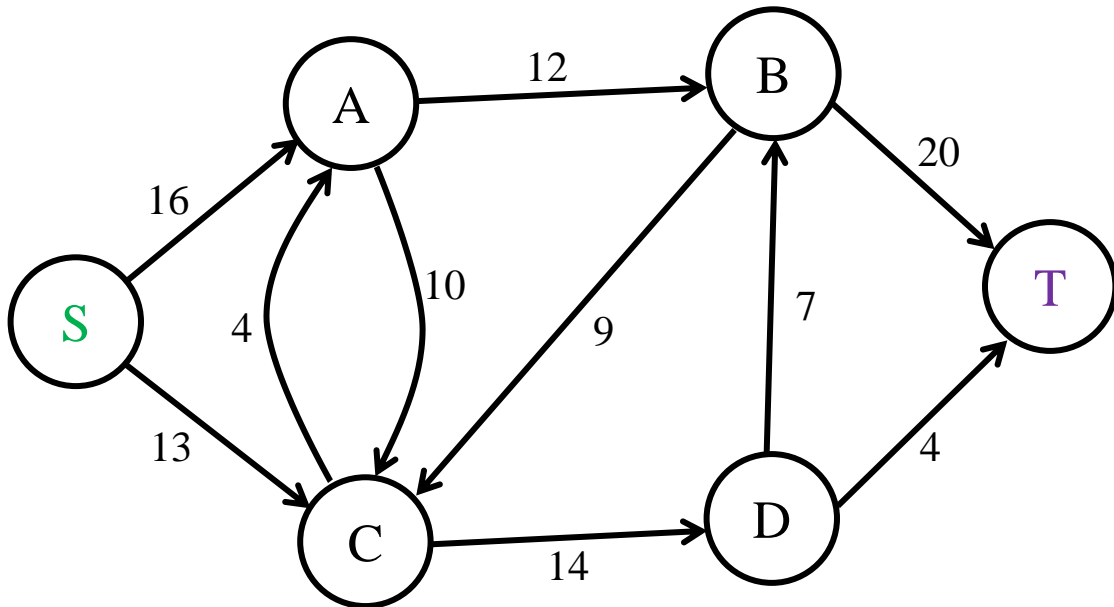
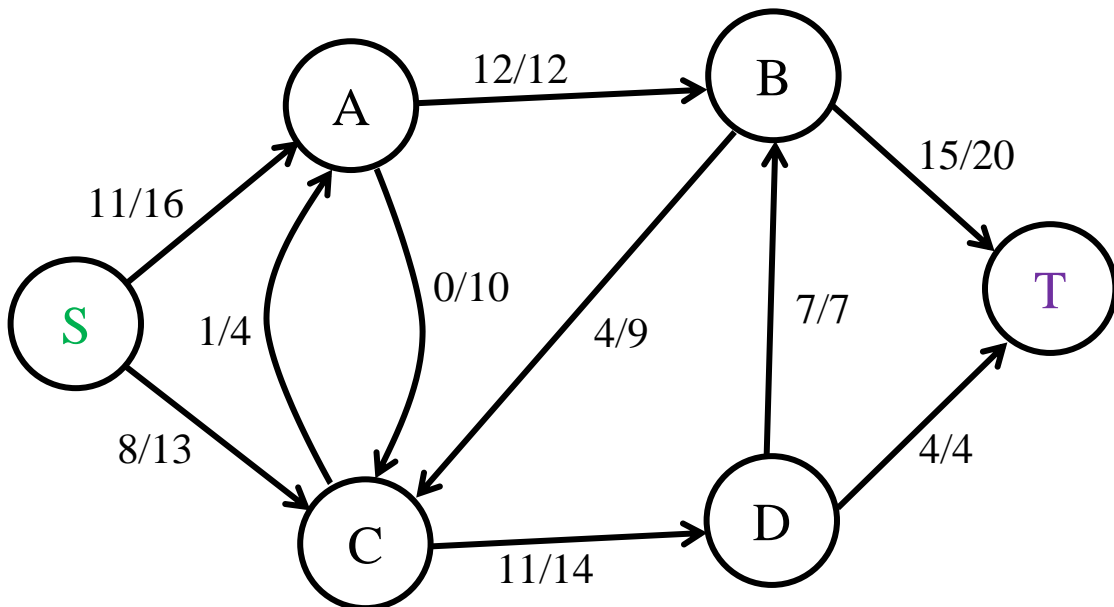


Network Flow

Here is an example of an “empty” flow graph:



Here is an example of some flow going through ...

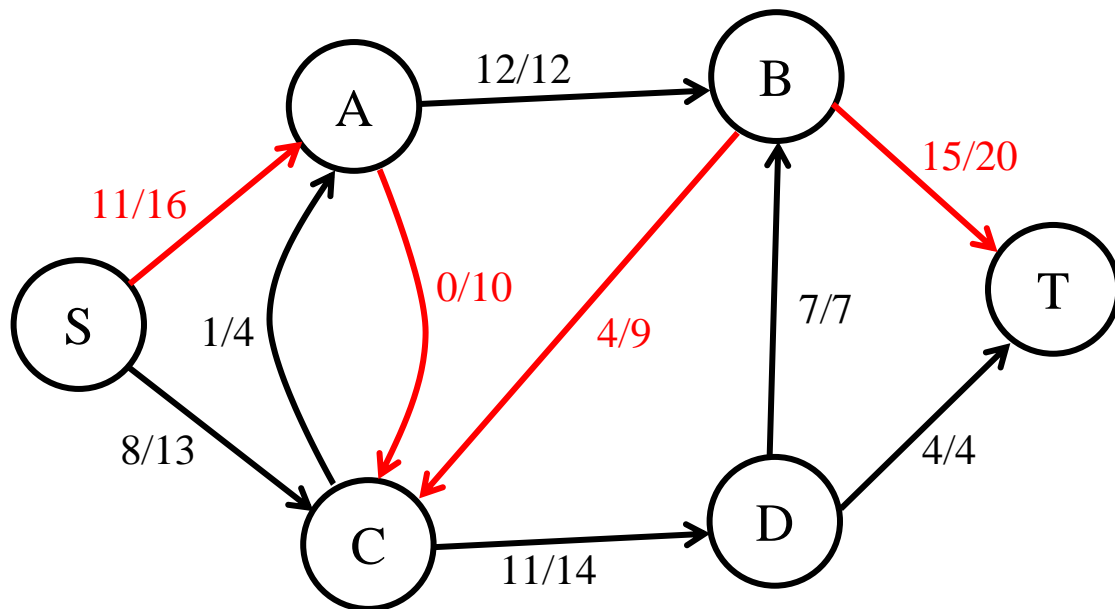


Finding the Maximum Flow in a Flow Network

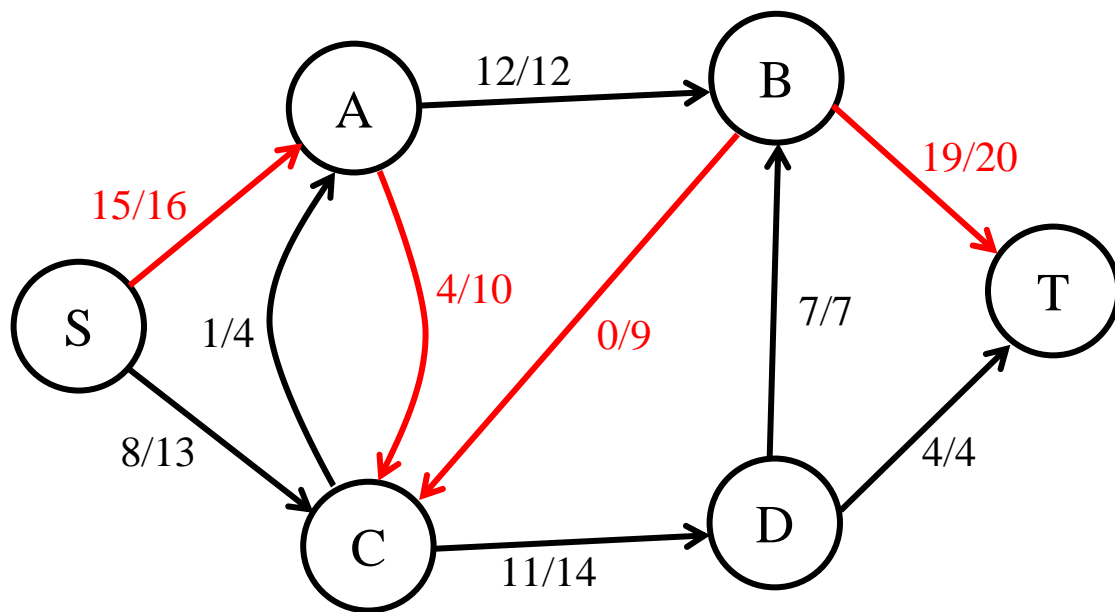
$S \rightarrow A \rightarrow C \rightarrow B \rightarrow T$

The forward edges on this path are SA, AC, and BT.

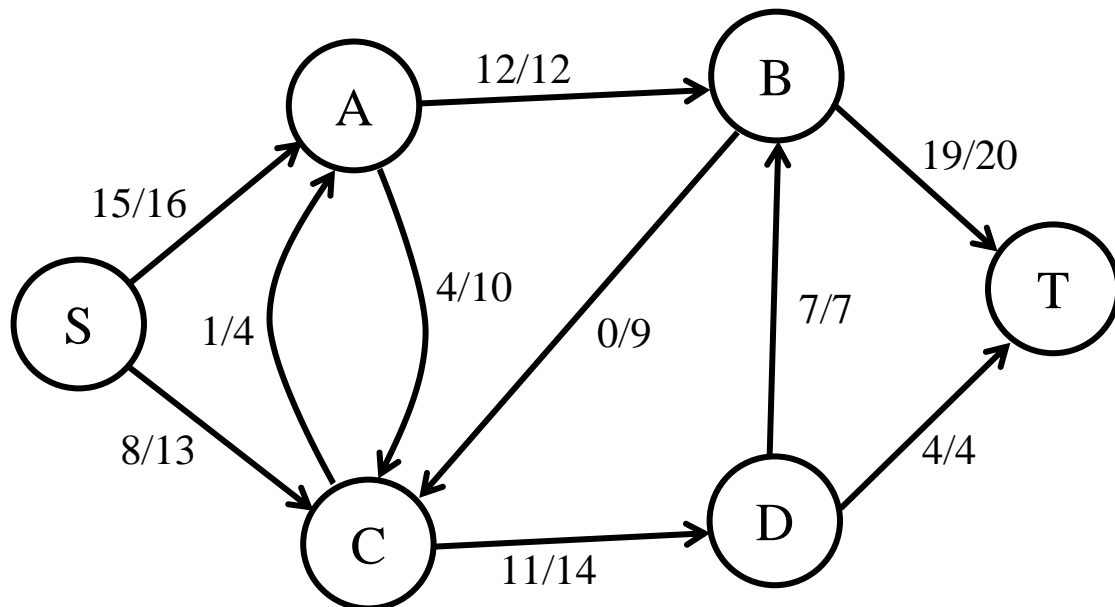
The backward edge is CB.



Now, let's augment this path:

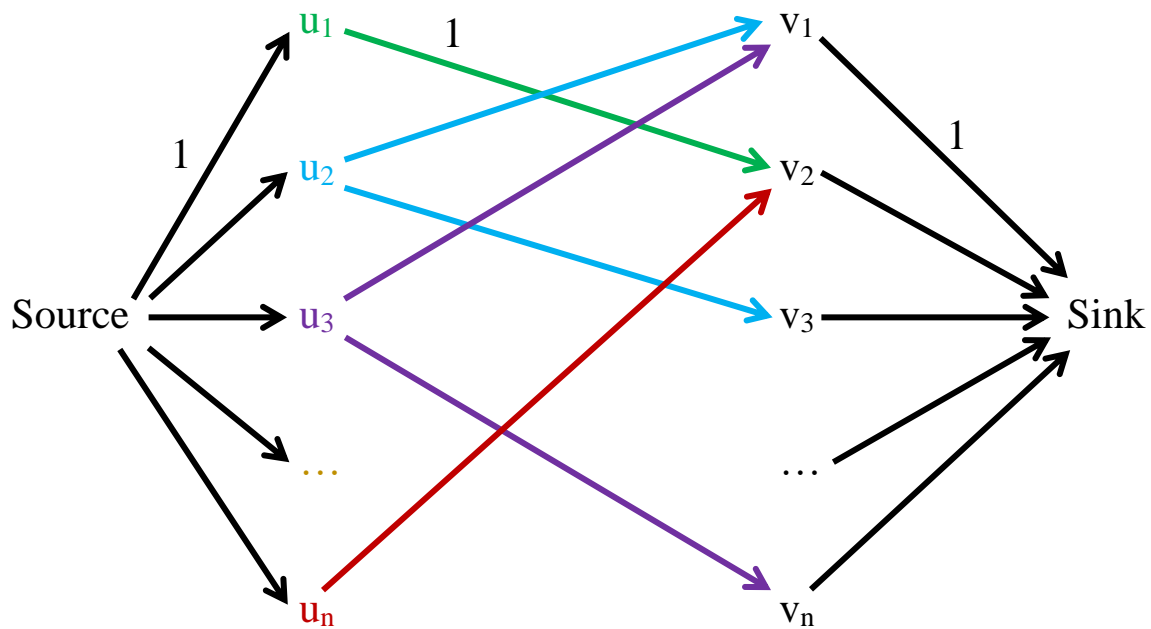


As mentioned before, it is impossible to reach B on an augmenting path since all edges leading to B are at full capacity already.



Applications of Network Flow

Bipartite Matching

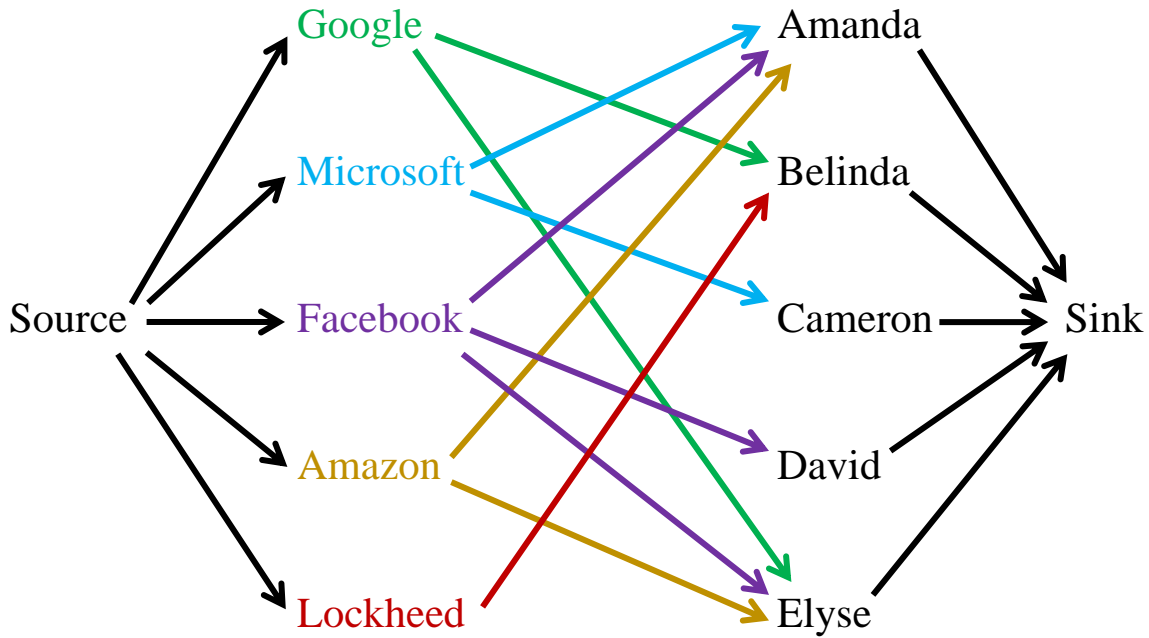


Instance of Bipartite Matching

Set of companies: ...

Set of students: {Amanda, Belinda, Cameron, David, Elyse}

Set of offers: ...

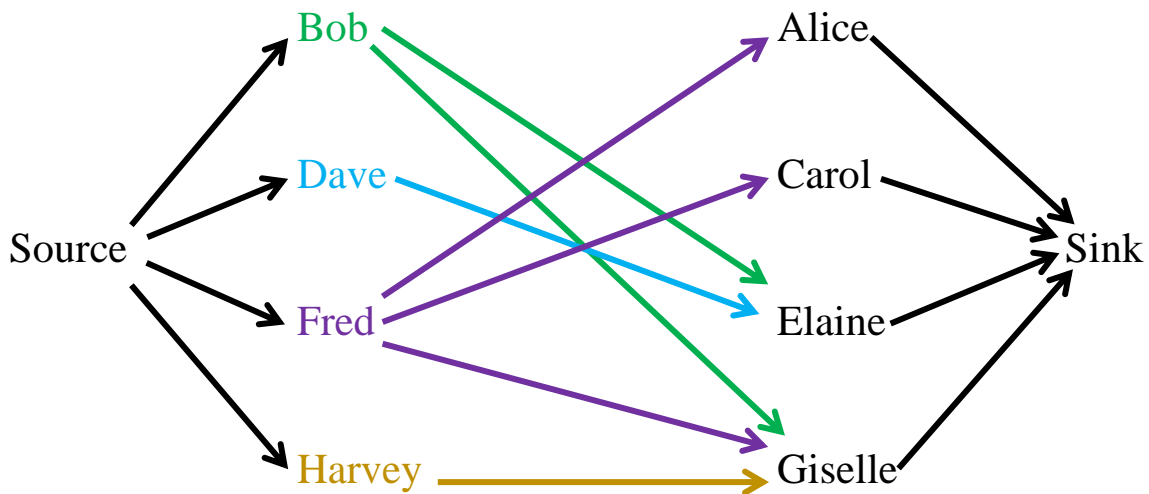


Second Instance of Bipartite Matching

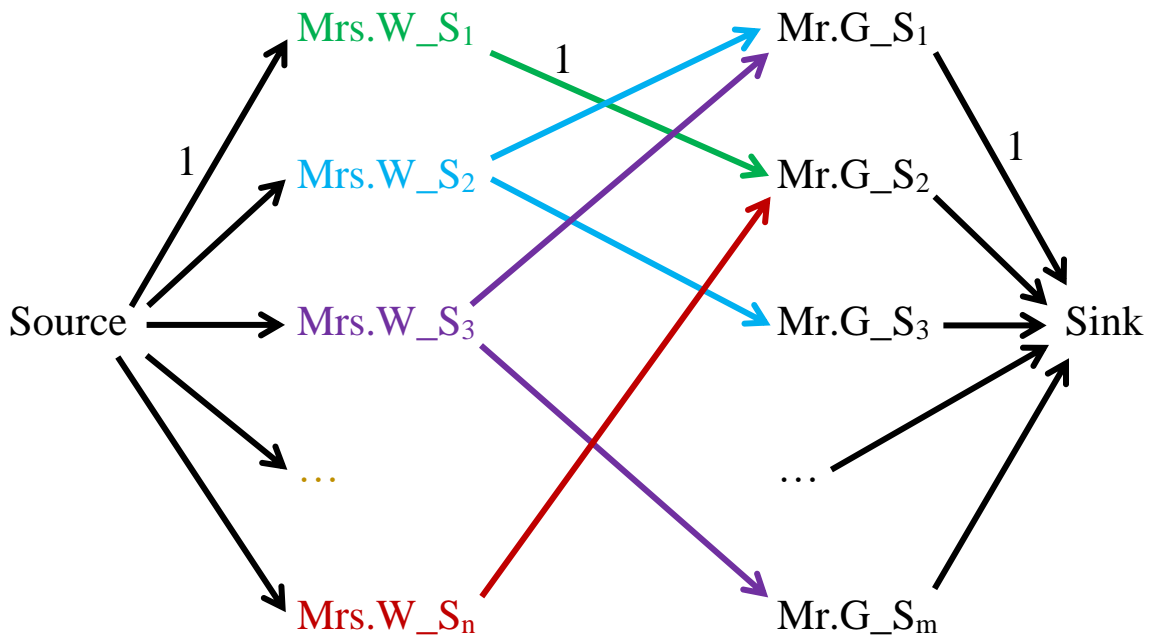
Set of boys: {Bob, Dave, Fred, Harvey}

Set of girls: {Alice, Carol, Elaine, Giselle}

Set of ordered pairs: ...

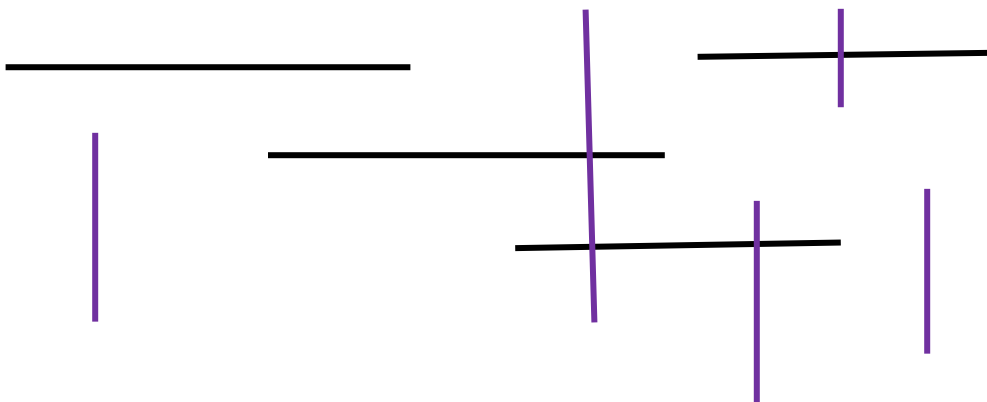


Indirect use of bipartite matching



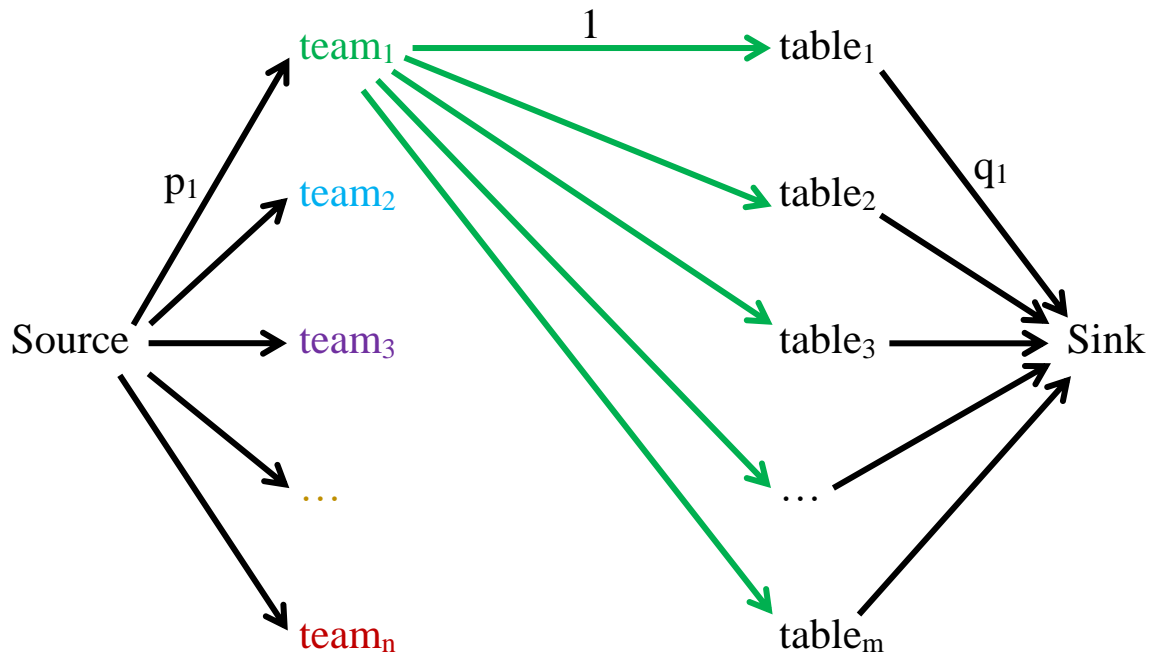
Cow Steeplechase Problem (from USACO) – Utilizes bipartite matching indirectly

... the most number of line segments that mutually don't intersect one another.



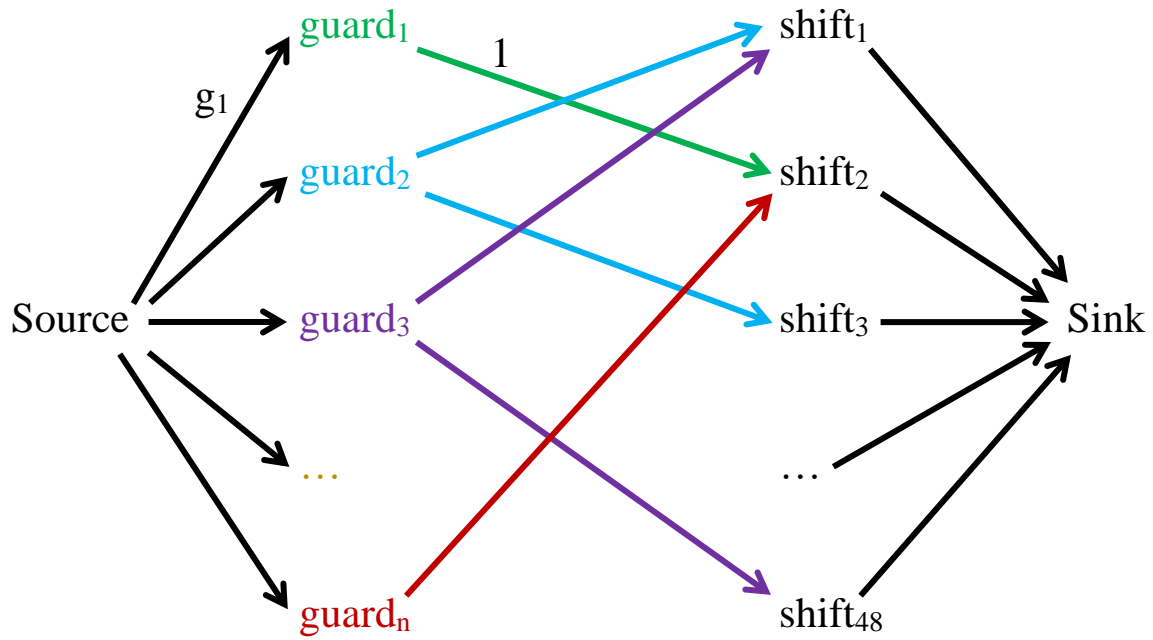
Network Flow for other matching problems

Example Problem: Grand Dinner Problem (from ACMUVA)



Museum Guard Problem: 2009 South East Regional

(picture/graph on the next page)



g_1 : maximum number of shifts $guard_1$ can work