15.093 - Recitation 6

Michael Frankovich and Shubham Gupta

October 23, 2009

1 BT Exercise 7.1 (Caterer Problem)

Solution

Construct the n/w as follows: For each day i, create two nodes as follows:

- node c_i for clean tablecloths, with supply r_i

- node d_i for dirty tablecloths, with demand r_i

Create a node s for the source of new tablecloths.

Each node c_i can:

- receive new tablecloths from purchasing: arcs (s, c_i) with arc cost p and unlimited capacity.

- receive "fast" laundered tablecloths from n days ago (or longer): arcs (d_{i-n-j}, c_i) if $i > n + j$ with arc cost f and unlimited capacity

- receive "slow" laundered tablecloths from m days ago (or longer): arcs (d_{i-m-j}, c_i) if $i > m + j$ with arc cost g and unlimited capacity

For each node d_i, create arcs (d_i, s) with zero cost and unlimited capacity, representing tablecloths which are not laundered and used again.

2 BT Exercise 7.3 (Tournament Problem)

Solution

We introduce nodes $T_1, ..., T_n$ that correspond to the different teams. These are the supply nodes and node T_i has a supply of x_i, the total number of games won by team i. For every unordered pair i, j of teams, we introduce a node G_{ij}. These are demand nodes, with demand k, the total number of games played between these two teams. Since

the total number of games must be equal to the total number of wins, we assume that $\sum_{i=1}^{n} x_i = n(n-1)/2$.

There are two arcs that come into a node G_{ij}; one from T_i and one from T_j. The flow from T_i to G_{ij} represents the total number of games between teams i and j that was won by team i.

The above constructed n/w flow problem is feasible if and only if the vector $(x_1, ..., x_n)$ belongs to the set of possible outcome vectors.

3 BT Exercise 7.23 (Marriage Problem)

Solution

A source node s, a node for each man, an arc connecting the source node with each man, capacity of 1 unit.

A sink node t, a node for each woman, an arc connecting each woman node with the sink node, capacity of 1 unit.

Two nodes for each broker, which are connected with each other by an arc with the capacity of b_i. One in these two nodes is connected with man nodes that the broker knows while the other node connects to all woman nodes that the broker knows.

15.093J / 6.255J Optimization Methods

Fall 2009