Sample Questions

1. Provide an implementation of FIFO-order perfect point-to-point links on top of perfect point-to-point links using sequence numbers.

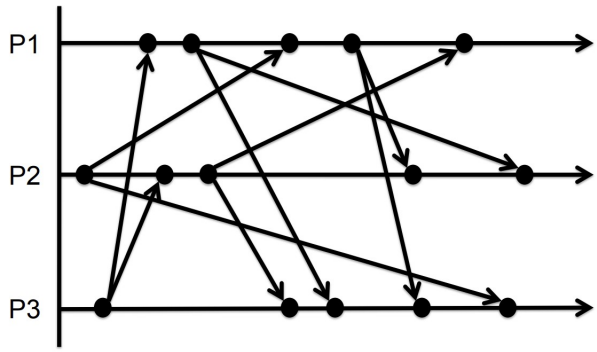
2. Explain the properties of the perfect failure detector and precisely write the difference between a perfect failure detector and an eventual perfect failure detector in terms of the interface and the properties.

3. Modify the uniform reliable broadcast algorithm such that it does not use the failure detector but assumes that a majority of processes are correct.

4. What happens in the reliable broadcast (RB) and uniform reliable broadcast (URB) algorithms if the (a) completeness, (b) accuracy property of the failure detector is violated? Show example execution diagrams if any of the four properties of broadcast is violated. Answer for RB.(a), RB.(b), URB.(a), and URB.(b) separately.

5. Can we devise a causal broadcast algorithm that ensures only the nonuniform variant of causal order property: "No correct process p delivers a message m_2 unless p has already delivered every message m_1 such that $m_1 \rightarrow m_2$?"

6. Using the causal broadcast algorithm discussed in class, write down the timestamps (vector clocks) at the point of each request and each receipt (Assume vector clocks are all zero in the beginning). Also, mark receipts that are buffered, along with the points at which they are delivered to the application.



7. (20 points) Assume that five processes sending requests to one another using FIFO-order causal broadcast abstraction covered in the class. Below are the current sequence vectors for each process:
   Process A (5, 4, 3, 4, 1)
   Process B (1, 5, 4, 3, 2)
   Process C (2, 1, 5, 4, 3)
   Process D (3, 2, 1, 4, 4)
   Process E (4, 3, 2, 2, 5)
   If Process D sends a message, which process(es) can accept it immediately? Choose all processes that can accept it *immediately*.