CSC 551:Spring 2012

Homework 3: Greedy Alorithms

Due at the start of class Thursday, March 15. You are allowed to do this homework individually, or in groups of two. Each group will return a single homework and will get the same grade. But a group is NOT allowed to share anything written with another group. Remember that each group member has to fully participate in the solution and understand the solution to perform well in an exam.

Problem 1. Consider the following problem. The input consists of n skiers with heights $p_1, p_2, \ldots, p_n$, and n skies with heights $s_1, s_2, \ldots, s_n$. The problem is to assign each skier a ski to minimize the average difference between the height of a skier and his/her ski. Give a greedy algorithm to solve this minimization problem. Provide pseudocode and state its asymptotic running time. Prove that your algorithm is correct.

Problem 2. Consider a long straight road with n buidings scattered sparsely along its length. Let $x_1 < x_2 < \ldots < x_n$ denote the locations of these buildings, measured in meters from the left endpoint of the road. Design a greedy algorithm that will place the minimum number of cell towers along this road so that every building is within four miles of one of the towers. Explain your algorithm on a figure, provide pseudocode and state its asymptotic running time. Prove that your greedy algorithm is correct.

Problem 3. Consider the problem of storing n books on shelves in a library. The order of the books is fixed by the catalog numbers and cannot be changed. Each book b_i has a thickness t_i. The length of each bookshelf is L. The heights of the books can be ignored since any book fits on any shelf. The problem is to minimize the number of shelves to store n books. Give a greedy algorithm to find the optimal placement of books. Provide pseudocode and state its asymptotic running time. Prove that your algorithm is correct.