Question 1:

a) Show an example of causal ordering violation involving point-to-point messages (when no causal delivery protocol is in place). Explain your example.

b) Expand the vector timestamp protocol for causal broadcast that we have seen in class to a matrix based protocol that can ensure causal ordering among point-to-point messages. Explain why it works. No need for a formal proof (but of course a correct formal proof is always acceptable 😊).

Question 2:

a) Describe at least three differences between Kademlia’s lookup/routing process and the one of Chord.

b) As was stated in class and in the slides, for a random overlay in which nodes pick d neighbors in an I.I.D. uniform random manner and links become symmetric it is enough to have d=2 to ensure connectivity with high probability. Why does the Bitcoin network require d=10?

Question 3:

a) What architectural feature of BigTable enables it to support atomic updates at a line border but prevents it from supporting atomic updates of multiple (fields in multiple) lines? Explain.

b) What architectural feature of Spanner allows it to support this missing functionality in BigTable? Explain.

Question 4:

a) Explain why waiting for a timeout even after receiving more than 2/3 pre-votes that are not all the same is required for Tendermint’s liveness, whereas if all these votes are the same, there is no need to wait for the timeout.

b) In the fast probabilistic shared coin Byzantine binary consensus protocol we have seen (Friedman, Mostefaoui, Raynal), show an example where the protocol would not provide safety if executed with n=3f+1 nodes (f the total number of faulty nodes of any kind).

Submission instructions:

You should solve this exercise alone – submissions are individual. Solutions must be submitted through the course web site – either printed or a high-resolution scan of handwriting. Solutions must be in Hebrew unless you get an authorization from Prof. Friedman to submit in English. Try to be brief. If your answer is very lengthy, it could be a sign that it is wrong.

The submission date is Tuesday 23/01/2018 before midnight.

Good luck!