Assignment 7

due Wednesday, March 13, 2019

- only the first problem will be graded
- no late assignments accepted after 4pm, Friday, March 15

1. You are running a software company and have a series of \( n \) jobs that must be pre-processed first on a supercomputer before being moved to a smaller PC. You have only one supercomputer, but you have \( n \) PCs so the second stage can be performed in parallel. More specifically, your jobs are described as \( J_1 = (s_1, f_1), J_2 = (s_2, f_2), \ldots, J_n = (s_n, f_n) \), where job \( J_i \) needs \( s_i \) units of time to be pre-processed on the super-computer and \( f_i \) units of time on the PC.

You need to work out an order in which to give the jobs to the super-computer. As soon as the first job is done on the super-computer, it can be moved to the PC for finishing; at that point a second job can be given to the super-computer; when the second job is done it can go straight to a PC since the PCs can work in parallel, and so on. So if the jobs are processed in the order given, job \( J_i \) finishes at time \( \left( \sum_{k=1}^{i} s_k \right) + f_i \).

A schedule is an ordering of the jobs to be given to the super-computer. The completion time is the point at which all jobs have finished being processed on the PCs. We wish to minimize the completion time.

(a) Give an efficient (greedy!) algorithm for computing the optimal order in which to process the jobs so that the completion time is minimized.

(b) Describe the greedy choice your algorithm makes and show that it is correct.

[10 points]

2. illustrate the Ford-Fulkerson algorithm on the graph of figure 1 [0 points]

Total: 10 points
Figure 1: Flow graph with capacities