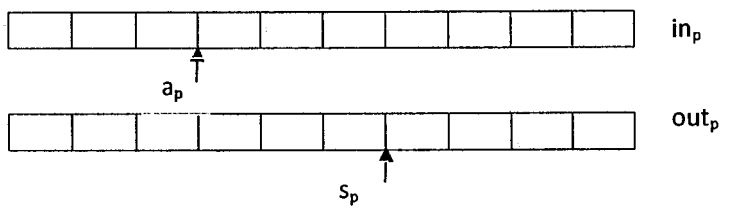
INDIAN INSTITUTE OF TECHNOLOGY, KHARAGPUR
Date 17.02.2012 FN Time: 2 Hrs. Full Marks : 78
Spring Semester: 2012 Department: Computer Science and Engineering
Sub. No: CS 60002 Sub. Name: Distributed Systems

Q1.

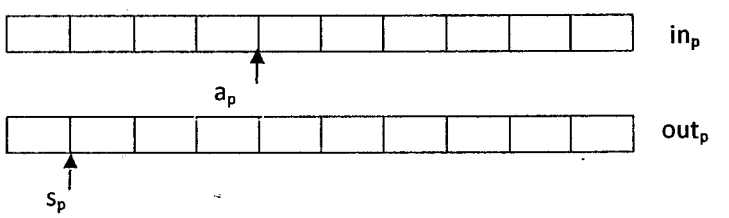
a) What do you mean by safety and liveness in the context of sliding window protocol?

b) Lets assume two processes p and q are exchanging information between themselves using sliding window protocol. Constraint for the protocols are lp=2 and lq=2. Comment on the following configurations' feasibility. (a_p is the minimum index of sending window of process p and s_p is the minimum index of expected word for process p.) 3+4x3=15

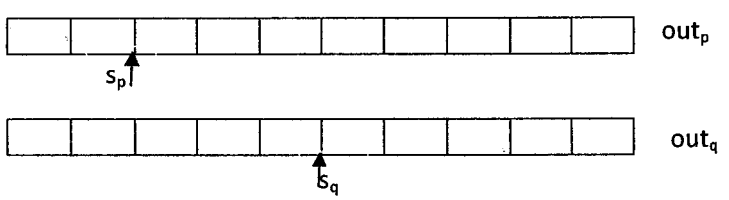
Case i)



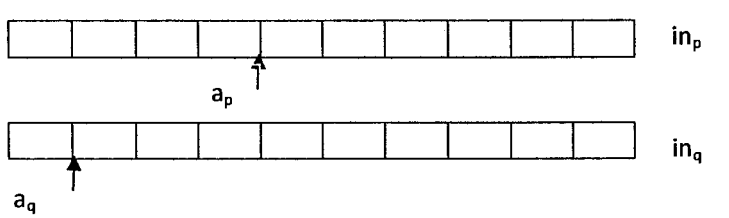
Case ii)



Case iii)



Case iv)



Q2.

a) Discuss the actions taken by different node when channel from node N5 to N6 becomes down (Fig.1) in Netchange algorithm.

b) Also discuss (Fig. 1) the actions taken by different nodes when it is up.

c) Discuss the importance of channel FIFO property in netchange algorithm with an example.

d) Does Toueg's routing need sequencing in selecting pivot? How does it make improvement from the simple version of the algorithm?

4+4+2+5=15

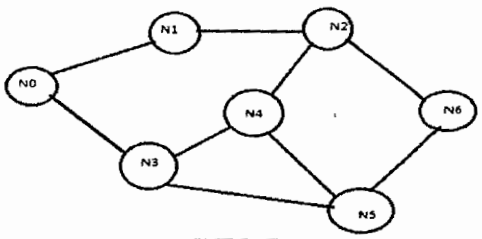


Fig.1

Q3.

a) Discuss the constraints to design a deadlock free buffer graph controller for Destination based scheme, Hop-So-Far scheme, Acyclic Orientation Cover

b) Discuss the constraints for Forward count and Forward-state controller

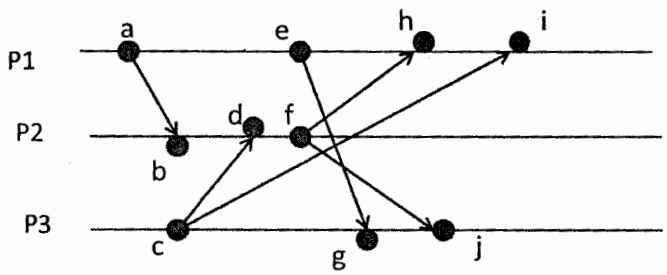
c) Prove that there is a deadlock free controller for a tree network which uses only two buffers per node.

6+4+5=15

Q4.

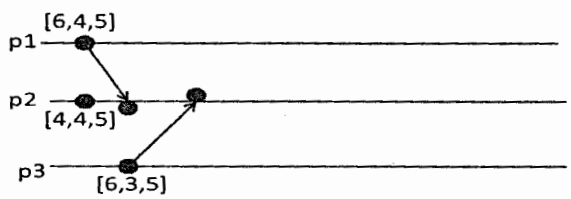
a) Some processes are running concurrently and processes use logical vector clock. T_a denotes the vector clock time stamp of some event a and T_b denotes the vector clock time stamp of some event b. If $T_a<T_b$ then prove that a→b.

b) Process p1, p2, p3 communicate among themselves and use vector clock. Consider Send and Receive as event and assign the timestamps of event a, b, c , d, e, f, g, h, i, j



c) Define consistent global state and strongly consistent global state.

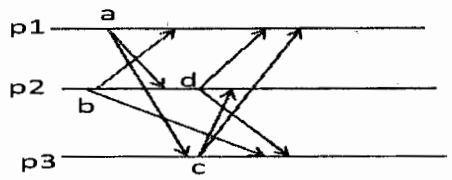
d) Show that the given timestamp is not possible in Birman-Schipher-Stephenson's protocol



5+3+3+4=15

Q5.

a) There are three processes in a system with process id p1, p2 and p3. a, b, c, d are request for entering Critical Section (CS) in a system which follows Lamport's mutual exclusion strategy. Write down the input queue of CS request at p1, p2 and p3 when they are about to enter CS.



b) Why FIFO property of channel is important in Lamport's mutual exclusion scheme and why FIFO property is not required in Ricarta Agarawal's scheme?

c) In Lamport's mutual exclusion strategy clock used in i^{th} process is <tsi, i>, where tsi is the time stamp and i is the process identifier. Discuss the importance of process identifier in clock. Let's assume now clock is denoted as <i, tsi>. What will be the effect?

d) Prove that nodes do not suffer with starvation in Suzuki Kasami's scheme for mutual exclusion.

e) Assume that node 1 holds the token and is executing its critical section. Node 10, node 8, node 3, node 6 request for critical section at 0, 2T, 3T, 4T time instant respectively, where T is the message delay from one node to its neighbour node. No further request for critical section is generated. Node 1 releases critical section at 5T instant. Show how the token is passed to the requesting nodes with sequence of modified trees and message queue in nodes. 4+4+2+3+5=18