Randomized algorithms for graph and hypergraph partitioning problems

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Graph and hypergraph partitioning problems have many important applications in many diverse domains, including parallel scientific computing, VLSI design, and data mining. The two problems amount to partitioning the vertices into a number of given parts so as to minimize the edges (or hyperedges in the hypergraphs) while having almost equal number of vertices in each part. Both of the problems are NP-complete and therefore efficient and effective heuristics are used in practice. The aim of this stage is to design and analyze randomized algorithms for the two problems. We will be looking for an algorithm based on sparsification/contraction for improving the efficiency of the well-known heuristics.

The context of this stage requires a background in theoretical computer science and an inclination towards theoretical study.

For some background material, see randomized minimum cut in undirected graphs in the book "Probability and Computing" by M. Mitzenmacher and E. Upfal or in the poly by Y. Robert (http://graal.ens-lyon.fr/~yrobert/probas.pdf); for advanced material see http://people.csail.mit.edu/karger/Papers/approxcut.ps.