CPSC 320: Intermediate Algorithm Design 2016 Summer Term 1

Tutorial 4

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1. In the Exhibition Guarding Problem, we are given a line L that represents a long hallway in a show room. We are also given an ordered set $X = \{x_1 < x_2 < ... < x_n\}$ of real numbers that represent the positions of precious objects or sculptures in this hallway. Suppose that a single guard can protect all the objects within distance at most d of his or her position, on both sides.

   (a) Design an algorithm for finding a placements of guards that uses the minimum number of guards to guard all the objects with positions in X.

   (b) Analyze the running time of your algorithm as a function of n, the number of objects that need guarding.

   (c) Prove that your algorithm works (write as complete an argument as you can in the time available in the tutorial).

2. Alice wants to throw a party and is deciding whom to call. She has n people to choose from, and she has made up a list of which pairs of these people know each other. She wants to pick as many people as possible, subject to two constraints: at the party, each person should have at least five other people whom they know and five other people whom they don't know.

   (a): Give a greedy algorithm that takes as input the list of n people and the list of pairs who know each other and outputs the best choice of party invitees. Hint: Try to identify people who should not be invited.

   (b): Prove the correctness of your algorithm from part (a).