MATH-434 **Lattice models**

Hongler Clément

Cursus	Sem.	Type
Ing.-math	MA1, MA3	Opt.
Mathematics for teaching	MA1, MA3	Opt.
Mathématicien	MA1, MA3	Opt.

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	

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

Assessment methods

Exam written
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