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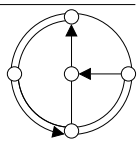

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Principles of Distributed Computing
Exercise 9: Sample Solution

1 Family Dinner

Build a complete bi-partite graph $G = (X, Y, E)$, where X is the set of families, Y is the set of tables. Set the capacity of each edge (x, y) to be 1. Create an artificial source node s, and join it to each node in $i \in X$, where the capacity of edge (s, i) is $a(i)$, the size of the family i. Similarly, create an artificial sink node t, with edges to it from each node $j \in Y$, with capacity of $(j, t) = b(j)$, the capacity of table j.

Now the seating is feasible if and only there is maxflow from s to t of value $\sum_i a(i)$.

2 Emergency Route Planning

Define a bipartite graph G, where U is the set of injured people, and V is the set of hospitals. Put an edge from node u to node v if the patient u is within 1/2 hour driving distance of hospital v.

Now add an artificial source s, and connect it to each node u with capacity 1. Add a sink node t, and add an edge from each hospital node v to t, with capacity n/k.

The load balanced hospital assignment is feasible if and only if this network admits a flow of value n. The flow assignment determines which patients go to which hospital.