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**COL 351: Analysis and Design of Algorithms****Instructor:** Ragesh Jaiswal

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1. Consider the following problem:

CLIQUE: Given a graph  $G$  and an integer  $k$ , determine whether  $G$  has a *clique* of size at least  $k$ . A clique in a graph is a subset of vertices such that all pair of vertices in the subset are connected with an edge.

Show that INDEPENDENT-SET  $\leq_p$  CLIQUE.

2. Consider the following problem:

MAX-INDEPENDENT-SET-SEARCH: Given a graph  $G$  find an independent set of  $G$  with maximum cardinality.

Recall, in the lecture, we showed that MAX-INDEPENDENT-SET  $\leq_p$  INDEPENDENT-SET. The MAX-INDEPENDENT-SET problem was the following: given a graph  $G$ , find the size of the maximum independent set of  $G$ .

Show that MAX-INDEPENDENT-SET-SEARCH  $\leq_p$  INDEPENDENT-SET.

3. (*Search 3-SAT*) Suppose you are given an algorithm  $A$  for solving the 3-SAT problem. Can you use this algorithm to design another algorithm that finds a satisfying assignment if there exists one?
4. (*2-SAT*) Recall, we said in the lecture that 2-SAT is easy. Design an efficient algorithm for solving the 2-SAT problem. Why doesn't ideas for solving the 2-SAT problem extend to the 3-SAT problem.