

Homework 6

Due 7 pm, March 31, 2018 (Saturday)

Total points: 40

You will be able to submit your homework in Compass only once. Before you submit the homework, be sure that you have completed all your work.

1. (10 points) Consider slide 9 in the set at <https://courses.engr.illinois.edu/ece428/sp2018/link-reversal.pdf>. Note that, in this network, node D is the destination. Show how the link reversal algorithm will change directions of the links, if link CE breaks in the network on slide 9 (i.e., link CE is removed from the network). Present your answer in the form of a sequence of network states, as shown in earlier slides in the above set of slides.

RECOMMENDED EXERCISE: What would happen if link CD breaks in the network on slide 9? Would the network state stabilize?

2. (10 points) Hypercube topology was discussed in class in the lecture on March 13. Consider a 4-dimensional hypercube (which consists of $2^4=16$ nodes). If node labeled 0000 (in binary) is removed from the network, determine the following in the resulting network.

-5 for incorrect
answer in (a)

(a) The length of the shortest path (in number of links) between nodes 1111 and 0010 (note that the node identifiers are in binary).

-5 for incorrect
answer in (b)

(b) Number of node-disjoint shortest paths between nodes 0101 and 1010. Here, two paths are node-disjoint if they do not have any nodes in common except the two endpoints (i.e., 0101 and 1010 in this question).

-2 for each
incorrect
entry in
the finger
table

3. (10 points) Consider the Chord network shown on slide 10 in the set at <https://courses.engr.illinois.edu/ece428/sp2018/indy-p2p.pptx> or <https://courses.engr.illinois.edu/ece428/sp2018/indy-p2p.pdf>.

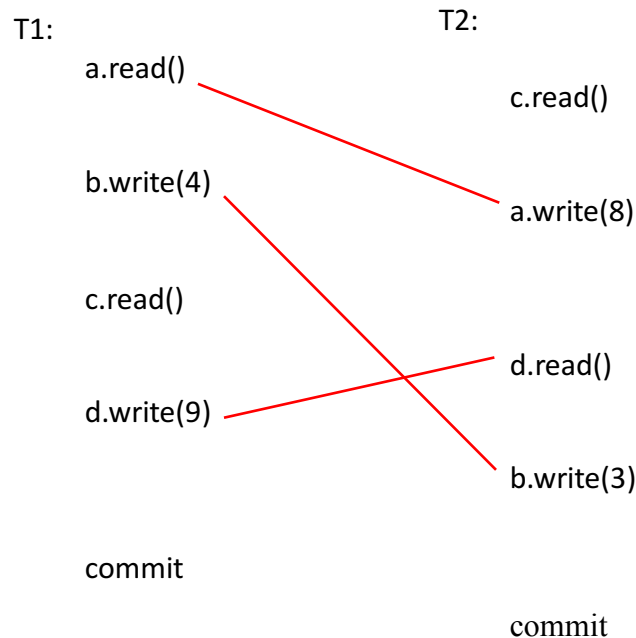
Determine the finger table at node N112. Present your answer in the format for the finger table at N80 shown in the above slide.

RECOMMENDED EXERCISE: Which node will store information for key K81? If node N112 wants to locate information for K81, in the network figure, draw the sequence of request messages that will be sent.

4. (10 points) The figure below shows interleaving of two transactions, T1 and T2. In the operations below, `a.read()` denotes a read operation on object a. `a.write(v)` denotes a write operation on object a that writes value v.

(a) In this figure, mark all the conflicts between operations of transactions T1 and T2 using arrows similar to those in slide 16 in the set of slides at <https://courses.engr.illinois.edu/ece428/sp2018/transactions-1.pptx> or <https://courses.engr.illinois.edu/ece428/sp2018/transactions-1.pdf>.

(b) Is the interleaving below serially equivalent? Answer YES or NO. **NO, it is not serially equivalent.**



-5 for incorrect
answer to part
(b)

-2 (minus 2)
for each missing conflict,
or extra conflict in part (a)

Homework 6 Solutions

2. (a) 3 hops (i.e., 3 links). Here is such a path: $1111 \rightarrow 0111 \rightarrow 0110 \rightarrow 0010$

2. (b) Node disjoint paths cannot share any nodes in common except the first and last nodes. In this problem, we need to avoid using node 0000, because that node has been removed. The distance between 0101 and 1010 is 4 hops. Four disjoint shortest paths exist, as shown below.

$0101 \rightarrow 1101 \rightarrow 1001 \rightarrow 1011 \rightarrow 1010$

$0101 \rightarrow 0001 \rightarrow 0011 \rightarrow 0010 \rightarrow 1010$

$0101 \rightarrow 0111 \rightarrow 0110 \rightarrow 1110 \rightarrow 1010$

$0101 \rightarrow 0100 \rightarrow 1100 \rightarrow 1000 \rightarrow 1010$

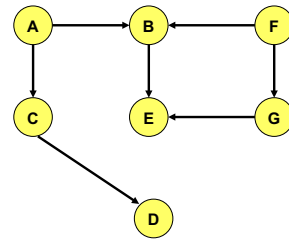
3. Finger table at node N112

i	ft[i]
0	16
1	16
2	16
3	16
4	16
5	16
6	80

Question 1

-5 for an incorrect node reversing its links
-5 for a missing node reversal

Node(s) that have
reversed links in
each step are marked
by an X next to them



**Initial
graph
after link
CE is
removed**

