The goal of this class is to acquire mathematical tools and engineering insight about networks whose structure is random, as well as decentralized processes that take place on these networks.

**Content**

- Course Introduction: Tree Percolation, Branching Processes
- Random Graphs 1: Models, Threshold Functions, Appearance of Subgraphs
- Random Graphs 2: Giant Component and Connectivity
- Random Graphs 3: Other models: the Random Regular Graph, Small World Networks, Scale-Free Networks.
- Evolution, Dynamics and Inference 1: Epidemics, Network and Source Discovery.
- Evolution, Dynamics and Inference 2: Information Cascades.
- Applications 1: Network Formation Games.
- Applications 2: Homophily, Structural Balance.

**Keywords**

Random graphs, percolation theory, social networks, communication networks.

**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.

**Learning Outcomes**

By the end of the course, the student must be able to:

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**Remarque**

Pas donné en 2018-19 - Cours biennal donné les années impaires
• Analyze social and communication systems
• Model such systems as stochastic models
• Compute key properties of these models

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

Ressources en bibliothèque
• Random Graphs / Bollobas
• Random Graphs / Janson
• Continuum Percolation / Meester
• Percolation / Grimmett
• Networks, Crowds and Markets / Easley
• Poisson Approximation / Barbour
• Random Graph Dynamics / Durrett

Notes/Handbook
Class notes will be available on the course website.

Websites
• http://icawww1.epfl.ch/class-nooc/