

Homework 6: NP-Hard Problems

*Due 11/12/13, at the start of class**UCSB 2013*

Instructions: Choose **one** of the problems below, and work on it until either:

1. You solve the problem, or
2. You have spent about 90 minutes working seriously on the problem.

Homework Problems

1. In class, we claimed that 3SAT was in NP. Prove this.
2. Similarly, we claimed that k -clique and k -independent set were in NP. Prove this.
3. A boolean formula is said to be in **2-conjunctive normal form** if we can write it in conjunctive normal form, where each disjunction (or) contains precisely two literals. For example, the following formula is in 3-conjunctive normal form:

$$(x \vee y) \wedge (\neg x \vee x) \wedge (a \vee a).$$

2SAT is the following problem: given any boolean formula written in 2-conjunctive normal form, is it satisfiable?

Prove that 2SAT is in P. (Yes, P, as in polynomial. Not NP. 2 is a weird number.)

4. Take your favorite one of the five problems from the past problem set. Show that it is NP-complete, if possible.
5. In class, we defined the traveling salesman problem. Prove that the traveling salesman problem is NP-complete.