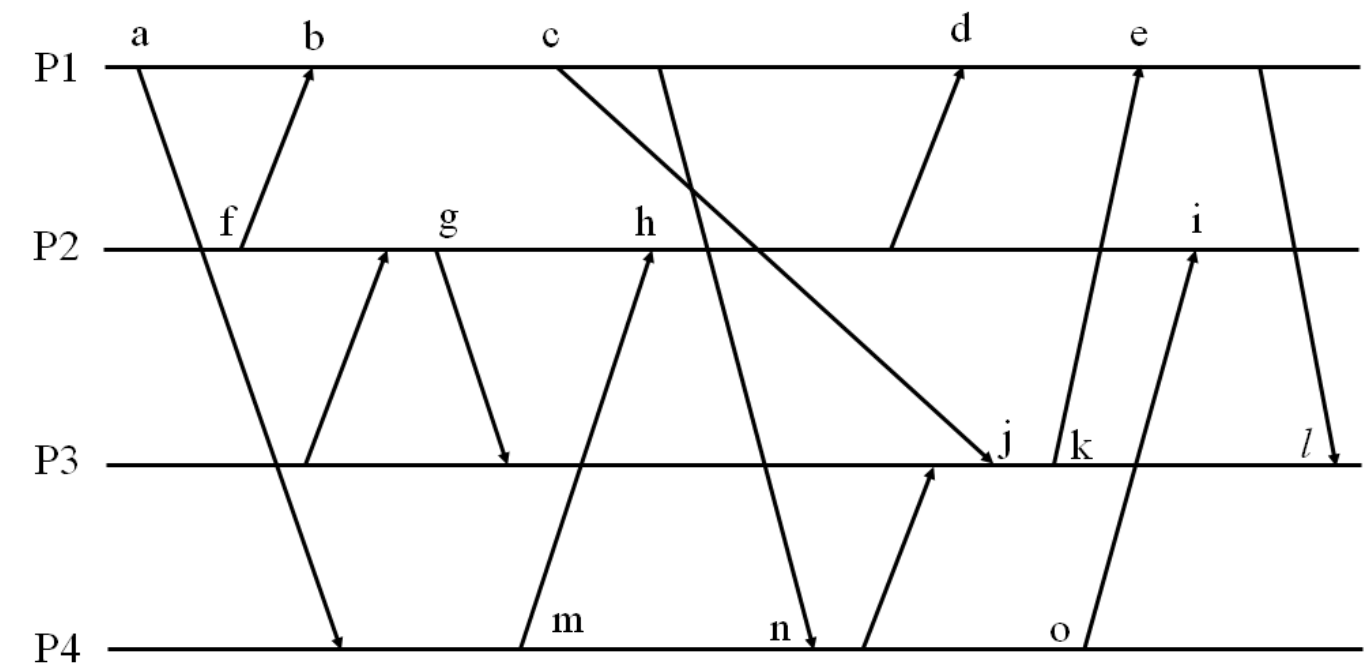


Roll :

Time : 20 minutes

1. Consider the following figure that shows four processes with events a, b, c, ... and messages communicating between them. Assume that initial logical clock values are all initialized to 0.
- (a) List the Lamport timestamps for each event shown in Figure 1. Assume that each process maintains a logical clock as a single integer value as a Lamport clock. Provide timestamps for each labeled event in the following table. **(5 marks)**
- (b) List the Vector Clock timestamps for each event shown in Figure 1. Provide timestamps for each labeled event. **(10 marks)**



Event	Lamport Time Stamp	Vector Time Stamp
a		
b		
c		
d		
e		
f		
g		
h		
i		
j		
k		
l		
m		
n		
o		

2. Consider, a Byzantine General Problem with n faulty processes in a synchronous system. What is the condition of reaching consensus in this situation? What is the message complexity in this case? What would be the condition of reaching consensus in an asynchronous system? **(3 marks)**
3. Write down **only** the name of some of the algorithms used for achieving mutual exclusion in distributed systems. **(2 marks)**