Algorithms and Complexity
2016
Extra Mästarprov 2: Complexity

This test is given to students who failed to get E on the ordinary Mästarprov 2. It consists of two problems. If both problems are solved correctly (basically) the test gives grade E. Your solutions should be handed in latest May 27th 16.00. No collaboration is allowed.

1. A variant of subset sum The normal subset sum problem can be stated in this form: Given a set $\{a_1, a_2, ..., a_n\}$ of positive integers and an integer M, is it possible to find a set $\{e_1, e_2, ..., e_n\}$ where $e_i \in \{0, 1\}$ such that $\sum_i^n e_i a_i = M$? Now we change the problem so that instead of $e_i \in \{0, 1\}$ we demand that $e_i \in \{0, 2\}$. We can call this problem DOUBLE SUBSET SUM. Show how we can reduce SUBSET SUM to DOUBLE SUBSET SUM. Then show how to reduce DOUBLE SUBSET SUM to SUBSET SUM. Which one of the reductions show that DOUBLE SUBSET SUM is NP-Hard?

2. Competent teachers
Let us assume that we have a set of n teachers and a set of m courses. All teachers have competence for teaching certain of the courses. Let us assume that we have list L_i which tells us what courses teacher i can teach. Let us formulate the problem COMPETENT TEACHERS as the problem of, given n, m, n lists $L_1, ..., L_n$ giving the teachers competences and a number K, to decide if there is a group of K teacher such that every course can be taught by at least one teacher in the group. Show that this problem is NP-hard by reducing VERTEX COVER to this problem.