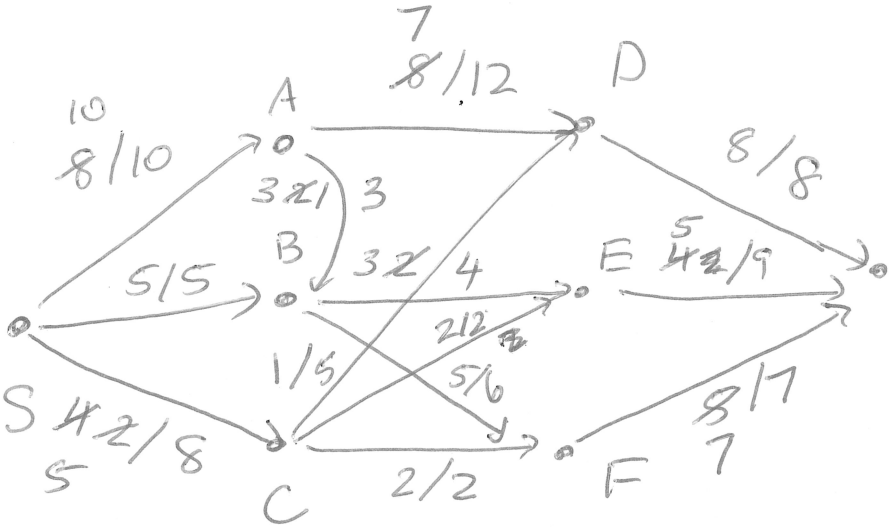
COP 3503 3/7/2024

Network Flow



Directed
Weighted
S - source
only has outgoing
edges
T - sink
only has incoming
edges

edge weights = capacities (max amt stuff flow through per unit of time)

Max Flow network = max units stuff/unit of time that can go from S to T.

How to find?

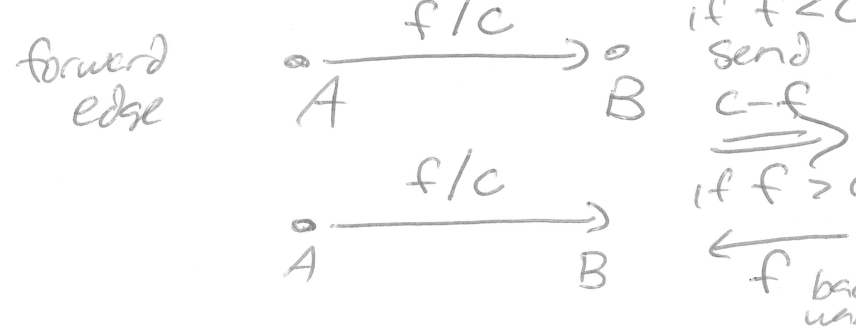
MOST ALGS LOOK LIKE THIS

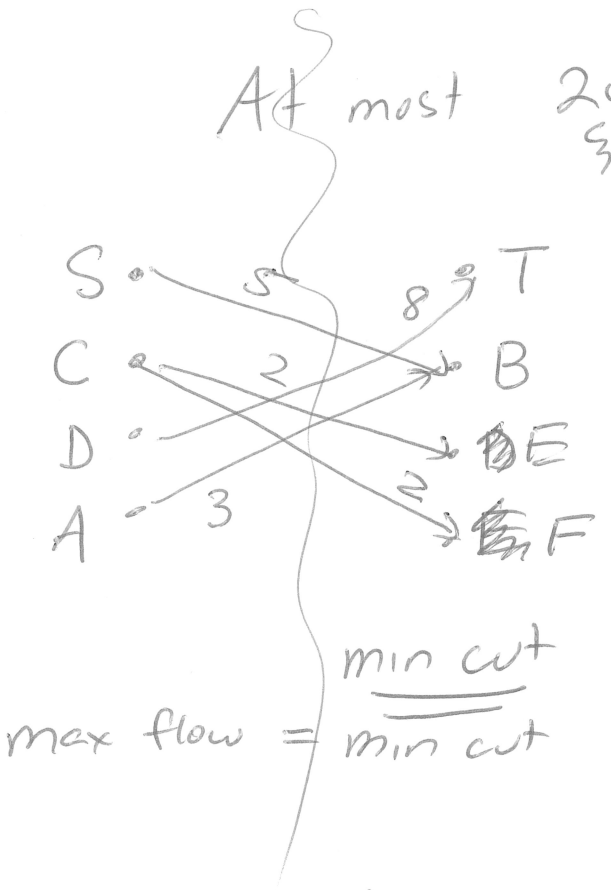
While (we can send more flow)
this is an augmenting path
⟹ Send max flow down that path.

SADT →	8
SBFT →	5
SABET →	2
SCFT →	2
SCET →	2
SCDABET →	1
	20

SEARCH S, C, D, A, STOPS

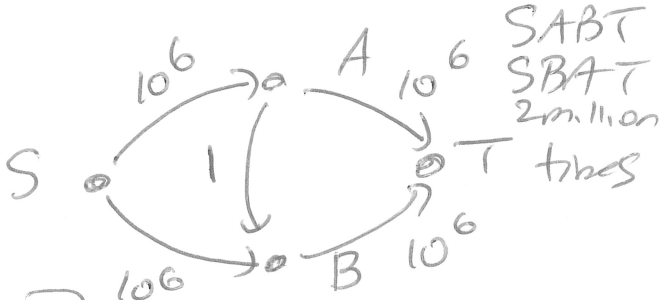
AUGMENTING PATHS





~~A cut~~

A cut is a partition of the vertices w/ S in one set, T in the other. The value of a cut is the sum of capacities of all edges from S's set to T's set.



3 ALGS

1) ~~Folk~~ Ford-Fulkerson - DFS } not poly time

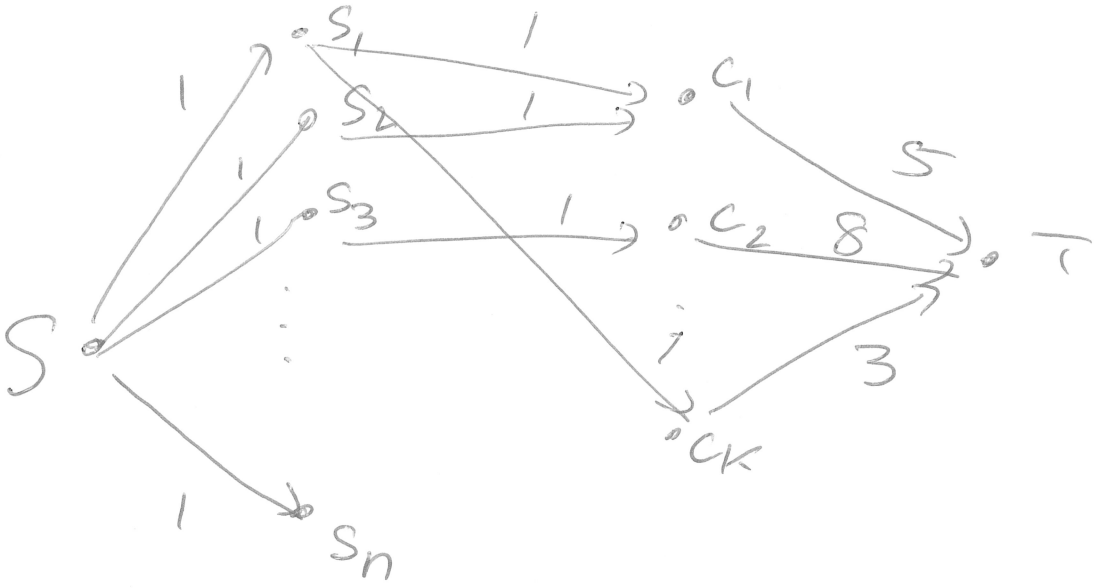
2) Edmonds-Karp - BFS } → finish in poly times

3) Dinic's (Dinitz)

while aug path { 1 BFS ⟹ DFS stops at length of BFS

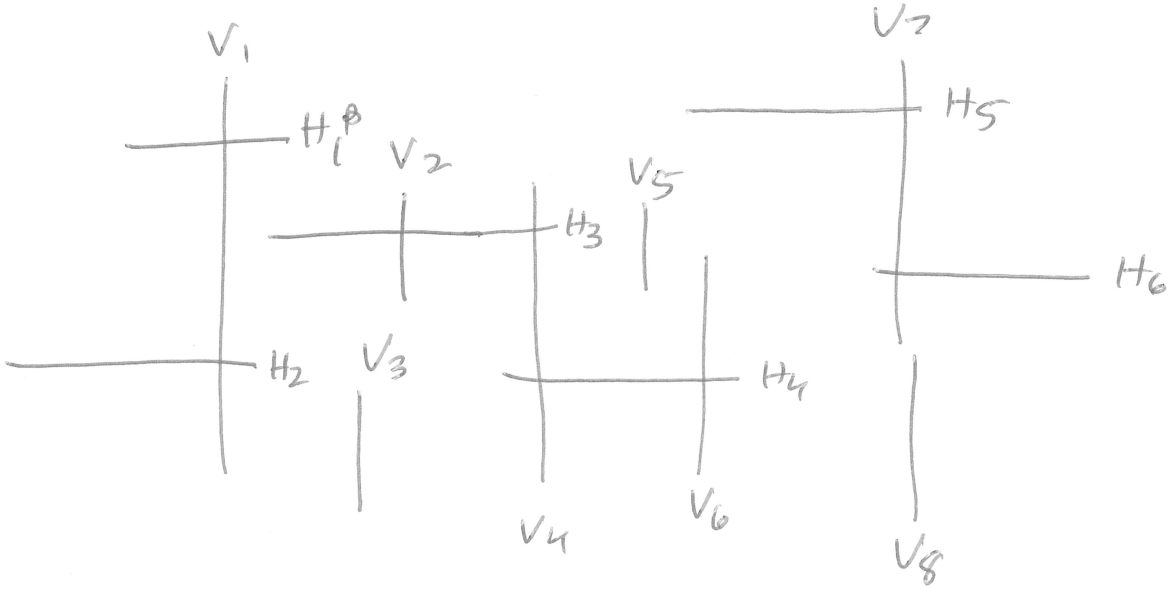
(1) Few Applications

(2) Walk Through Posted Code

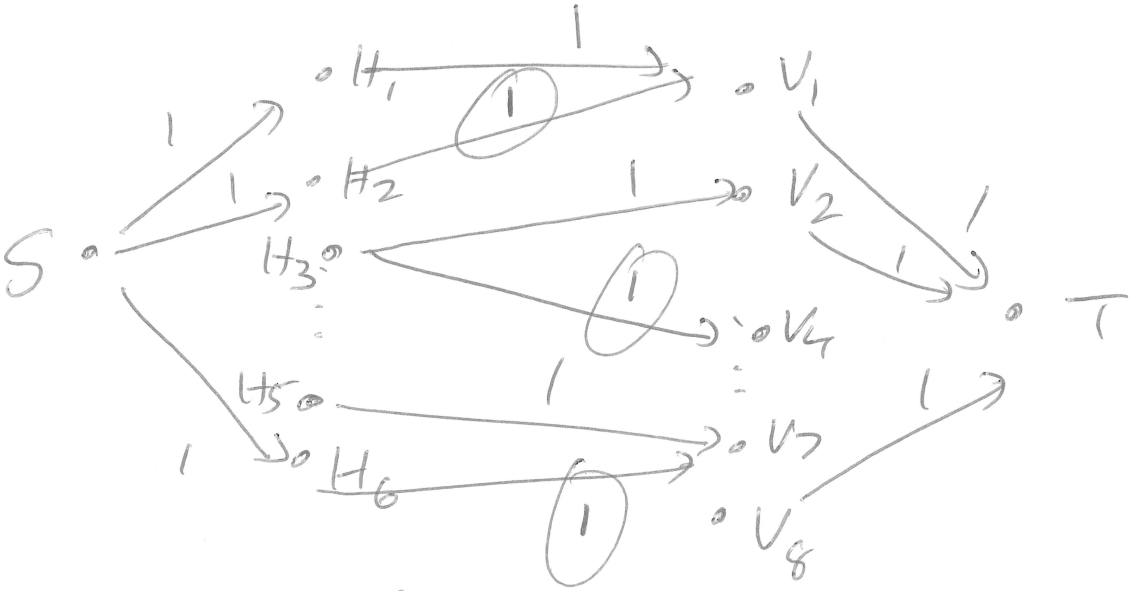


max flow = max # students who could get internships

Cow Steeplechase

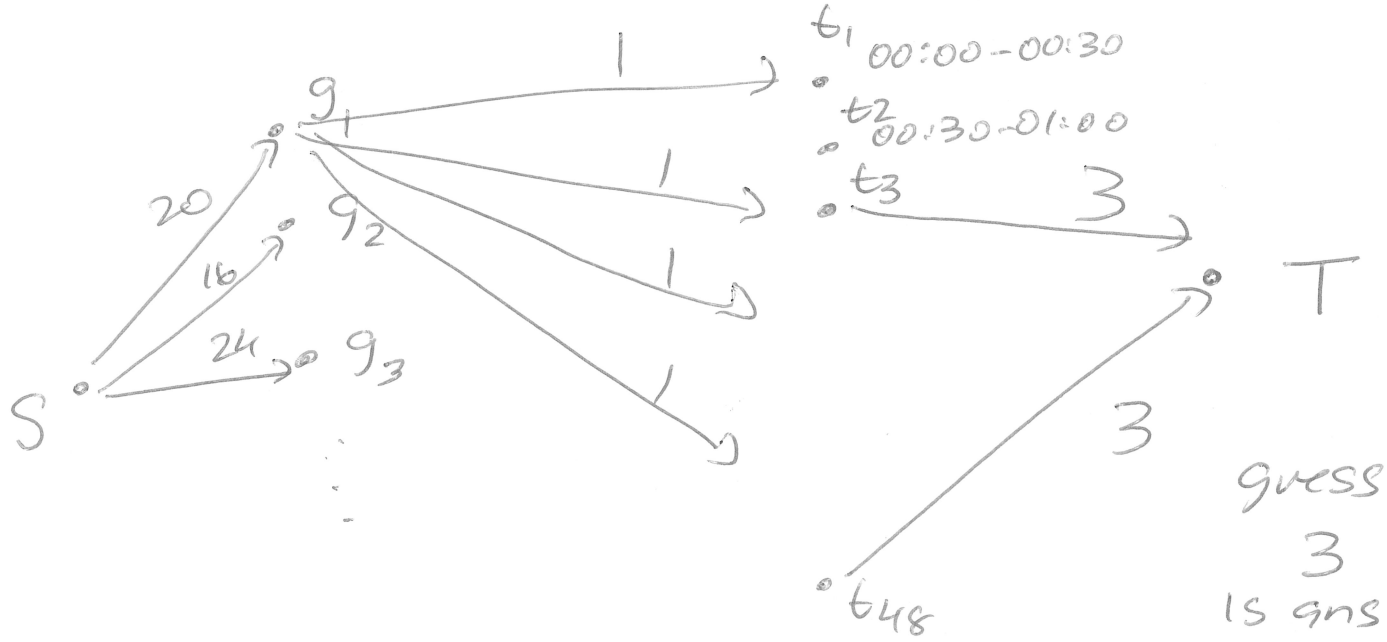


What is the fewest # of line segments I need to remove so no 2 line segment intersect?



max flow represents the # of ordered pairs where we are forced to remove one line segment.

Museum Guards



run max flow $\Rightarrow$ if ans = 3×48 then it's possible to use 3 guards

Binary Search the correct ans if flow works ans ≥ tried, else ans < tried