

COM-512

**Networks out of control**

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<b>Cursus</b>	<b>Sem.</b>	<b>Type</b>
Computer science	MA2, MA4	Opt.
Cybersecurity	MA2, MA4	Opt.
Data Science	MA2, MA4	Opt.
Data science minor	E	Opt.
Electrical Engineering		Opt.
SC master EPFL	MA2, MA4	Opt.
Systems Engineering minor	E	Opt.

Language of teaching	English
Credits	4
Session	Summer
Semester	Spring
Exam	Written
Workload	120h
Weeks	14
<b>Hours</b>	<b>3 weekly</b>
Courses	2 weekly
Exercises	1 weekly
<b>Number of positions</b>	

**Remark**

Cours biennal

**Summary**

The goal of this class is to acquire mathematical tools and engineering insight about networks whose structure is random, as well as learning and control techniques applicable to such network data.

**Content**

- Random graph models: Erdős-Renyi, random regular, geometric, percolation, small worlds, stochastic block model
- Learning graphs from data: centrality metrics, embeddings, Hawkes processes, network alignment
- Control of processes on graphs: epidemics, navigation

**Keywords**

Random graphs, network data, machine learning, graph processes.

**Learning Prerequisites****Required courses**

Stochastic models in communication (COM-300), or equivalent.

**Important concepts to start the course**

Basic probability and statistics; Markov chains; basic combinatorics.

**Teaching methods**

Ex cathedra lectures, exercises, mini-project

**Expected student activities**

Attending lectures, bi-weekly homeworks, mini-project incl. student presentation at the end of semester, final exam.

**Assessment methods**

1. Homeworks 10%
2. Mini-project 40%

3. Final exam 50%.

### Supervision

Office hours	Yes
Assistants	Yes
Forum	No

### Resources

#### Bibliography

- A. D. Barbour, L. Holst and S. Janson, Poisson Approximation, Oxford Science Publications, 1992.
- B. Bollobas, Random Graphs (2nd edition), Cambridge University Press, 2001.
- R. Durrett, Random Graph Dynamics, Cambridge University Press, 2006 (electronic version).
- D. Easley, J. Kleinberg. Networks, Crowds, and Markets: Reasoning About a Highly Connected World, Cambridge University Press, 2010 (electronic version).
- G. Grimmett, Percolation (2nd edition), Springer, 1999.
- S. Janson, T. Luczak, A. Rucinski, Random Graphs, Wiley, 2000.
- R. Meester and R. Roy, Continuum Percolation, Cambridge University Press, 1996.

#### Ressources en bibliothèque

- [Random Graphs / Bollobas](#)
- [Random Graphs / Janson](#)
- [Continuum Percolation / Meester](#)
- [Random Graph Dynamics / Durrett](#)
- [Networks, Crowds and Markets / Easley](#)
- [Poisson Approximation / Barbour](#)
- [Percolation / Grimmett](#)

#### Notes/Handbook

Class notes will be available on the course website.

#### Websites

- <http://icawww1.epfl.ch/class-nooc/>