

CS 425/ECE 428 Distributed Systems

Homework 7

Due by 7 p.m. on March 29, 2016 (Tuesday)

Total 30 points

1. (a) (5 points) In a 5-dimensional hypercube, list all the shortest routes from node 01010 to node 01111. For each such route, list the nodes in the order they appear on the route.

(b) (5 points) In a 5-dimensional hypercube, how many node disjoint shortest routes exist between nodes 00101 and 10010? Two routes are said to be node disjoint if they do not contain any nodes in common (except the source and destination nodes).

2. Consider the Chord peer-to-peer system. Suppose that the identifiers of nodes contain 8 bits (i.e., the node names are hashed to 8 bit numbers).

Suppose that the (hashed) identifiers of the nodes in the system are as follows: 9, 10, 20, 24, 90, 105, 245.

(a) (5 points) List all the fingers at node 9. Similar to slides 10 in the set at <https://courses.engr.illinois.edu/CS425/sp2016/indy.pptx>, list the fingers in a table.

(b) (5 points) Suppose that node 9 needs to locate the node that stores key with hashed identifier ~~248~~. Using a figure similar to slide 15 in the above slide set, show how this request will be forwarded from node 9 to the node that stores the desired key.

Change key
248 to 242
in part (b).

3. Consider the executions E and F in Figure 9 and 12, respectively, in the file at <https://courses.engr.illinois.edu/CS425/sp2016/shared-memory-figs.pdf>

(a) (3 points) Does execution E satisfy causal consistency? Answer Yes or No.

(b) (3 points) Does execution F satisfy causal consistency? Answer Yes or No.

(c) (2 points) Answer true or false: In execution E, $Write_3(Y,5) \rightarrow Read_1(X,2)$.

(d) (2 points) Answer true or false: In execution E, $Write_3(Y,5) \rightarrow Read_2(X,2)$.

The question **below** is a recommended exercise (you do not need to submit the solution for recommended exercises):

In the Chord p2p network above, determine which nodes will store the keys with the following hashed identifiers: 9, 10, 11, 29, 248, 255