---------- EXAM ORGANIZATION -------------------------------------

- I will be flexible concerning exam dates; we can agree on different dates with respect to the official one, even separately with each of you.

- During the exam I may make questions about topics covered in the course, only if related to the subject of your presentation.

- The presentation should last at least 30 minutes and not more than 1 h (the upper bound can be flexible).

- The presentation will be given (and slides will be written) in English.

- The presentation itself can take any form. In the winter session we will have online exams, so you may prepare slides or write on a tablet (as I do for teaching) or write on a piece of paper properly kept in a webcam frame. If in May/June we are back to the pre-Covid life, and therefore to exams in physical presence, you may also choose to deliver your presentation on the blackboard.

- Aside from the replies to my possible questions, I will evaluate the way you organize your presentation (for example on which parts of the source material you focus and which ones you leave out of the presentation) and how you are in control of the subject.

- In the (hopefully most unlikely) case the exam grade is not accepted by the student, she/he will need to select a different project (among the available ones) when retaking the exam; the first selected project will remain not available to other students.

--------------------- PROJECT CHOICE -------------------------------------

- The same project cannot be chosen by more than one student. This rule is supposed to be maintained for the whole 2021; an already assigned project will not be available for the rest of the year.

- You can e-mail to me the project you wish to select.

- The projects are roughly divided into 3 classes (although in a couple of cases they are a mixture): book sections/chapters to read and report on, scientific papers to read and report on, numerical simulations to perform and report on. You are welcome to propose a specific project you are interested in, or to propose a generic subject (I will try to find a relevant paper).

- One paper corresponds to one project (with the exception of the Hinrichsen paper, to be used only as a reference in the simulation projects, see below), even when they are grouped under one item in the list. I refer to paper by last author's name.

- The project description is very brief: you are in general expected to be mature enough to "digest" and organize the source material by yourself; yet, you are welcome to discuss with me in case of any major doubt.

BOOK SECTIONS

-- Livi-Politi book

6) Interface Roughness: scaling, exponents, self-affinity; general derivation of WE,KPZ equations (5.2, 5.3, 5.4, 5.5)

7) Edwards-Wilkinson equation (5.6)

8) Kardar-Parisi-Zhang equation (5.7)

-- Mezard-Montanari book

9) Introduction to Combinatorial Optimization and Complexity classes (P vs NP): (chapter 3)

10) Proof of the "direct part" of channel coding theorem for a generic channel (6.4,6.8) and of the "converse part" for BST (6.5)

11) Number partitioning (chapter 7)

COMPUTATIONAL PROJECTS

12) Domany-Kinzel model (d=1+1), evaluation of rho(t,p) -> quenched average (q fixed), omogeneous initial conditions: find p_c and critical exponent using phenomenological scaling -> fig. 20 Hinrichsen 2001

14) Parity conserving model (1+1): PC vs DP; find transition point and critical exponents

SCIENTIFIC PAPERS

22) Review KPZ: Corwin

23) Review of Reaction-Diffusion models: Frey, Luthey-Schulten, Voit

24) Non equilibrium statistical physics: Van den Broek

25) Information thermodynamics; a very recent book (2019) where concepts from information theory and stochastic thermodynamics (including fluctuation theorems) are put together to discuss topics such as the Landauer principle and the experimental realization of Maxwell demon.

b) chapter 3,4 (Sagawa and Porod); second law, entropy production and reversibility in "computation thermodynamics"
c) chapter 5 (Ciliberto and Lutz): experimental information physics: from Maxwell to Landauer

26) Fluctuation theorems

a) section 3.3.2 and all section 4 from Ritort review: FT for NESS with a specific example for a gaussian trapping potential (the solution of FP equation with a quadratic potential is obtained in Livi-Politi 1.6.3 -elastic force, Ornstein-Uhlenbeck process -; section 4.1.1. in Ritort review is the same as 1.6.5 in Livi-Politi); section 4.2.3 is particularly relevant (efficient strategies to extract free energy measurements from non-equlibrium experiments)

27) Quantum fluctuations theorems

a) Wojcik 2004: classical and quantum FT derived in the case of heat exchange between to objects kept at different temperatures
c) Sagawa 2018: general review on quantum FT

29) Large Deviations:

b) Gherardini 2019: large deviations for quantum observables