CMSC 858S: Algorithms in Networking

Fall 2004

Ungraded Homework Assignment #3, handed out Nov. 14, 2004

Note: We will have *ungraded* homework assignments such as this one, as well as ones that will be graded. I will post the solutions for all the assignments some time after they are handed out. You will get the most out of this course if you do your best to solve all the homework problems (whether they are graded or not) in collaboration with your group-members. In addition, I hope the collaboration will be a rewarding experience in co-operative work for you; please let me know if you have found simpler or more elegant solutions than the ones handed out.

The suggested deadline by which to finish this assignment is November 23rd; since this assignment is ungraded, you don't need to turn it in – just compare your solutions with the solutions I give.

1. Consider Uniform Gossip. We have n nodes. A node s starts with a message m, which then gets routed to all nodes as follows. At each step, each node u independently does the following: if it has received m, then it chooses a node v uniformly at random, and sends m to it. Give as good an upper-bound as you can, on the expected time for m to reach all nodes.

Next, suppose some t nodes fail initially (in the sense that they will be unable to forward m any further), but no non-failed node knows which are the failed nodes. Give as good an upper-bound as you can, on the expected time for m to reach all non-failed nodes when using Uniform Gossip.

2. What happens in the Kempe-Dobra-Gehrke protocol (for everyone to estimate the average $\sum_i x_i/n$) if instead of a fraction $1/2$, each node sends a fraction β to itself in each round? β here is some constant that lies in $(0, 1)$. Can you give a good upper-bound on the time to achieve the desired type of estimate?