca.tornatore @ inaf.it        stefano.cozzini @ areasciencepark.it