



Aalto University  
School of Science  
and Technology

# CS-E5745

## Mathematical Methods for Network Science

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# Learning goals

- ▶ Knowledge of the most common mathematical methods in network science
- ▶ Improved skills for doing pen and paper calculations especially related to methods commonly used in network science
- ▶ Increased ability to justify the use of particular analytical techniques
- ▶ Increased confidence when reading more mathematical networks articles

# Learning methods

- ▶ Learn by doing exercises!
  - ▶ Lots of hints and guidance: exercise seem very long
  - ▶ If you get stuck, ask help.
- ▶ Lectures support exercises, not vice versa.
  - ▶ Exercises are published before lectures, start working on them immediately
- ▶ Project: make sense of a relatively recent research paper
  - ▶ More info on the project later

# Lecture topics

1. Basic models and the typical approaches in network science
2. Probability generating functions, Galton-Watson process, percolation threshold
3. Component size distributions (using PGF's)
4. Network evolution models and processes on networks
5. Exponential random graphs, block models

# Reading material

**Main course book** Networks: An Introduction, *M.E.J. Newman* (2010 or 2018)

**More mathematical approach** Random Graphs and Complex Networks, *R. van der Hofstad* (2016-2017)  
<http://www.win.tue.nl/~rhofstad/NotesRGCN.html>

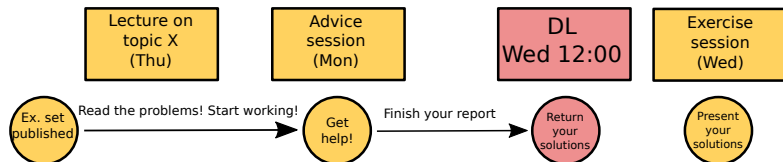
# Exercise sessions

**Monday session at 14.15:** Assistant answers questions and gives help. Good time and place to work on the exercises, but maybe too late to start working on them!

**Wednesday session at 12.15:** Students present their solutions. **Mandatory participation!** Only solutions which are returned before the deadline 12.00 on Wednesday *and* marked as (at least partially) done in the exercise session will be graded.

- ▶ Note that the course has no exam so all the work is in doing the exercises.

# Weekly schedule



# Information on the practicalities

- ▶ See the *practicalities* document in the MyCourses page.