PhD Doctoral Course – Network Design – 17th November 2009

10th Assignment

1. Consider the following scheduling problem. We have n jobs, and we want to schedule each job on one of m parallel machines, but job j can only be scheduled on a subset of the machines $M(j)$, that depends on j. The processing time of job j is p_j on any of the admissible machines, and the goal is to minimize the makespan of the schedule. Formulate this problem as an unsplittable flow problem.

2. Prove that the algorithm shown in the lecture leads to a 2-approximation even if the cut-condition is not satisfied.

3. Give an example showing that the factor of 2 in the congestion between a fractional flow and an unsplittable flow is essentially tight (Note: we assume $u_{min} \geq d_{max}$).

4. Apply the algorithm shown in the lecture to the following instance, where all the edges have unit capacities. Moreover, find a *cost vector* for the edges $c : E \rightarrow Q_+$, such that the cost of the unsplittable flow found by the algorithm is much larger than the cost of the original fractional flow.