13/12/16, Due to 29/12/16, Distrib'd Alg's

Assignment 2, Due to

1) Consider CONGEST(b) model, in which in every round up to b messages can be delivered through an edge. Analyze Upcast in this model, Upcast of m items. How much time does it require?

2) Devise an alg' for computing a shortest paths tree in a distributed weighted graph. Assume that on every round, O(1) edge ~~at~~ weights can be delivered through every edg. Analyze its time and message complexities.

3) Below is a variant of Szegedy-Vishwanathan's color reduction.

Partition all color classes into sets of $\Delta+2$ colors, $\{1, 2, \ldots, \Delta+2\}$, $\{\Delta+3, \ldots, 2\Delta+4\}, \ldots$. In each set of color classes, reduce in parallel one color via a naive color reduction. We obtain a proper coloring with fewer colors. (Prove that it is proper. How many colors are used?) Analyze this color reduction, and devise and analyze an iterated variant of this color reduction. How many rounds are required to reduce the number of colors from some α to $\Delta+1$?

4) Devise a variant of Luby's reduction from $(\Delta+1)$-vx-coloring to MIS for the case that vs do not know the value $\Delta = \max_{v \in V} \{deg(v)\}$.

5) A graph G has <u>neighborhood independence</u> $\leq t$ if for every vx $v \in V(G)$, the set of its neighbors $\Gamma(v)$ does not contain an independent set of sz $> t$.
Devise a variant of Luby's reduction for graphs of bounded neighborhood independence.

6) Analyze the following centralized algorithm for computing a diameter of a tree: Pick a vx v, find a farthest vx u from v. Find the farthest vx w from u. Return $dist_T(u, w)$ as the diameter of the input tree T. Prove the correctness of the alg'.

7) Devise a distributed alg' for edge-coloring a graph with max'm degree Δ in $O(\Delta^2)$ colors in $\log^* n + O(1)$ time, without using Linial's alg'.

Good luck,

Enjoy!