Illinois Institute of Technology
Department of Computer Science

Homework Assignment 5

CS 330 Discrete Structures
Spring Semester, 2015

Due: Friday, April 3, 2015

1. In choosing a computer terminal in a public space, users want privacy and refuse to sit adjacent to another user. So, given a row of n terminals, the first user to arrive will choose one end and the second to arrive will choose the opposite end. From then on, a user arriving makes the greedy choice of the terminal furthest away on each side of occupied terminals; if all remaining terminals are adjacent to an occupied terminal, the user just leaves. Let $U(n)$ be the maximum number of users that this protocol can service; analyze $U(n)$.

2. Professor Reingold is planning to have n problems on Exam 3. There happen to be exactly n students in the course and each has discovered a different one of the exam problems. The students want to share their information by sending email, so that every student knows every problem. Assume that a student includes all the problems she/he knows at the time a message is sent and that email can go only to one recipient.

   (a) Give a greedy algorithm organizing the email communication, trying to minimize the total number of email messages for the students to fully share their knowledge.

   (b) Prove that your greedy algorithm results in the fewest messages possible, or give an example where it does not.