

CS3230 : Tutorial - 10

Rahul Jain

30/31-Oct-2012

Please drop your answer sheets in Bakh's office by 1 pm Tuesday, 30th October, 2012.

1. Show that Independent-Set \leq_P Set-Packing. Independent-Set is as defined in lecture notes and Set-Packing is defined as below:

Given a set U of n elements, a collection S_1, \dots, S_m of subsets of U , and a number k , does there exist a collection of at least k of these sets with the property that no two of them intersect.

2. Show that the Hitting-Set problem (defined as below) is NP-complete.

Given a set U of n elements, a collection S_1, \dots, S_m of subsets of U , and a number k , does there exist a hitting set $H \subseteq U$ for collection S_1, \dots, S_m so that H is of size at most k ? We say that H is a hitting set for collection S_1, \dots, S_m if $H \cap S_i$ is not empty for each $i \in \{1, \dots, m\}$.

3. Given a monotone instance of Satisfiability (that is the input formula has no negated variable in any clause, for example $(x_1 \vee x_2) \wedge (x_1 \vee x_5) \wedge (x_6 \vee x_8)$), together with a number k , the problem of *Monotone satisfiability with few true variables* asks : Is there a satisfying assignment for the input instance in which at most k variables are set to true? (Note that a monotone instance of Satisfiability is always satisfiable.)

Prove that Monotone satisfiability with few true variables is NP-complete.

4. Show that the following Path-Selection problem is NP-complete.

Given a directed graph $G = (V, E)$, a set of paths P_1, P_2, \dots, P_c (in G) and a number k , is it possible to select at least k of the paths so that no two of the selected paths share any nodes?