**EPFL**

MATH-434 **Lattice models**

| Cursus | Sem. | Type |
|---|---|---|
| Ing.-math | MA1, MA3 | Opt. |
| Mathématicien | MA1, MA3 | Opt. |

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|---|---|
| Language of teaching | English |
| Credits | 5 |
| Session | Winter |
| Semester | Fall |
| Exam | Written |
| Workload | 150h |
| Weeks | 14 |
| **Hours** | **4 weekly** |
| Courses | 2 weekly |
| Exercises | 2 weekly |
| **Number of positions** | |

**Remark**

pas donné en 2020-21

**Summary**

Lattice models consist of (typically random) objects living on a periodic graph. We will study some models that are mathematically interesting and representative of physical phenomena seen in the real world.

**Content**

We will discuss some classical lattice models, such as: random walks, percolation, Ising model, random spanning trees, gaussian free field.
We will prove non-trivial theorems for each of the models. The goal is to allow students to learn general methods and concepts from a number of detailed case studies.

**Keywords**

probability, graph theory, complex analysis, lattice models, statistical mechanics

**Learning Prerequisites**

**Required courses**

Basic probability, basic analysis, linear algebra
I think that students who like to learn in the definition/theorem/proof/lemma way might be disappointed. While the class will be completely rigorous, the emphasis is more on revealing some interesting phenomena (that somehow exists in nature) rather than on constructing some theories. The goal is to learn things that are generalizable, but I almost always prefer to work out particular cases first.

**Recommended courses**

None of this is mandatory, but it could help: complex analysis, basic graph theory, simulations

**Learning Outcomes**

- Reason with probabilistic lattice models
- Manipulate random variables in geometric settings
- Manipulate discrete and continuous objects

**Assessment methods**

Written exam

Dans le cas de l'art. 3 al. 5 du Règlement de section, l'enseignant décide de la forme de l'examen qu'il communique aux étudiants concernés.