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Parallel and Distributed Computing:

Assignment # 3: Due Date: 5-06-2025

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| **CLO** | **CLO STATEMENT** | **Bloom’s Taxonomy Level** | **PLO** |  |
| 3 | Demonstrate and understanding of parallel and Distributed Computers | C2 | P1 |

# Question #1: (5 Marks)

A distributed banking system runs on multiple servers across different time zones. A transaction involves timestamps from three different servers, and the integrity of transaction logs depends on synchronized clocks.

Due to slight clock drifts, inconsistencies are being observed in transaction ordering.

Answer the following questions:

1. **Explain why clock synchronization is critical in this distributed system.**
2. **Describe any two clock synchronization algorithms (e.g., Cristian’s Algorithm, Berkeley Algorithm) and compare their use in this scenario.**
3. **Propose a suitable synchronization method for this banking system and justify your choice.**

# Question #2: (5 Marks)

A distributed ticket booking system has multiple nodes that try to update seat availability simultaneously. Two processes on different servers request access to the same shared resource (seat booking database) without coordination. This leads to inconsistent booking records.

Answer the following questions:

1. **Explain how mutual exclusion can prevent this issue.**
2. **Identify and explain the necessary conditions for deadlock.**
3. **Design a basic distributed algorithm to ensure mutual exclusion.**
4. **Suggest how deadlock could be detected or prevented in this system. Explain why clock synchronization is critical in this distributed system.**

# Question #3: (5 Marks)

A client wants to synchronize its clock with a server. The round-trip time (RTT) measured is 120 ms. The server replies with its current time as 10:15:30.500 when it receives the request. Assume the network delay is symmetric.

Answer the following questions:

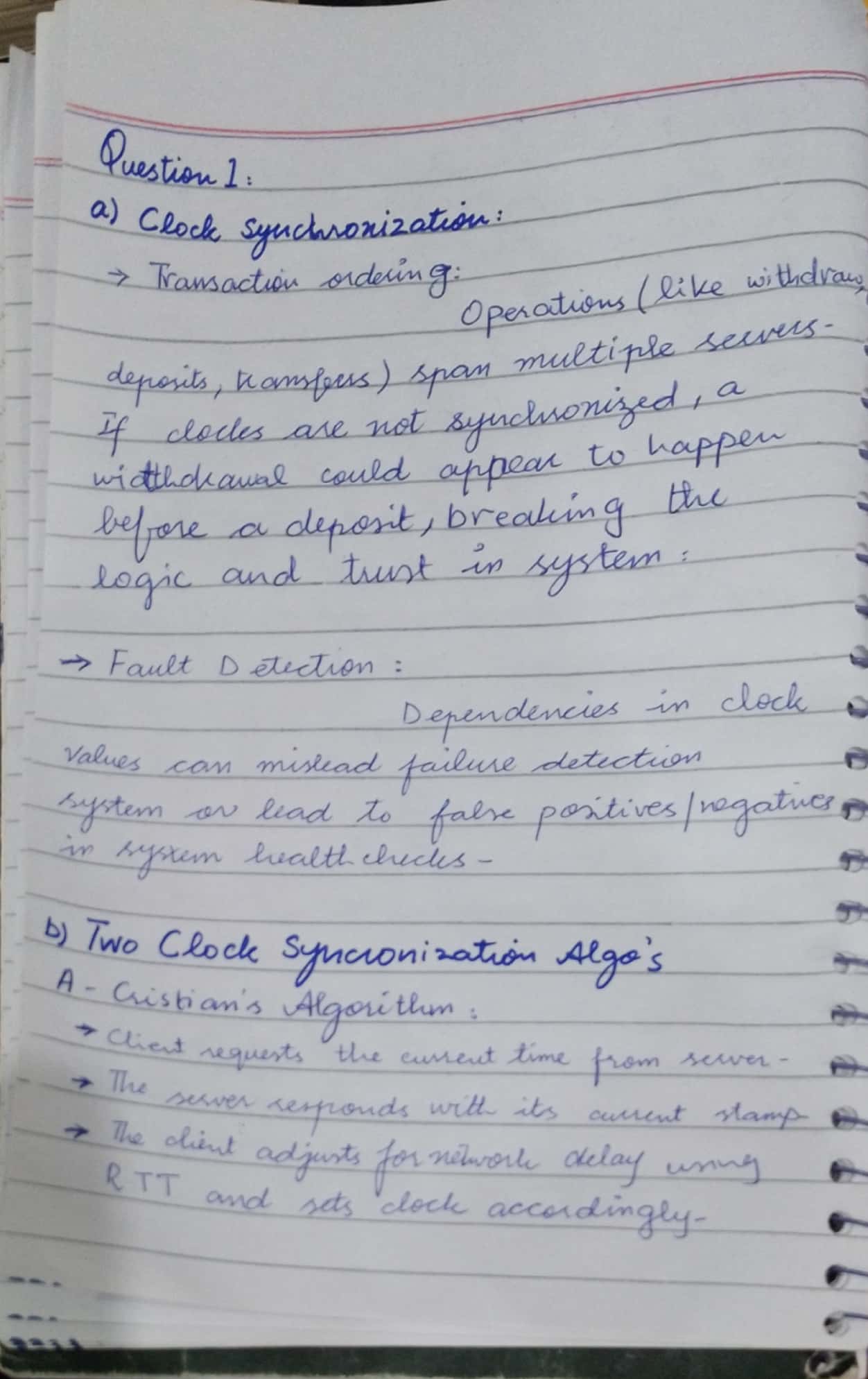
1. **Calculate the time at which the client should adjust its clock.**
2. **Which clock synchronization algorithm does this method follow?Explain how mutual exclusion can prevent this issue.**

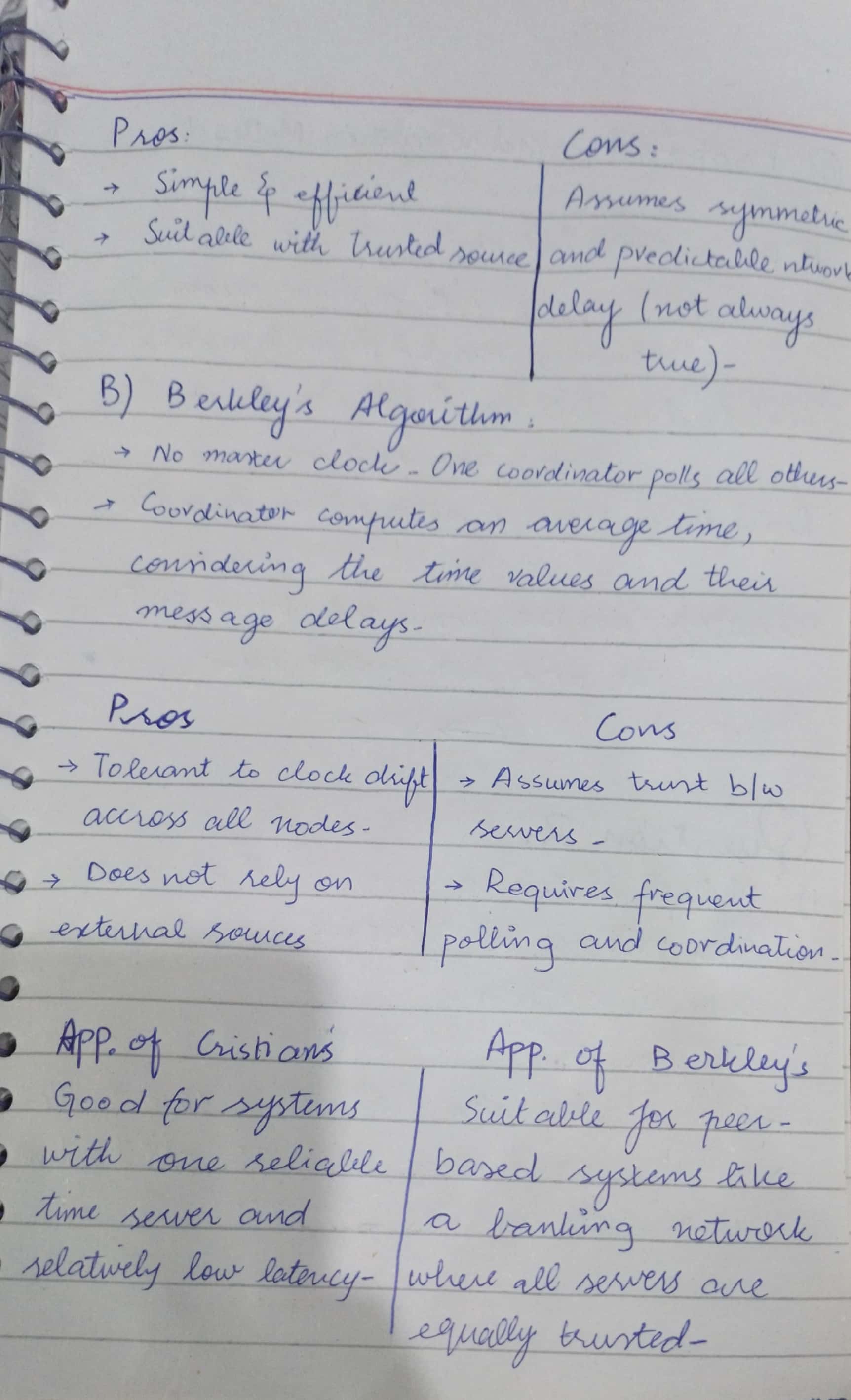
# Question #4: (5 Marks)

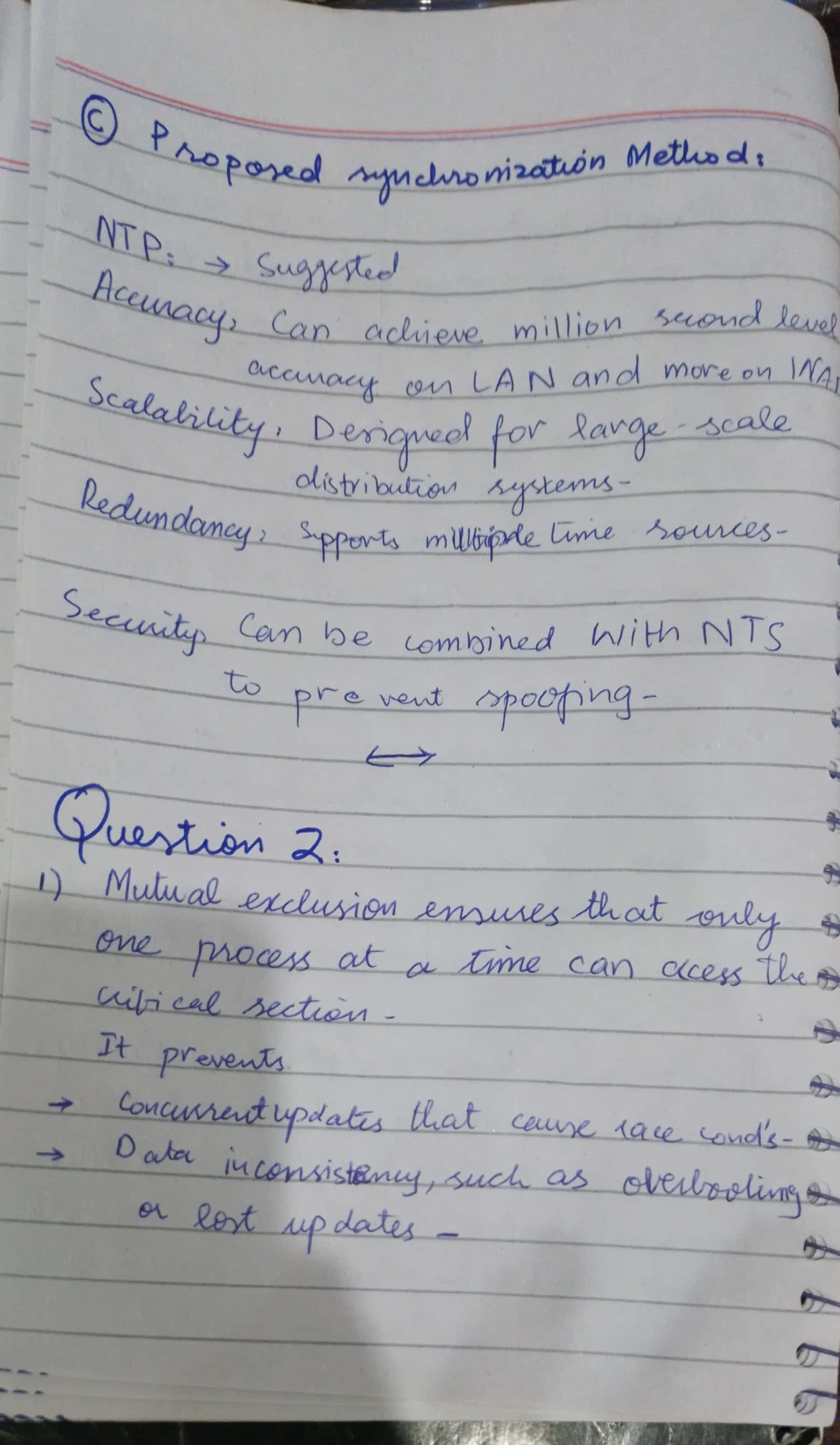
A computation task takes 100 seconds to complete using a single processor. 70% of the task can be parallelized.

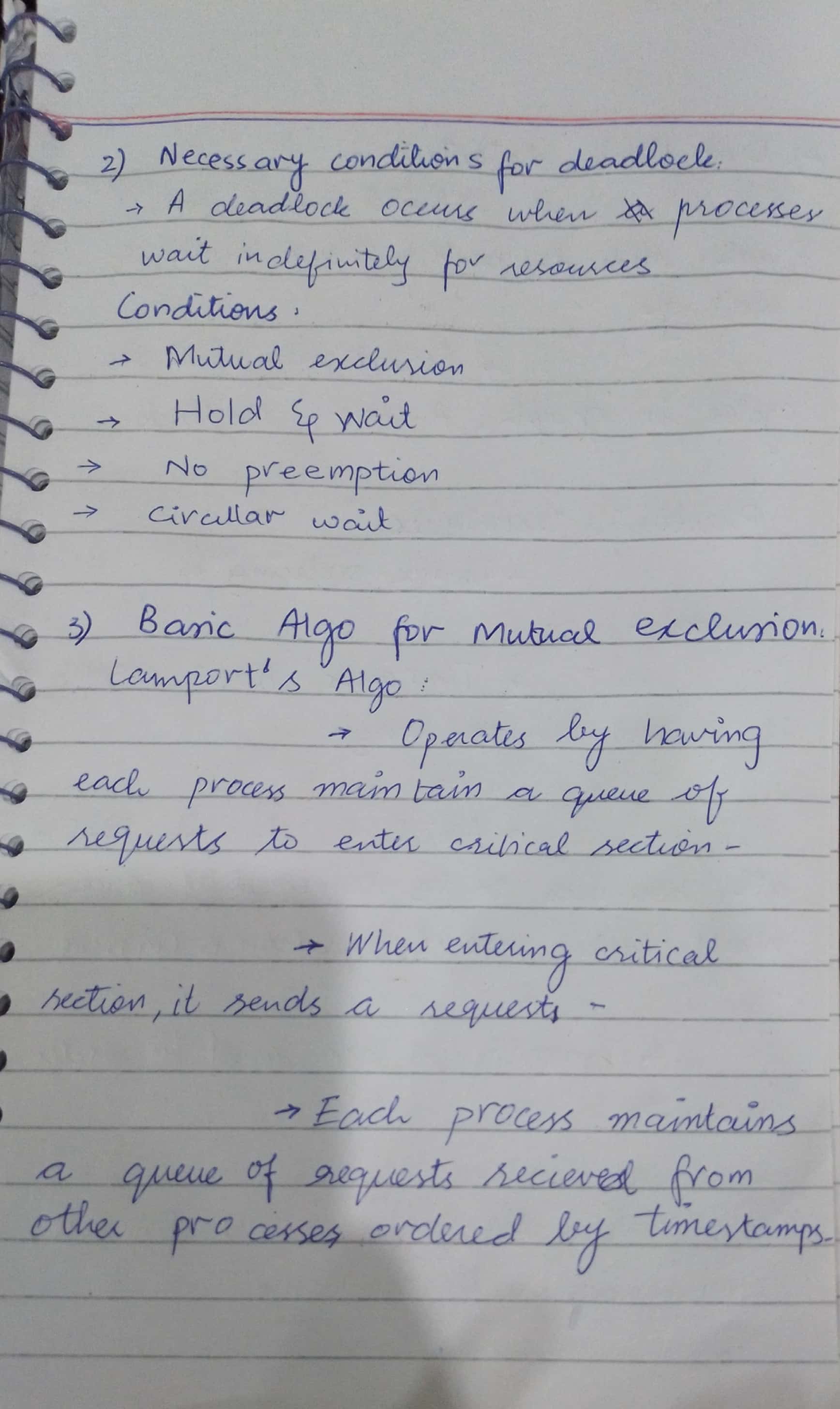
1. Answer the following questions:
   1. **Calculate the expected execution time and speedup if the task is run on 2, 4, 8, and 16 processors.**
   2. **Plot or tabulate the speedup for each processor count.**
   3. **What is the maximum possible speedup? Explain the implications of Amdahl’s Law in this context.**
2. If the portion of a task that can be parallelized is increased from 70% to 95%, what is the new maximum speedup possible according to Amdahl’s Law? Explain how improving parallelism impacts scalability.:

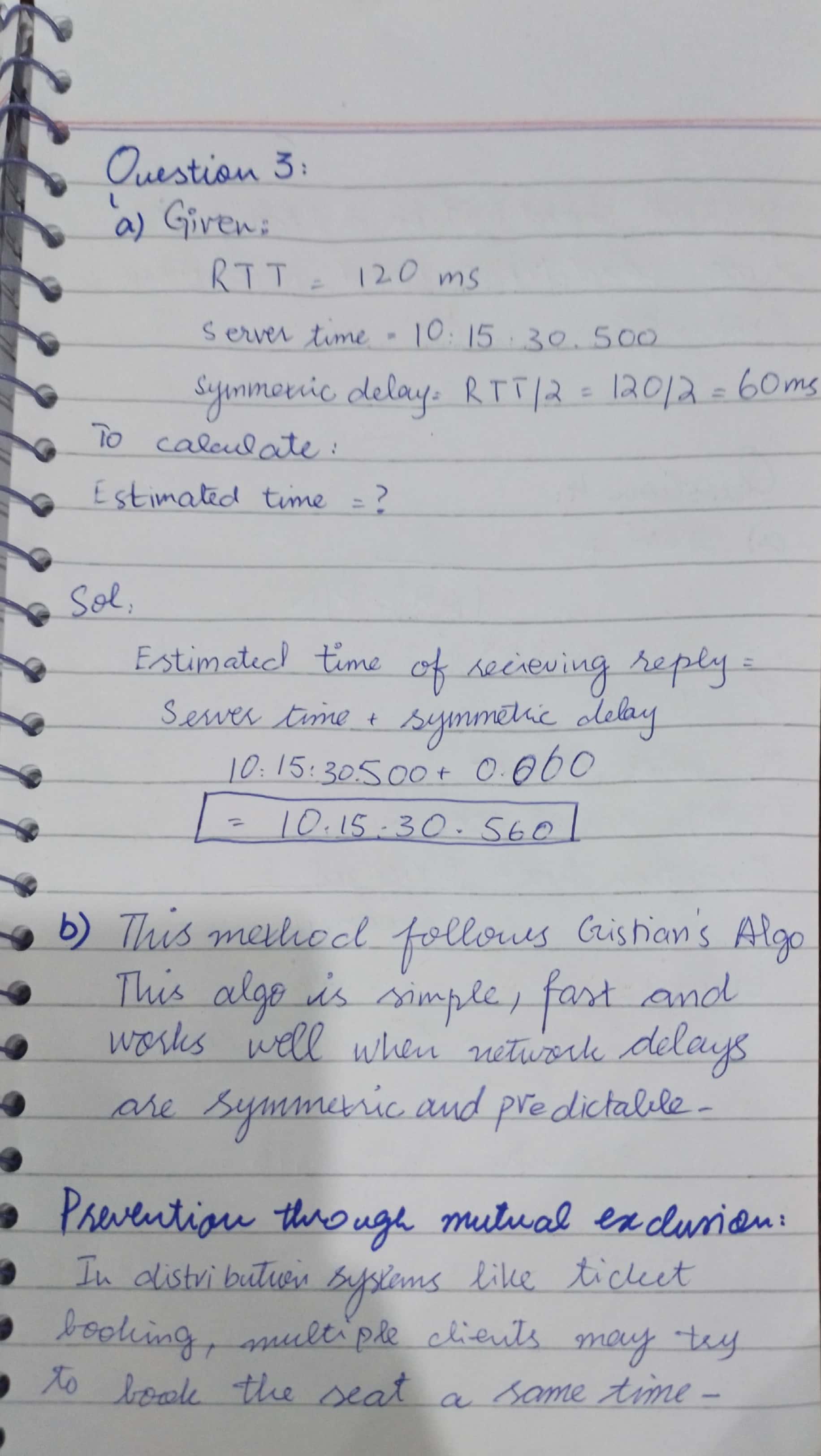
**ANSWERS:**

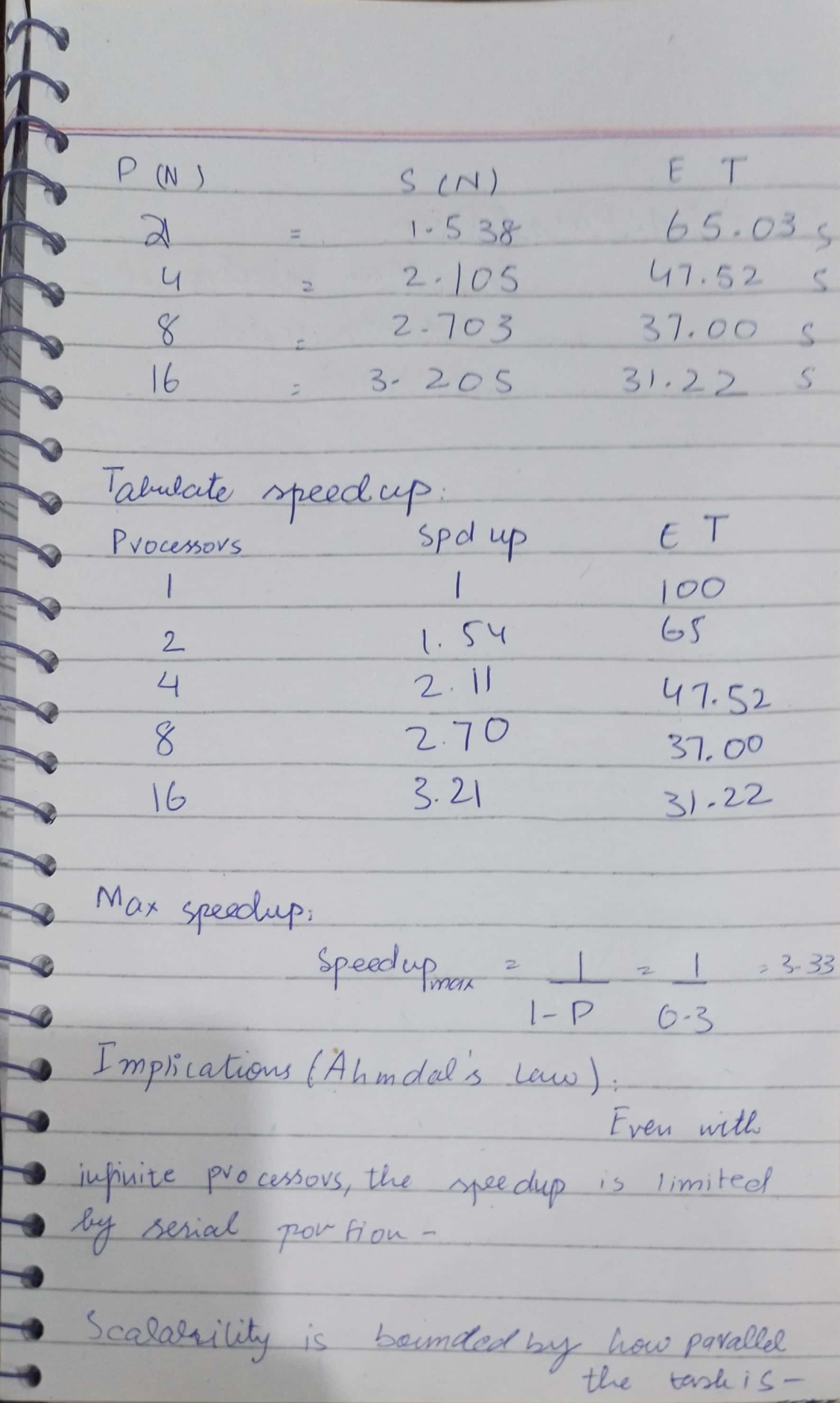


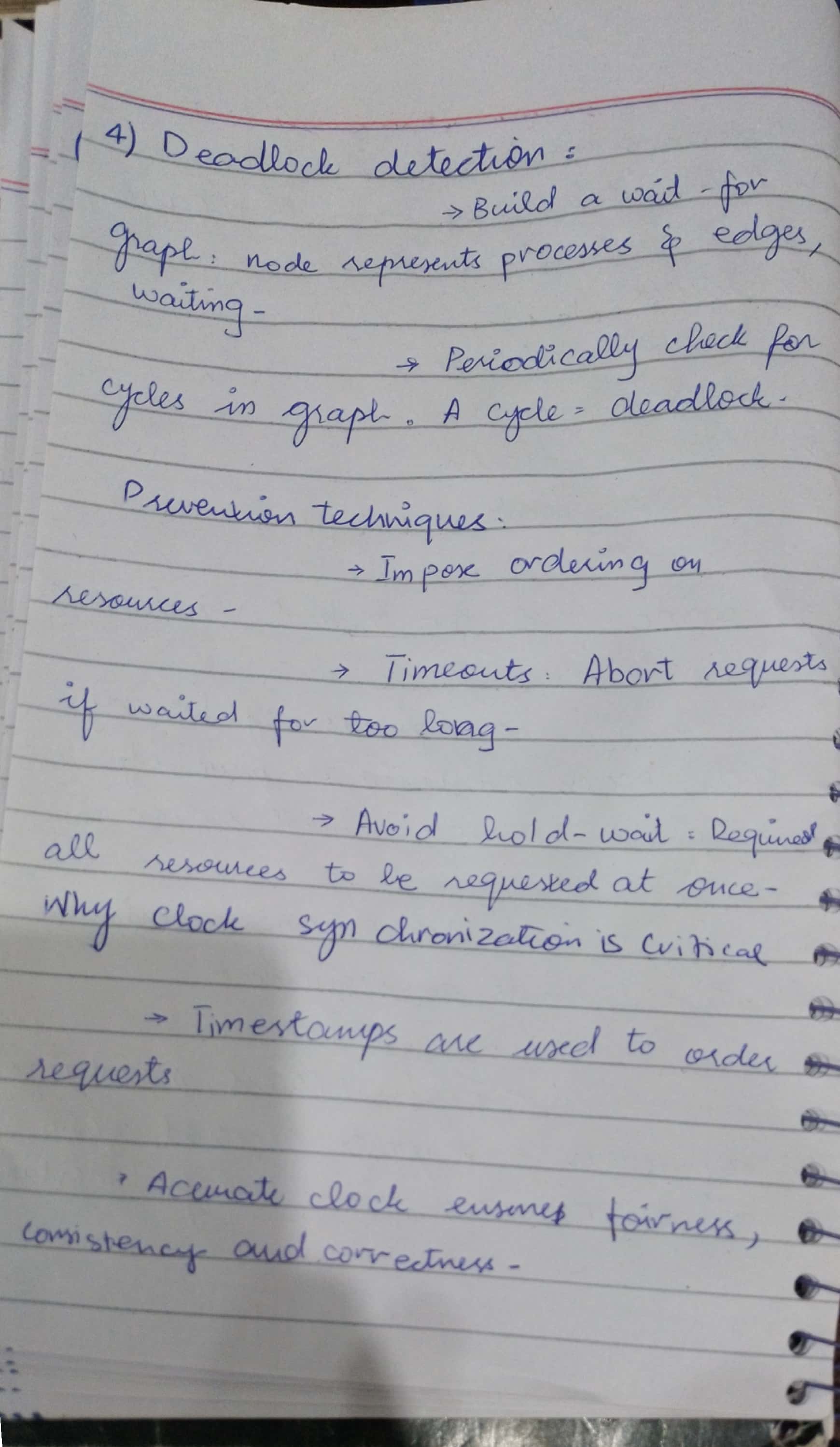












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