

22C: 196: 001 Peer-to-peer Networks

Spring 2010, Assignment 2

50 points

Assigned February 25, 2010, Due March 4, 2010, in class

Please submit the answers in a typewritten form. Good documentation is essential. It is ok to consult other papers, but please cite them at the end of the answer.

1. (5+10 = 15 points) Consider Kleinberg's small world model on a (100 x 100) grid topology. Let each node have short-range links to every node at lattice distance 1, and one long-range link.
 - (a) How many nodes will be there at lattice distance 40?
 - (b) What is the probability that a node will have a link to a *specific node* at lattice distance 40? An approximate numeric answer in the format (x% probability) should be sufficient.
2. (3+4+4+4 = 15 points) Consider a Chord peer-to-peer network with a key space of 256 (i.e. from 0 to 255), but populated only by eight machines with keys 3, 65, 88, 100, 150, 185, 192, 244.
 - (a) Draw the finger tables of the nodes 100, 150, and 244.
 - (b) Show in which machines will the documents with keys 14, 34, 200, 250, 91, 75, 22, 0 be placed.
 - (c) How will the routing tables and the object locations change when the machine with key 100 leaves the network?
 - (d) Is there a problem with keyword-based searches in Chord?
3. (10+5 +5= 20 points) Consider a Skip List with approximately one million nodes in it.
 - (a) Assume that each node moves to the next level by tossing a fair coin. When the coin returns a head, the node succeeds in moving to the next higher level (and forms a linked list with other successful nodes), otherwise it stays in the same level and does not try further. The successful nodes keep tossing coins until they see a tail of the coin, or only a single node exists at its level.

(a) What will be the average number links per node including all the levels?

Justify your answer.

(b) What is the average number links per node for a Skip Graph?

(c) Identify one task that a Skip Graph is able to do much better than Chord.

Briefly explain.