

Elective MS course: SPECTRAL CLUSTERING

Final test

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You are assumed to send me the answers before 16:45 pm today in one handwritten pdf file to the gmail address below. Please, write on it: I certify that it is my own work and sign it. In case of any questions during the exam, you can contact me via Teams or e-mail: marianna.bolla@gmail.com

1. What kind of graph based matrices and representation theorems you know? How Laplacian matrices and their spectra (eigenvalues and eigenvectors) are related to quadratic placement problems (in terms of edge-weighted graphs)?
2. What is the idea behind the spectral relaxation? How minimal multiway cuts (partition and normalized cuts) can be estimated with the Laplacian spectra? How near optimal partitions can be found by the k -means algorithm?
3. Modularity matrices, Newman–Girvan modularity. Idea of Reproducing Kernel Hilbert spaces. How reproducing kernels can be applied to image segmentation?
4. Definition of convergent graph sequences, graphons, and testable graph parameters.
Notion of generalized random and quasirandom graphs.
5. Random graph models, stochastic block models, parameter estimation with the EM algorithm.
Definition and asymptotic properties of the eigenvalues of a Wigner-noise.

You are supposed to know the basic facts, notions, theorems, but need not prove the statements. You can get max. 10 points for each answer. I will contact you as for the result and the final grade I can offer. You can solve this test only if have the signature (at least 20 midterm points for the exercises or made presentation last week).