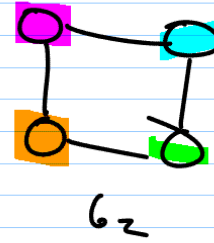
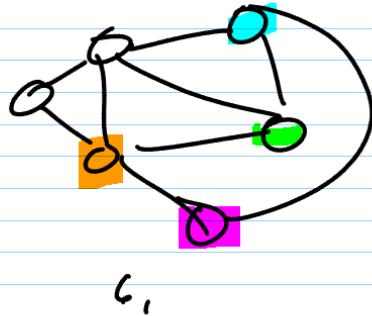


SUBGRAPH-ISOMORPHISM: Given G_1, G_2 , is G_2 isomorphic to subgraph of G_1 ?

Ex:



YES

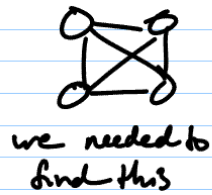
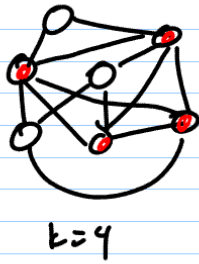
S-G is NP-c

- 1) S-G \in NP : certificate to map from V_{G_2} to V_{G_1} - can check isomorphism in P time
- 2) reduce some known NP-c to S-G

CLIQUE \leq_p SUBGRAPH-ISO

[need to given $\langle G, k \rangle$ construct $\langle G_1, G_2 \rangle$]

S.t. G has a k -clique iff G_2 is a subset of G_1]



Given $\langle G, k \rangle$

let $G_1 = G$

$G_2 = k$ -clique

now G has k -clique

G_2 is a subset of G_1

SET-PARTITION: Given set S of n integers, can S be split into two sets w/ equal sums?

$\{1, 2, 6, 10\}$ NO

$\{1, 2, 3, 4, 5, 6, 7, 14\}$ YES

Assume SET PARTITION is NP-complete

SUBSET-SUM: Given set S of integers, and k ,
is there a subset of S that sums to k ?

SUBSET SUM is NP-complete

1) $SS \in NP$: Evidence is the subset; can check sum in poly time

2) can use SET-PARTITION or VERTEX COVER

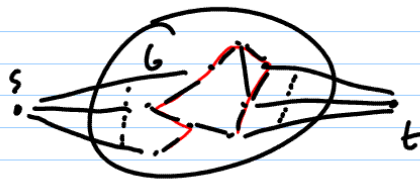
(s-t) HP: Given $G, s, t \in V_G$, there is a HP between them?

(s-t) HP is NP-complete

1) (s-t) HP \in NP: evidence is HP $s \rightarrow t$
can be verified to be a HP in poly time

2) HP \leq_p (s-t) HP

[Given G , we need G', s, t s.t. G has HP
(and need to be able to make G' , pick s, t
in poly time) $G' \text{ has HP } s \rightarrow t$]

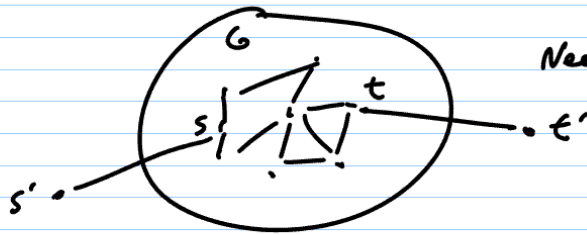


Suppose $(s-t)$ HP is NP-c (but we don't know HP is NP-c)

HP is NP-c

1) $HP \in NP$

2) $(s-t) HP \in_p HP$



Need G' s.t. G has HP $s \rightarrow t$

\Downarrow
 G' has HP