

Exercise No. 5
Peer-To-Peer Networks
Summer 2008

Exercise 9 *Constant hop lookup*

Kelips performs a lookup in only two hops, but needs $O(\sqrt{n})$ pointers. Outline a system that requires only $O(\sqrt[3]{n})$ pointers for a three hop lookup!

Exercise 10 *Rumor spreading*

The following description is an algorithm for rumor spreading:

- At the beginning one node is infected.
- In one round, each infected node contacts and thus infects a random neighbor.
- No termination strategy is used.

Answer the following questions for both a line of n nodes, and a balanced binary tree of $n = 2^b - 1$ nodes ($b \in \mathbb{N}$), if the first infected node is the first on the line, or the root of the tree, respectively.

1. What is the expected number of rounds necessary to infect all nodes?
2. How many rounds are required until all nodes are infected with high probability $1 - n^{-c}$?
Hint: Chernoff!