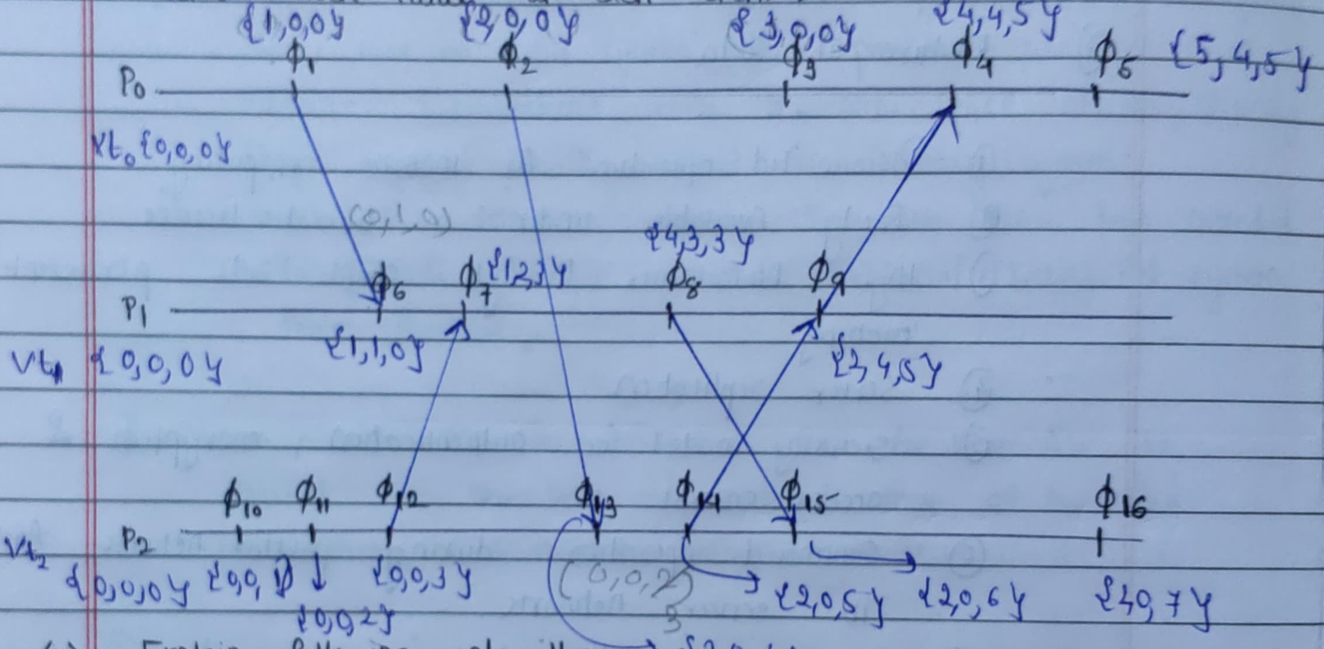
TUTORIAL 10

1.) Explain clock skew and how to deal with it?

2.) Why do we need synchronization in a distributed system?

3.) For the figure below, write down the lamport clock and vector clock value at each event:



4.) Explain following algorithms

a) Berkeley Algorithm
b) Cristian Algorithm

1.) ① When a system has n computers, all n crystals will run at slightly different rates, causing the (software) clocks gradually to get out of synch and give different values when read out.
② This difference in time values is called clock skew.
③ It causes time drifting.

How to deal with it?

① Assume we set computer to true time. (It is not good idea to set clock back).

⇒ Illusion of time moving backwards can confuse message ordering and software development environments.

② There should be go for gradual clock correction

- if fast : make clock run slower until it synchronizes.
- if slow : make clock run faster until it synchronizes

③ Operating system can change rate at which it requests interrupts.

⇒ if system requests interrupts every 14 msec but clock is too slow; request interrupts at 12 msec.

④ Software Correction: Redefine the interval

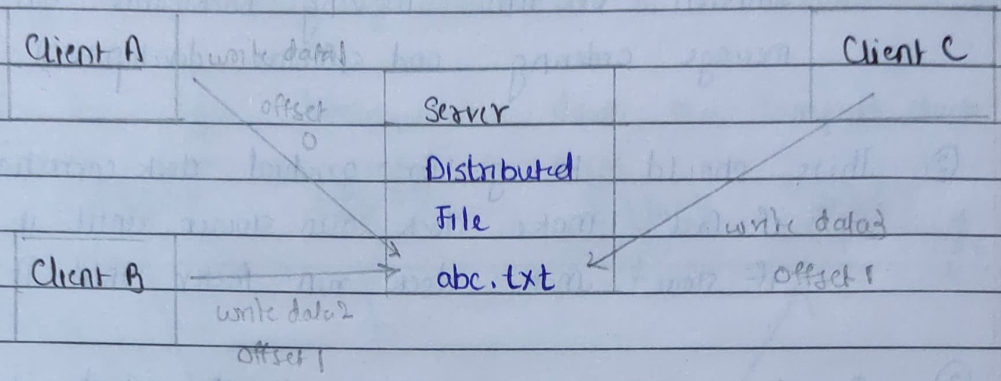
2.> ① Entities in DS. often have to cooperate and synchronize to solve a given problem correctly.

(a) Eg, In Distributed file system, processes have to synchronize and co-operate such that two processes are not allowed to write to the same part of a file.

(b) Simultaneously access a shared resources, such as printer.

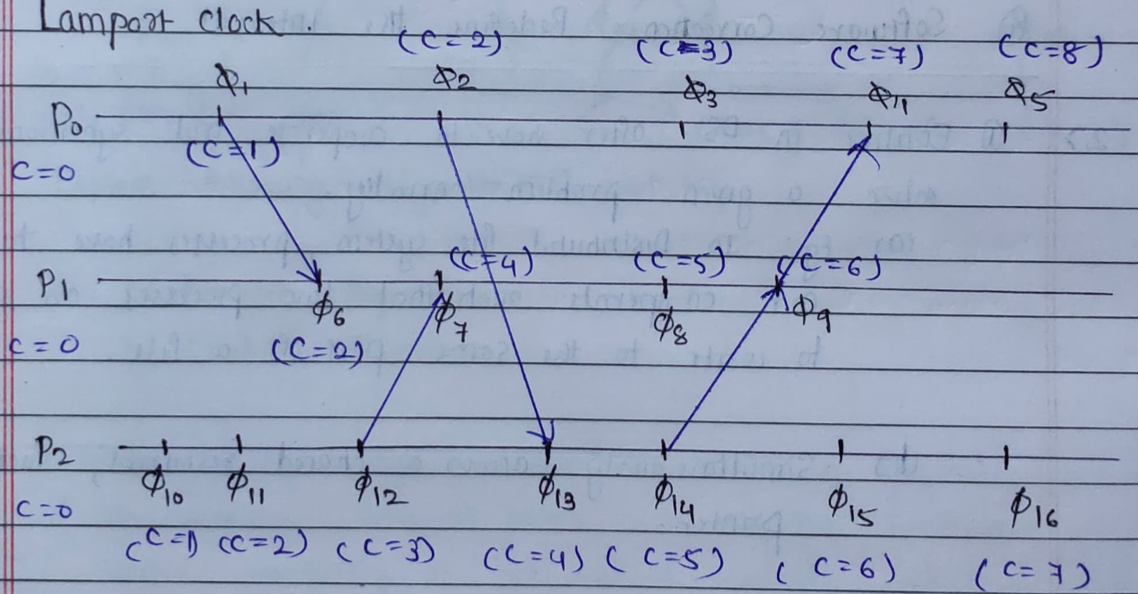
(c) Agree on the ordering of events, such as whether message m1 from process P was sent before or after message m2 from process Q.

Writing a file in Distributed File system



"If the distributed clients do not synchronize their write operations to the distributed file, then the data in the file can be corrupted"

3.) Lamport clock



modified
Vector Clock
in Question

4.) a) Berkeley Algorithm :-

1. Its a centralized synchronization Algorithm.
2. It is dependend on single time Server.
3. In this algorithm, the time server sends a message (time = ?) to all the other computer in the group
4. On receiving the message each computer sends back its clock value to the time server.
5. The time server has prior knowledge of approx. time required for propagation of the message.
6. Based on this knowledge, it first re-adjusts the clock values of the reply message.
7. It takes fault tolerance average of clocks values of all computers including its own.
8. It re-adjusts its own value to this average and sends the amount of re-adjustments to each computer which can be positive or negative and takes propagation time of message into consideration

b) Cristian's Algorithm

1. Centralized Algorithm
2. Identify a network time server that has accurate Source of time.
3. All the clients contact the network time server for synchronization.
4. However, the network delays when client ~~at~~ contacts the time server results in outdated time
5. Cristian's ~~de~~ algorithm estimates the network delay & compensates for it.

⑥ If Client sent a request at To and received T_{Server} at T_1

$$T_{new} = T_{Server} + \frac{(T_1 - T_0)}{2}$$

⑦ If Server ~~stakes~~ I time to process a request

$$\therefore T_{new} = T_{server} + \left(\frac{T_1 - T_0 - I}{2}\right)$$

⑧ If several measurements are taken, $(T_1 - T_0)$ which exceeds a threshold are considered to be unreliable & descarded.

$$T_{new} = T_{server} + \text{average}\left(\frac{T_1 - T_0}{2}\right)$$

⑨ The Algoritham assumes round trip time for message exchange are resonably short.

⑩ Delay for the request & response are equeal.

⑪ Fault in time server leads to inaccurate clocks in the DS.

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