Problems: Approximation Algorithms

Palash Dey
Indian Institute of Technology, Kharagpur

November 8, 2024

1. Consider the task of scheduling n jobs into m identical machines. Each job i needs to run t_i time in any machine to complete. A job once started to run in a machine cannot be stopped midway. A schedule is an assignment $\mathcal{A} : [n] \longrightarrow [m]$. The load ℓ_j of machine j in a schedule $\mathcal{A}$ is $\sum_{i \in \mathcal{A}^{-1}(j)} t_i$. The makespan of a schedule $\mathcal{A}$ is $\max_{j \in [m]} \ell_j$. Show that computing a schedule which achieves the minimum makespan is NP-complete. Design a simple 2 factor approximation algorithm for this problem. Change the algorithm suitably to improve the approximation guarantee to $\frac{3}{2}$.
2. Design a greedy $1/2$ factor deterministic approximation algorithm for the maximum cut problem on edge-weighted graphs. (Note that this is also called 2 factor approximation algorithm.)
3. Design a $7/8$ factor deterministic approximation algorithm for the weighted Max 3SAT problem.