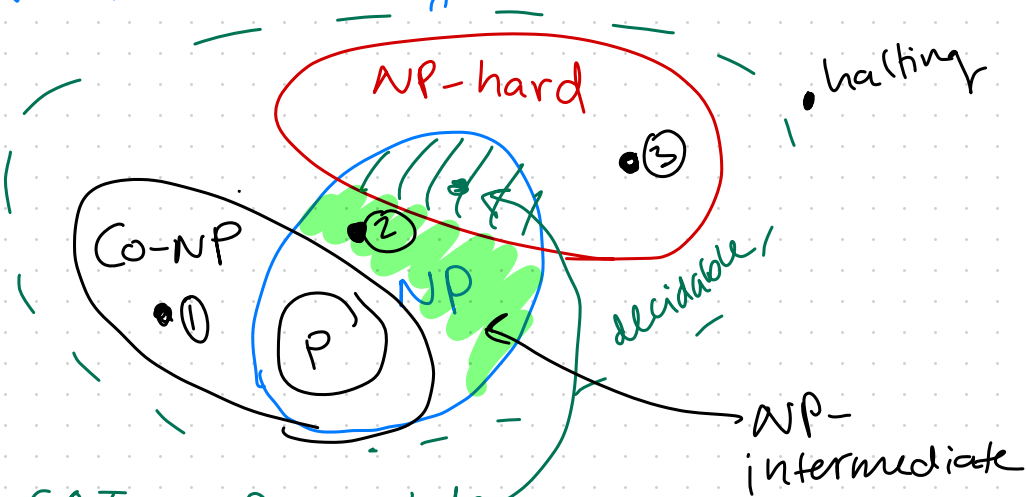


P = the set of all problems that can be solved in polytime

NP = the set of problems that can be verified in polytime



ex: 3SAT \in NP-complete

NP-complete: the set of problems that are NP-hard and in NP.

Co-NP: problems whose "no" answers can be verified in polytime

Problem X is NP-hard:

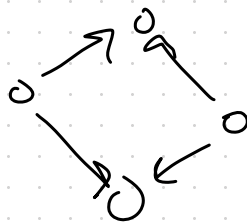
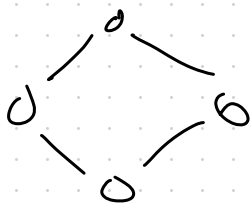
Solving X in polytime $\Rightarrow P = NP$
or equivalently

there is a polytime reduction from SAT to X

or some other known NP-hard prob

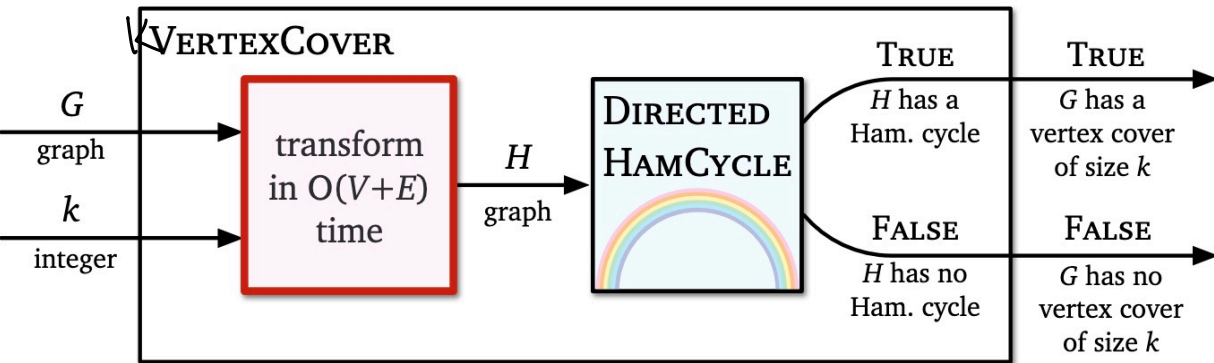
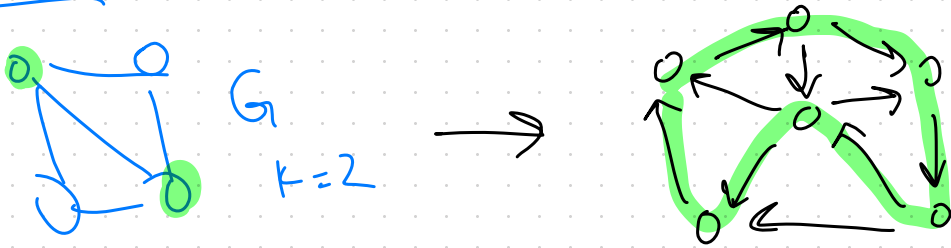
- use internet to find a problem on your dot
- write down:
 - explain what probs there are like
 - what you found

MaxIndSet \in NP-hard but \notin NP
by reduction from KIndSet



claim Directed Hamiltonian cycle is NP-hard.

Proof: we reduce from k -Vertex cover.



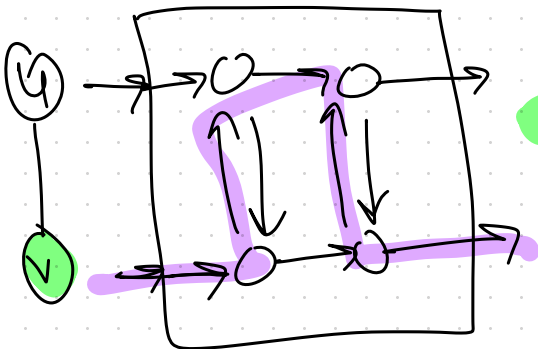
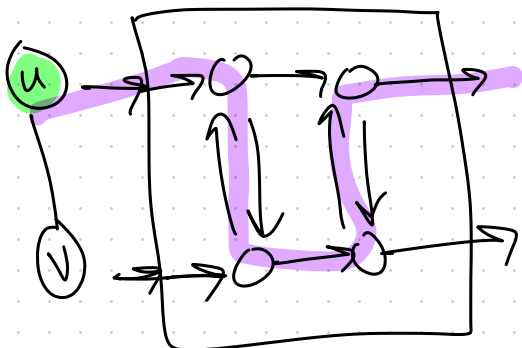
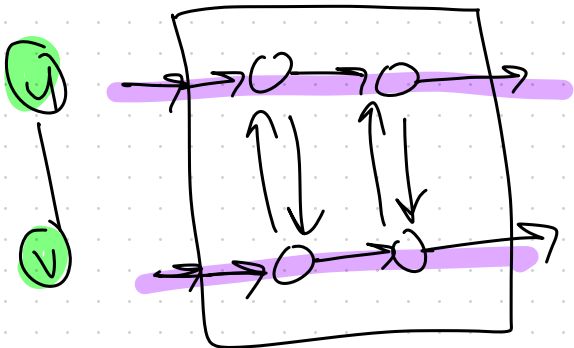
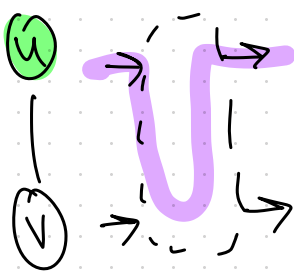
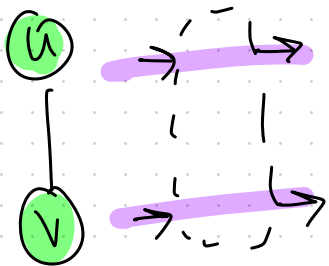
Given an instance G, k of k -VERTEXCOVER, transform G into H as follows.

We will create

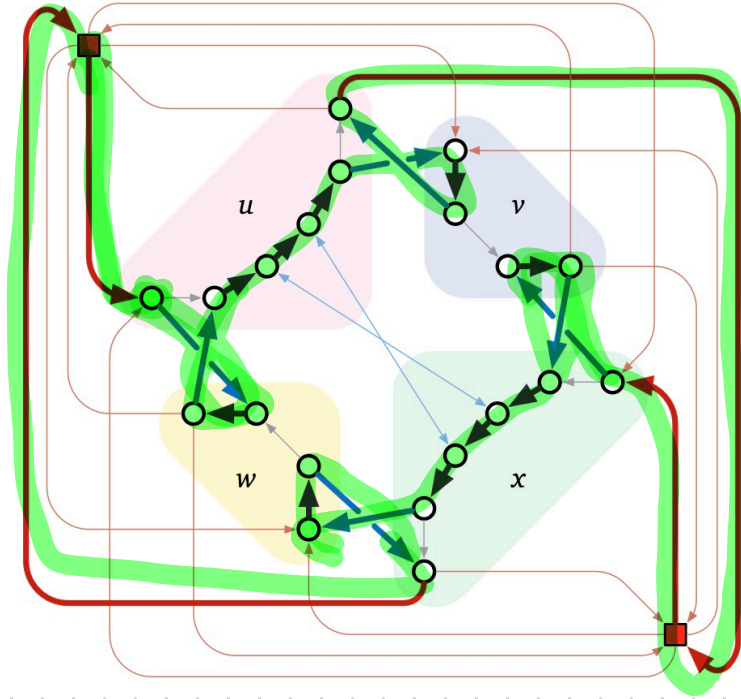
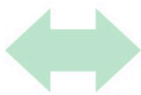
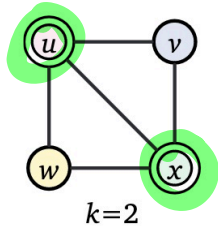
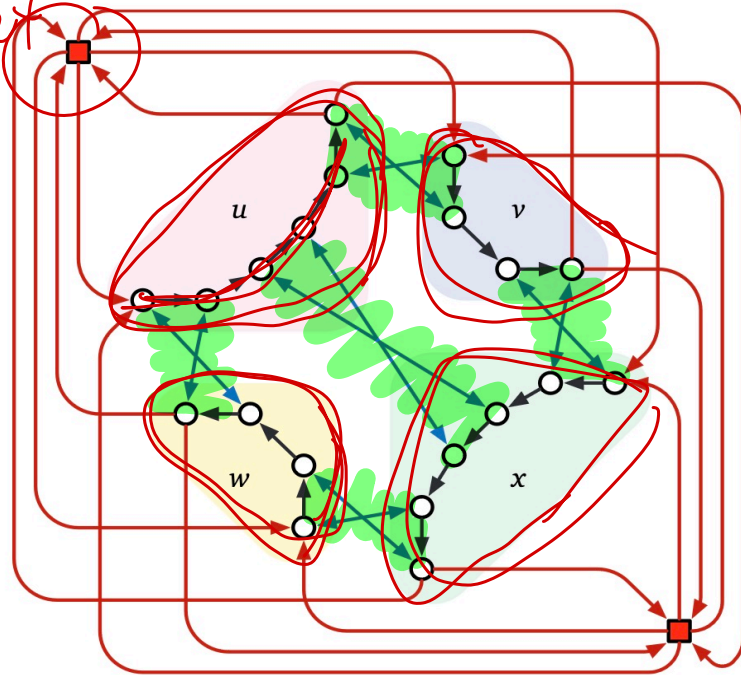
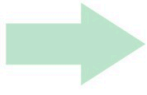
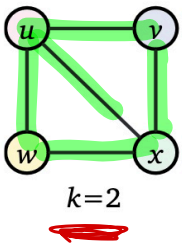
vertex gadgets

edge gadgets

edge gadgets:



Cover vertex



G has a size k Vertex Cover

\Leftrightarrow

H has a directed Ham Cycle