CIS 315, Intermediate Algorithms
Spring 2018

Assignment 7

due Wednesday, June 6, 2018
(note: no late assignments accepted after 2pm, Friday, June 8)

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 super-computer, but you have n PCs so the second stage can be performed in 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 $(\sum_{k=1}^{i} s_k) + f_i$.

   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. exercise 5.18, part (a), left column only (DPV). That is, consider the left column of the table for problem 5.18, characters *blank, e, t, a, o, i, n, s, h* with the given frequencies. Show the Huffman encoding of these characters. **[5 points]**

3. illustrate the Ford-Fulkerson algorithm on the graph of figure 1 **[8 points]**

Total: 23 points

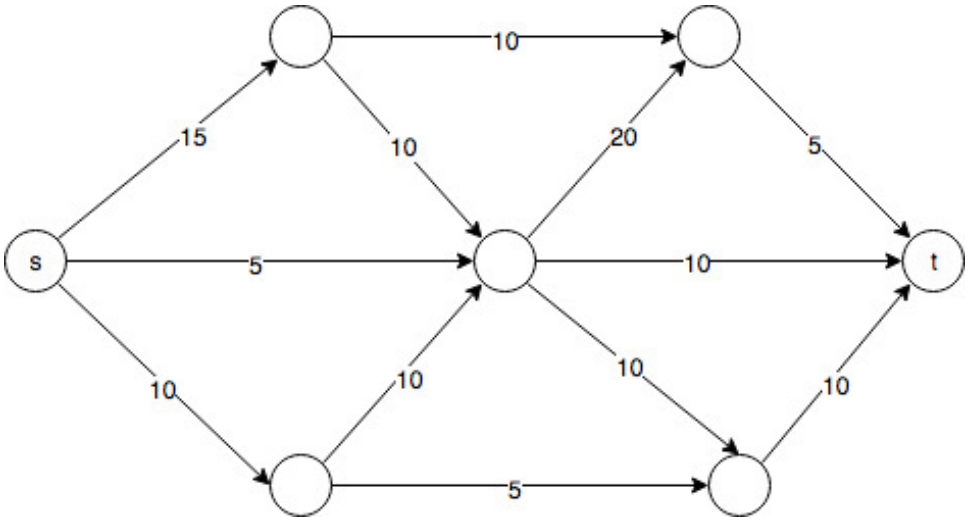

Figure 1: Flow graph with capacities