

Graph Coloring by 3  $\in$  NP-Complete (GC3)

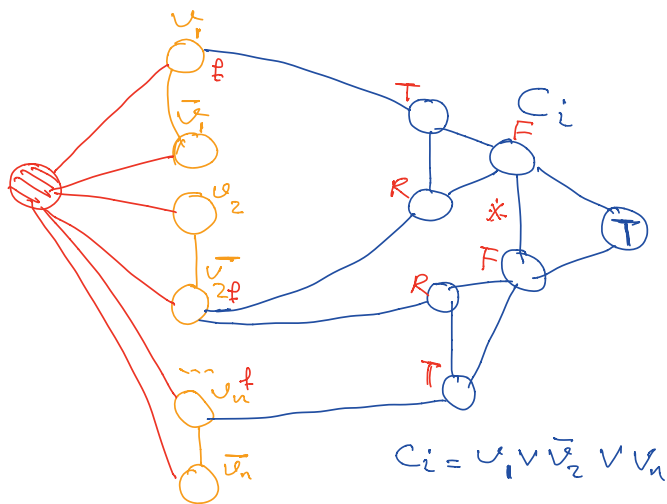
① GC3  $\in$  NP  $\checkmark$   $O(n+m)$

② Reduction

$3SAT \leq_p GC3$



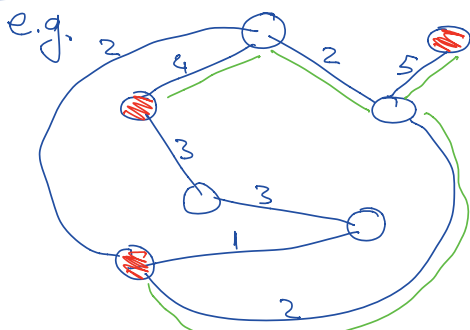
Colors: {Red, True, false}



Min. Steiner Tree

Given a weighted Graph  $G(V, E)$  and a Set  $S \subseteq V$ ,

Find the tree w/t min weight that includes all nodes in S



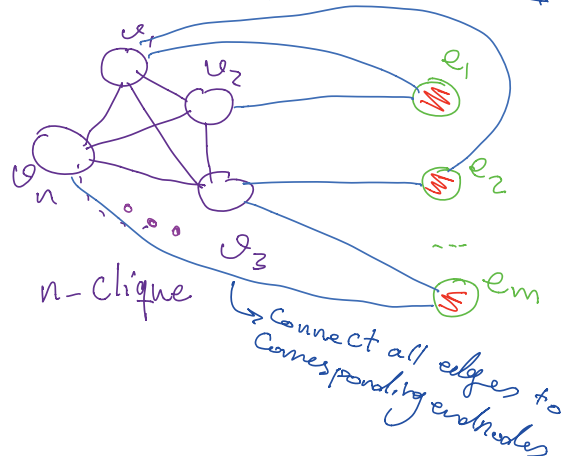
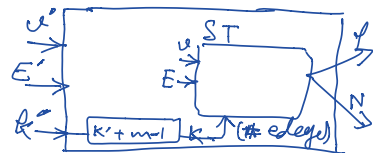
Steiner Tree: Green edges

Min Spanning Tree

Given a weighted graph  $G(V, E)$  find Spanning Tree (That Contains all nodes, and has the min weight)

Step 2: Reduction

$V-C \leq_p ST$



Steiner Tree  $\in$  NP-Complete

Step 1:

ST  $\in$  NP

Given a Certificate (Tree) check if it includes all nodes in  $S$ ,  $|Tree| \leq k$

$O(n) \checkmark$