* You will be able to upload your solution in Compass at most twice.

* This is the last homework for this course.

SOLUTIONS

CS 425/ECE 428 Distributed Systems (Spring 2018)
Homework 8
Due by 7 p.m. on Friday, April 27, 2018
Total points: 30

1. (10 points) Exact Byzantine vector consensus was discussed in class on April 19. Consider Byzantine vector consenus where the vector input of each process contains 3 elements (i.e., dimension d=3).

   If the inputs of all processes are constrained to be on a particular line in the 3-dimensioanl space, is it possible to solve Byzantine vector consesus for d=3 and f=1 using only 4 processes? You may assume that the processes know the line to which all the inputs are constrained.

   Briefly explain your answer.

   YES, it is possible. The Exact consensus algorithm in the paper will be correct. Due to the constraints that the inputs be on a single line, the intersection of the convex hulls in step 2 of the algorithm (using equation (1) in the paper) will be non-empty.

2. (10 points) This question relates to distance-vector routing, which was discussed in Lecture 24.

   Suppose that a network consists of 5 nodes, with identifiers A, B, C, D and E. Suppose that the routing tables at nodes A and D are as shown below at a certain point of time.

   Table at node A

To	Next-Hop	Cost
B	B	5
C	C	7
D	D	1
E	E	10

NEW TABLE AT A

To	Next-Hop	Cost
B	D	3
C	D	3
D	D	1
E	D	6

   Table at node D below

To	Next-Hop	Cost
A	A	1
B	B	2
C	C	2
E	B	5

Subsequently, node D sends its distance vector to node A. Assume that the cost of link DA is 1. Determine the routing table at node A after it updates the table on receipt of the distance vector from D.

3. (10 points) This question relates to timestamps for star graph discussed in the paper "Effectiveness of Delaying Timestamp Computation", assigned for reading for the lecture on April 17. The topic was discussed in class on April 17 and 19.

Suppose that in a star graph, process p0 is the center process, and processes p1 and p2 are other processes. As discussed in the paper, the first element of each timestamp is the process identifier. Below, we specify process identifier of process p0 simply as p0, but in the paper it is equivalently specified as 0.

Consider the following timestamps assigned to events, e, f, g and h.

Timestamp for event e: (p0, 4)

Timestamp for event f: (p1, 3, 0, 4)

Timestamp for event g: (p2, 1, 5, 8)

Timestamp for event h: (p1, 4, 2, 9)

--> below denotes the happend-before relation, and || denotes concurrent events.

Answer True or False:

(a) f --> e TRUE

(b) f --> g TRUE

(c) e || h TRUE

(d) g --> h FALSE

(e) h --> g FALSE