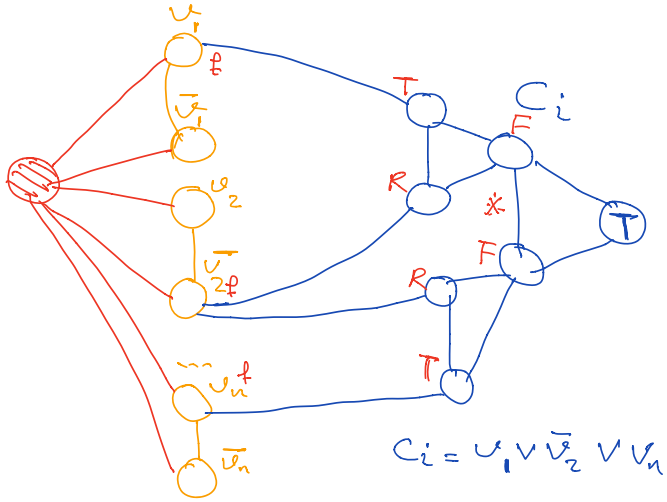
Graph Coloring by 3 $\in$ NP-Complete (GC3)

Colors = {Red, True, false}?

① GC3 $\in$ NP ✓ $O(n+m)$

② Reduction

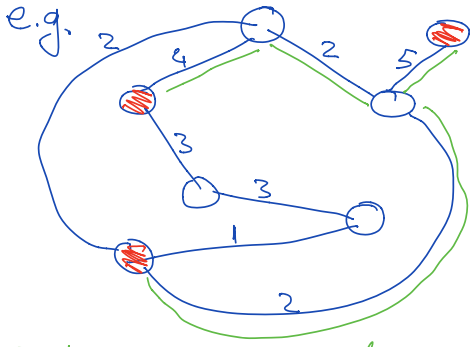
3SAT $\leq_p$ GC3



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

e.g.



Steiner Tree: Green edges

Steiner Tree $\in$ NP-Complete

Step 1:

ST $\in$ NP

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

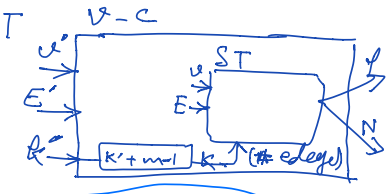
$O(n)$ ✓

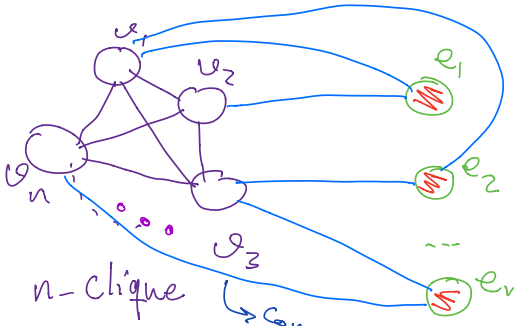
Min Spanning Tree

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



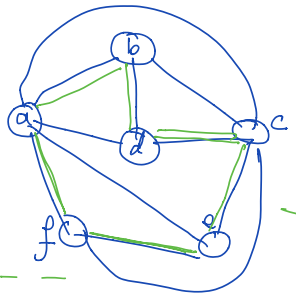


Hamiltonian Cycle (H-C)

Given a graph $G(V, E)$

Is there a Simple Cycle that passes through all nodes

e.g.



→ Yes

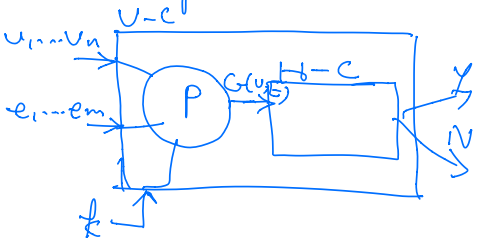
H-C ∈ NP-Complete

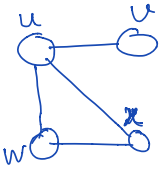
Step 1: H-C ∈ NP

given a Certificate (a sequence of nodes), if it is a H-C ← $O(n)$

Step 2: Reduction

V-C $\leq_p$ H-C





V-C of 2

$\forall (u, v) \in E$