



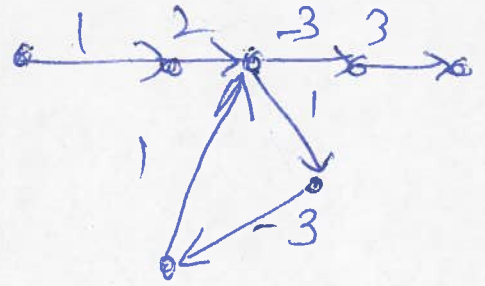
# Shortest Path problem

Input: Directed graph  
 $G = (V, E)$

$\forall e \in E, c_e \in \mathbb{Z}$   
 (Note  $c_e < 0$ )  
 is allowed  
 with NO  
 -ve cycle.

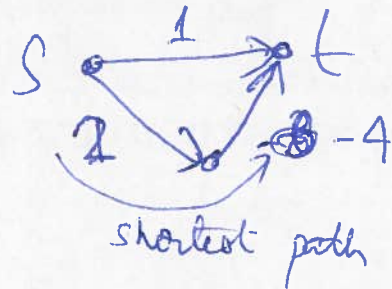
A cycle<sup>c</sup> is -ve cycle

$$\sum_{e \in C} c_e < 0$$



Output: All s-t shortest paths  $\forall s \in V$   
 (cost of path  $P = \sum_{e \in P} c_e$ )

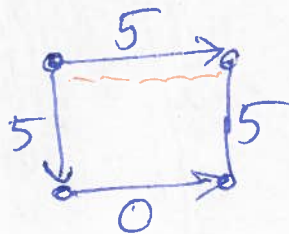
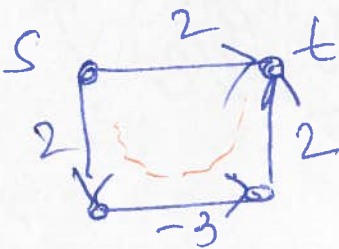
Dijkstra doesn't work:



Dijkstra:  
 pick  
 (s, t)

Algo 2: Add large ~~not~~ cost  $M$  to all edges

$$c'_e = c_e + M \geq 0 \quad \forall e \in E$$



-----: shortest path (not same!)