Sublinear Time and Space Algorithms 2020B – Problem Set 4

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Due: July 6, 2020

General instructions: Please keep your answers short and easy to read. You can use results, calculations or notation seen in class without repeating them, unless asked explicitly to redo them.

Read the following paper: Rasmus Pagh and Charalampos E. Tsourakakis, Colorful triangle counting and a MapReduce implementation, Inf. Process. Lett. 112(7): 277-281 (2012). `http://dx.doi.org/10.1016/j.ipl.2011.12.007`

1. Use the results in this paper to design a streaming algorithm for 1.1-approximation of the number T of triangles in a graph $G = (V, E)$. You can assume that the algorithm is given in advance $n = |V|$, $m = |E|$, and a lower bound $0 < t \leq T$. For simplicity, assume the input is a stream of edge insertions (without deletions), and ignore storage of random bits.

   Make sure to describe: (a) your algorithm; (b) its storage requirement in terms of (only) $n = |V|$, $m = |E|$, and t; (c) an analysis of the algorithm's storage requirement and accuracy.

   You can rely on everything that appears in the paper; just write the statement you are using, without repeating its proof.

Extra credit:

2. Explain briefly if/how to modify your algorithm and its analysis to (i) storing all the random bits needed; (ii) to handle edge deletions.