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.