McGill University COMP360 Winter 2011 **Instructor: Phuong Nguyen**

Assignment 3

Due January 31 at the beginning of lecture

The work you submit must be your own. You may discuss problems with each others; however, you should prepare written solutions alone. Copying assignments is a serious academic offense, and will be dealt with accordingly.

Question 1 Show that the problem (called A1P2) from Assignment 1 is NP-complete by many-one reducing one of the following problem to it:

3CNF-SAT, CLIQUE, 3-COL, IND (Independent set), SubsetSum

Clearly specify which problem you use, describe the transformation, and prove the correctness of the reduction.

Question 2 Show that the problem Knapsack (see below) is NP-complete by many-one reducing one of the following problem to it:

3CNF-SAT, CLIQUE, 3-COL, IND, SubsetSum, A1P2

Clearly specify which problem you use, describe the transformation, and prove the correctness of the reduction.

For sake of completeness, here is our version of the Knapsack problem.

Input: A weighted set where the i-th element (or item) has weight w_i and value v_i:

$$S = \{(w_1, v_1), (w_2, v_2), \ldots, (w_n, v_n)\}$$

and an upper bound W for the total weight and a target V for the total value.

All numbers are written in binary.

Question: The question is whether there is a set of items in S with total weight $\leq W$ and total value $\geq V$.