Sub-linear Algorithms	February 14, 2017

Homework 1

Lecturer: Ronitt Rubinfeld | *Due Date: February 23, 2017*

Turn in your solution to each *problem on a separate sheet of paper, with your name on each one.*

1. Given a graph G of max degree d, and a parameter ϵ, give an algorithm which has the following behavior: if G is connected, then the algorithm should pass with probability 1, and if G is ϵ-far from connected (at least $\epsilon \cdot dn$ edges must be added to connect G), then the algorithm should fail with probability at least 3/4. Your algorithm should look at a number of edges that is independent of n, and polynomial in d, ϵ. For extra credit, try to make your algorithm as efficient as possible in terms of n, d, ϵ.

   For this homework set, when proving the correctness of your algorithm, it is ok to show that if the input graph G is likely to be passed, then it is ϵ-close to a graph G' which is connected, without requiring that G' has degree at most d.

2. In class we gave an MST approximation algorithm for graphs in which the weights on each edge were integers in the set $\{1..w\}$. Show that one can get an approximation algorithm when the weights can be any value in the range $[1..w]$ (it is ok to get a slightly worse running time in terms of $w, 1/\epsilon$).