

# Foundations of High Performance Computing

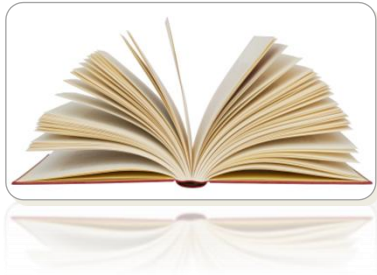
I N S T R U C T I O N S   F O R   U S A G E

**“Foundation of HPC” course**

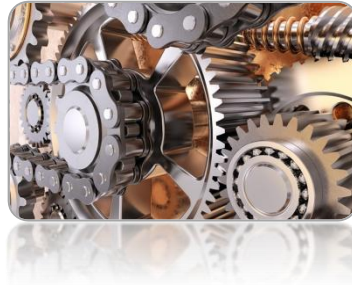


DATA SCIENCE &  
SCIENTIFIC COMPUTING  
2021-2022 @ Università di Trieste

# Outline



What you  
will learn



How it  
works



Some  
common  
rules & principles



# What you will learn

## What is High Performance Computing

Tools, basic and not-so-basic concepts



# What you will learn

## Modern computer architecture

Why is it there and what will be next

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



# What you will learn

## Parallel programming

Why & how

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



# What you will learn

## Attitude

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



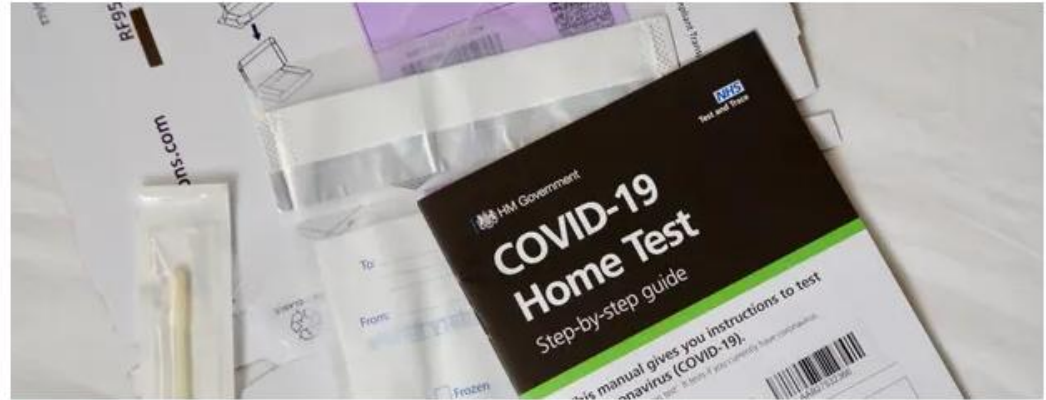


# What you will learn

## Attitude

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



6/10/2020

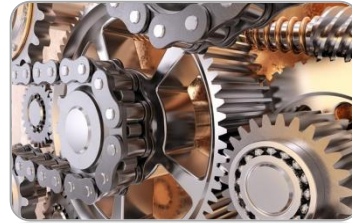
<https://www.theguardian.com/politics/2020/oct/05/how-excel-may-have-caused-loss-of-16000-covid-tests-in-england>

**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.

# Outline



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# How it works

The baseline is:

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

The lectures will be recorded and you'll find the related files both in the Teams and in this [GDrive](#).

The pdfs that we will use and the example codes will be put in this GitHub [repository](#) (we'll make our best effort to upload the files *before* the lecture).



# How it works

The baseline is:

- 1) **lectures**: we prepare slides and examples and we expose them.
- 2) **questions**: you ask what you want whenever you want; if we say something wrong or stupid, you notice that and you raise your hand.



# How it works

The baseline is:

- 1) **lectures**: we prepare slides and examples
- 2) **questions**: you ask what you want whenever you want
- 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.



# How it works

The baseline is:

- 1) **lectures**: we prepare slides and examples
- 2) **questions**: you ask what you want whenever you want
- 3) **discussions**: you ask to discuss much deeper
- 4) **Office hours**: each of us will be available weekly an hour (we'll communicate which one). However, we are ready for chatting, Q&A or alike upon appointment

# Outline



What you  
will learn



How it  
works



Some  
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# 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*.





# Common rules & principles



let us spend a bit more time on this point

« 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*. »



# Common rules & principles

- 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**; what matters more is what will follow-up.
- 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).



# Common rules & principles

- 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 may be risky supposing that at the examination we will be unable to spot whether you fully understand the code you have submitted or not.. :-)*



# Exam

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

There are **2 possible paths**:

1. You complete in due time the 2 assignments that will be given; then you can access directly the final oral examination
2. You do not complete the assignments; then you'll be required to complete an equivalent project *before* to access the oral examination (a list of projects from which you could pick-up yours will be published at the end of the course).



# Exam

You will be allowed to repeat the oral 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
- (iii) there will be regular exam sessions, however usually we do prefer to agree with small groups of students to have exams whenever it fits at best.



# Exam

Here is what ideally you should expect as final grade:

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





# Basic principles, *resumé*

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 another one will fit as well).

But, in case that later on you will experience *l'esprit de l'escalier*, you can still contact us:

luca.tornatore @ inaf.it

stefano.cozzini @ areasciencepark.it