

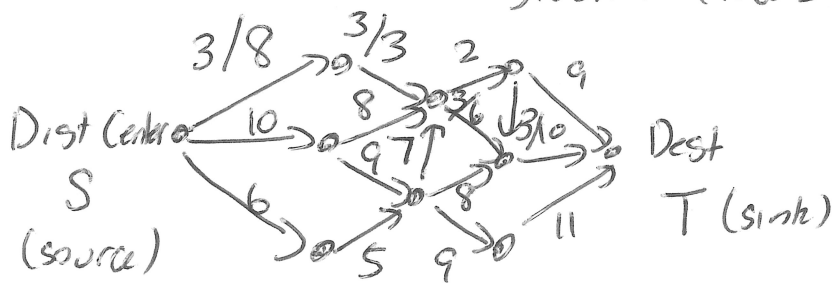
COPUSU 3/11/2025

- ① Slight Changes to Team (Teams - V2)
- ② NO CONTEST FRIDAY  
- Friday (Pre me 10<sup>30</sup> - 11<sup>30</sup> am)
- ③ Network Flow (1st contest after S.B 3/28/28)  
↳ common to use "handpeck" pre-written

Input ① directed GRAPH

② Special vertices labeled source, sink

③ each edge has 2 "weights" assigned to it: flow, capacity. Initially only capacities are given + flows are assumed to be 0.



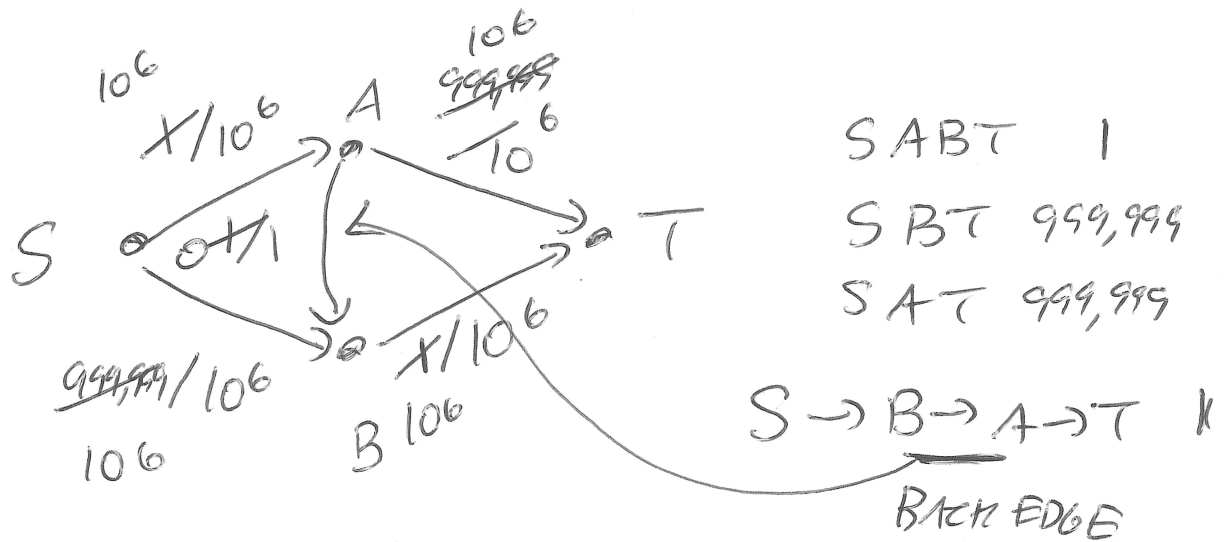
What is maximum amt of flow per unit time we can send through network in a steady state?

Augmenting Path is a single path in network where we can ~~add~~ add additional flow from source to sink.

While there's an augmenting path:

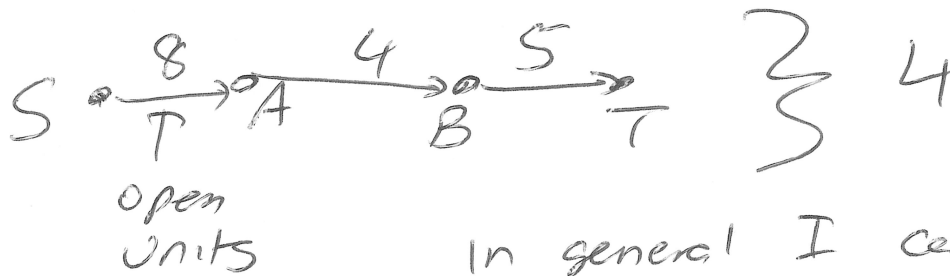
Add 1 specific augmenting path

Augment Paths can have "back-edges"



back edge is subtracting flow currently going forward + redirecting it elsewhere ("fixing mistakes")

Given an augmenting path how much flow can I send through?



In general I can send through  $\min(\text{open}(u,v))$  where edge  $(u,v)$  is on path

$\text{open}(u,v)$  for edge  $u \rightarrow v$  is cap-flow

$\text{open}(u,v)$  for edge  $v \rightarrow u$  is flow

To find augmenting paths use either DFS or BFS.

# 3 ALGS

1) Ford - Fulkerson - DFS

Pros - easy to implement

Cons - not poly time in size graph

2) Edmonds - Karp - BFS

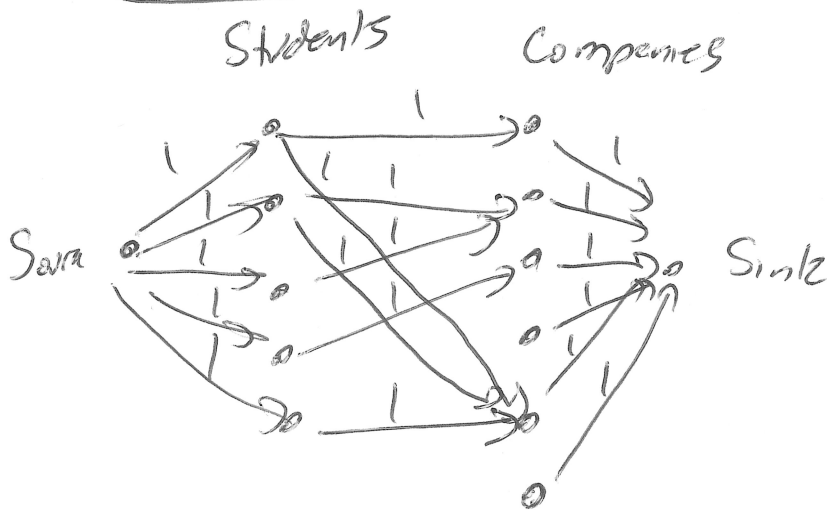
Pros - now poly

Slight Cons - not the fastest we have

3) Dinitz listed as Dinic

While aug paths exist {  
- Runs 1 BFS  
- Runs DFSs capped at this edge length }  
}

## Bipartite Matching



## Simple Changes

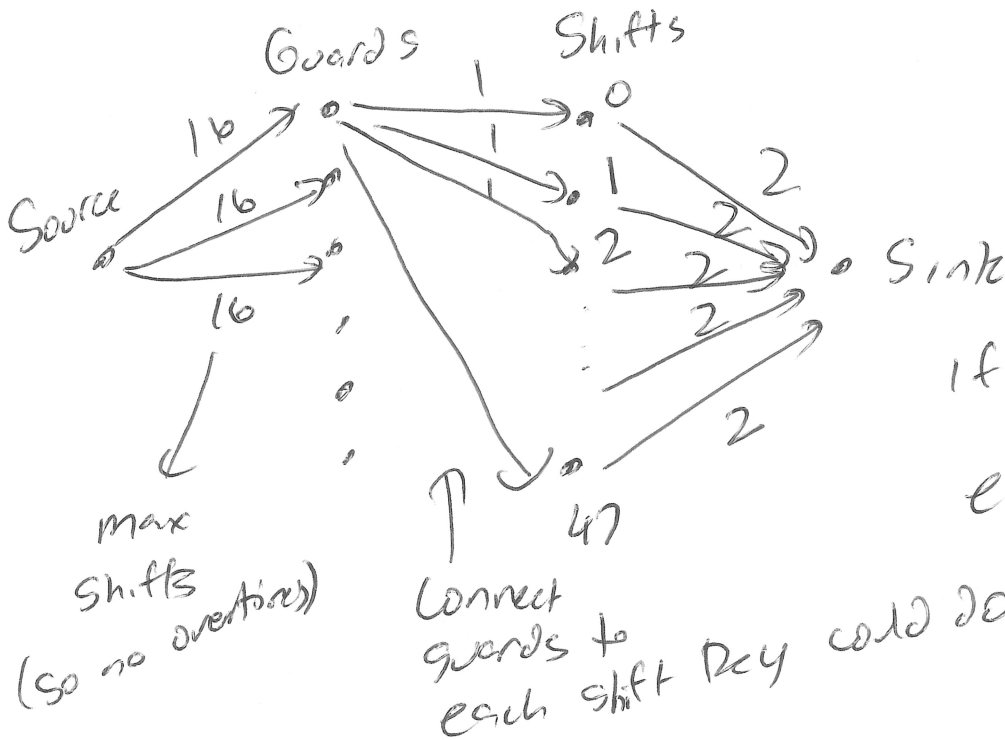
1) Companies can have  $> 1$  slot just change capacities.

# Museum Guards

30 min shifts man museum 24 hrs

each guard has some shifts can work some can't  
every guard max # shift.

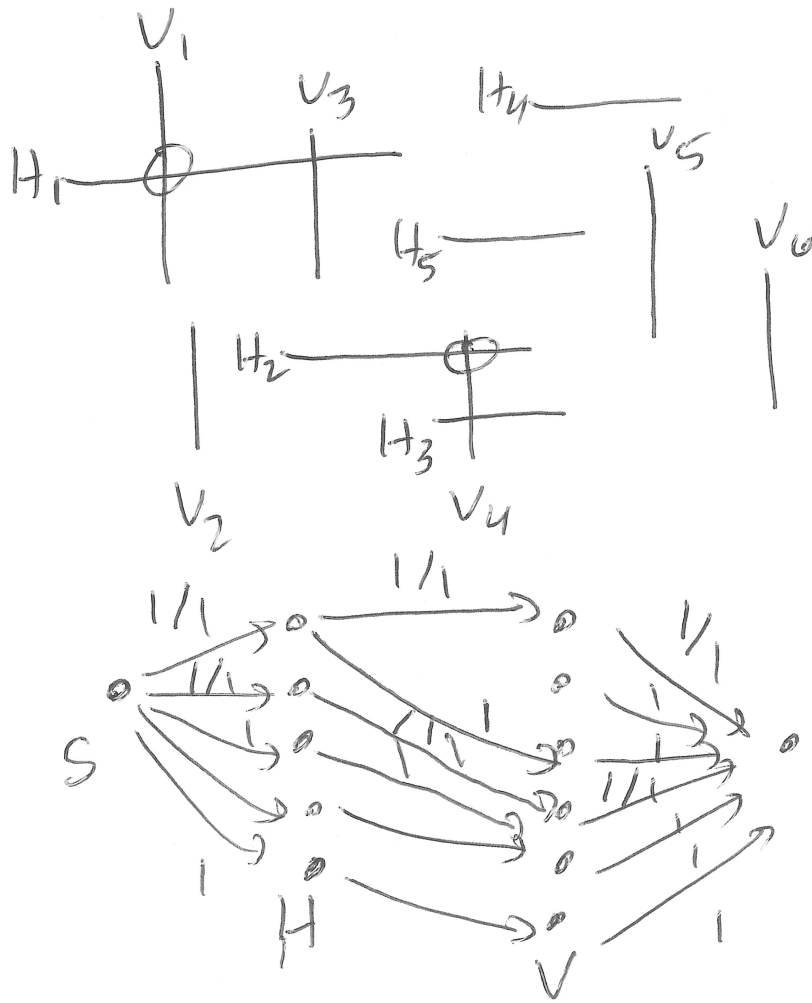
What is the most # guards I can guarantee  
fill 24 hr coverage?  
Is 2 guards possible?



if maxflow == 48 \* 2  
yes  
else  
no

- ① try 1, 2, 3, ... no
- ② Binary search

# Low Span + Steeplechase



Remove fewest  
# of line segs  
so that there's  
no intersection

T max flow = 2