CSE 347 Analysis of Algorithms April 8, 2019

Homework 9

Instructor: Brendan Juba *Due: April 15, 2019, 11:59 PM*

Reminder: You may work in groups and use outside sources. But, you must write up solutions in your own words and properly reference your sources for each problem. This includes listing your collaborators and properly citing any sources you use. Solutions to each problem must be electronically typeset and submitted online via Gradescope. Instructions appear in the E-Homework Guide: `http://www.cse.wustl.edu/~bjuba/cse347/s19/ehomework/`

1. *Kleinberg & Tardos* Chapter 13, question 8

2. *Kleinberg & Tardos* Chapter 8, question 19

3. Show how to construct a dictionary data structure that, with probability $1 - \delta$, supports lookup and delete in $O(1)$ time and inserts in $O(1)$ amortized time per insert when the number of inserts n is *not known in advance*. Your data structure should only require an amount of memory bounded by $O(\frac{1}{\delta} n^2 \log^2 n)$. (Note that by convention, $\log^2 n = (\log n)^2$, *not* $\log \log n$.)

   For this problem, you may assume that you have a function that on input k returns a k-bit prime number (i.e., between 2^k and 2^{k+1}) and runs in time polynomial in k. You may also assume that allocating any amount of memory initalized to NULL can be done in $O(1)$ time. (Note: this last assumption can be removed, but you are not required to address this.)