

### CMSC 451: Homework 4, Spring 2002

Due at the beginning of class on April 18, 2002.

If you cannot come up with algorithms that run in the required time, then provide (correct) slower algorithms for partial credit. Write your answers using *pseudo-code* in the same style as the textbook. These make the algorithm description precise, and easy to read (as opposed to code in C or some other language).

1. Suppose that you are given an algorithm as a *black box* — you cannot see how it is designed — that has the following properties: if you input any set of integers  $A = \{r_1, r_2, \dots, r_m\}$  and an integer  $k$ , the algorithm will answer “yes” or “no”, indicating whether there is a subset of the numbers  $A$  whose sum is exactly  $k$ . Given a set  $B$  of  $n$  elements and an integer  $t$ , show how to use this black box to find a subset of  $B$  whose sum is  $t$ , if such a subset exists. You should use the black box  $O(n)$  times.
2. Let  $x_1, x_2, \dots, x_n$  be a set of non-negative integers, and let  $S = \sum_{i=1}^n x_i$ . Design an algorithm to partition the set into two subsets of equal sum, or determine that it is impossible to do so. The algorithm should run in time  $O(nS)$ .
3. Planning a company party: problem 15-4 in page 367 of the textbook.