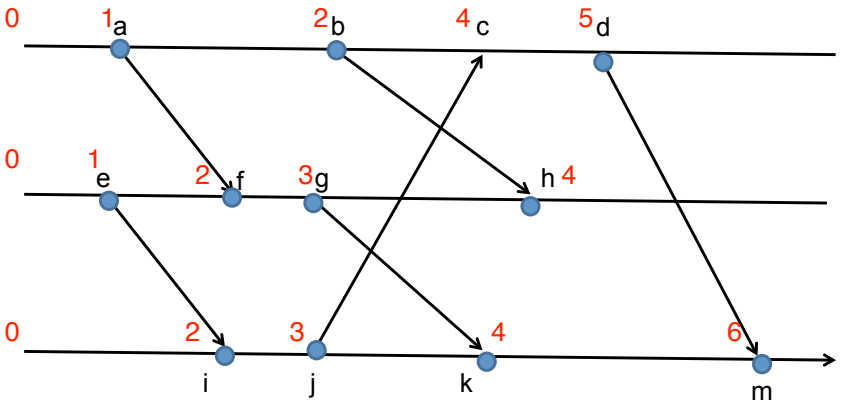
CS 425 / ECE 428 Distributed Systems (Spring 2018)
Homework 1
Due by 9 a.m. on January 30, 2018 (Tuesday)

See the 48-hour extension policy in the course handout. Please submit electronically. Submission instructions to be provided separately.

Question 1 - 15 points
Question 2 - 10 points
Question 3 - 10 points
Total points: 35

1. (a) Determine the logical timestamps for events h and k in the execution below, obtained using the rules discussed in the textbook or in the slides.

h: 4
k: 4



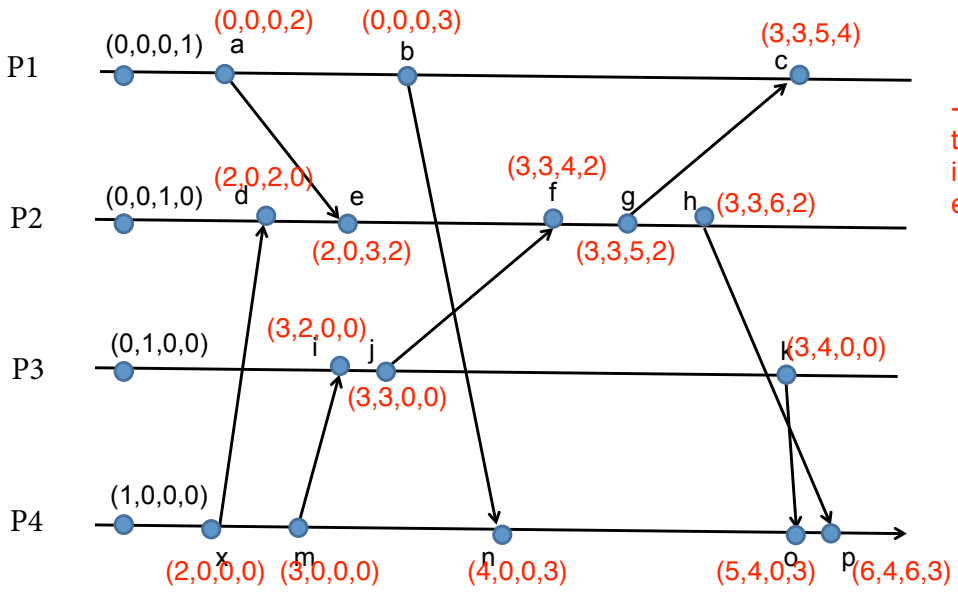
1(a) -3 for incorrect/ missing timestamp for 1 event, -5 for incorrect/ missing for both events
1(b) -3 for one omitted/ incorrect event, -5 for two omitted/incorrect events
1(c) -3 for one omitted/ incorrect event, -5 for two omitted/incorrect events

(b) In the above execution, determine all the events that are concurrent with event f. Events b,c,d,i,j

(c) In the above execution, determine all the events that happened-before event d. Events a,b,c,e,i,j

2. In the execution below, determine the vector timestamps for events h and k.

The figure shows the vector timestamp of the first event at each process.



-5 for incorrect/missing timestamp for 1 event, -10 for incorrect/missing for both events

h: (3,3,6,2)

k: (3,4,0,0)

3. A client attempts to synchronize its clock using Cristian's method. It sends requests to three different servers simultaneously, and records the round-trip time, and timestamp returned by each server, as shown in the table below.

server	**round trip time (ms)**	**Time** T
A	60	06:23:25.575
B	45	06:23:25.345
C	30	06:23:25.823

3(a) -5 for incorrect answer
3(b) -5 for incorrect answer

To minimize the wors-case skew, (a) which server should the client synchronize with, and (b) what time should it set its software clock to?

Assume that the minimum delay between the client and each server equals 10 ms.

(a) Worst case skew = (RTT/2 - min) (see lecture slides).
To minimize worst-case skew, client should synchronize with server C since RTT/2-min is smallest for server C (note that min is identical for all servers in this example).

(b) Client should set its time to T + RTT/2 on receipt of response from server C
Set time = 06:23:25.823 + 30ms/2 = 06:23:25.838