NANYANG TECHNOLOGICAL UNIVERSITY SINGAPORE

Tutorial

Distributed Systems

CE/CZ4153

Blockchain Technology

Tutorials

Expectations and format.

Tutorials will be dedicated to clarifying LAMS lectures and answering your queries.

Seminars will be dedicated to deep-dive into specific topics from the LAMS sequences.

Meant primarily for discussion and interaction.

- Tutorial questions are mostly the ones posted as open-ended questions within the LAMS lectures.
- We may also discuss certain non-trivial objective questions from the LAMS lectures, as required.

Feel free to debate and discuss the representative answers to these questions posted by you, either in the LAMS sequences, or during the tutorial session.

LAMS questions closely resemble Quiz questions.

Question 1

Ref : Week 1 Lectures

Propose a new or identify an existing instance of a Distributed System **within the University**.

Briefly justify the reason behind the system being a Distributed System in terms of the **Design Goals**.

Question 2

Ref : Week 1 Lectures

In case of the Distributed System you proposed or identified at the University, answer the following:

- What is the **System Architecture**?
- How would the **Nodes communicate**?

Question 3

Ref : Week 1 Lectures

In case of the Distributed System you proposed or identified within the University earlier, what kind of Replication or Consistency will you require?

Briefly justify your answer.

Question 4

Ref : Week 1 Lectures

In case of the Distributed System you proposed or identified in the University, which of the properties would you like to preserve in the network?

Consistency or Availability or Partition Tolerance

Briefly justify why.

Question 5

Ref : Week 1 Lectures

Suppose a distributed system A crashes for 1 sec every hour (is perfectly operational otherwise) and another system B crashes for 1 week every year (is perfectly operational otherwise).

Out of systems A and B, which one is more Available and which one is more Reliable? Briefly justify.

Question 6

Ref : Week 1 Lectures

Suppose you are running a Distributed Filesystem (like Dropbox), where updates to files in one server is communicated to other servers once every hour. However, there may be disruptions in such communication, resulting in arbitrary delay in communicating the updates. To solve this issue, you set a daily synchronisation session for all servers to match everyone's update status, and start afresh.

Which kind of synchrony assumption does your distributed system follow?

Question 7

Ref : Week 1 Lectures

Continuing from the previous question:

Why can't we assume the setup to be just in "Synchrony" mode, with the bound on the delay being 1 day (as the servers are anyway synced daily)? Do we really need a "Partial Synchrony" assumption? Justify your answer, briefly.

Question 8

Ref : Week 1 Lectures

Consider the case of Byzantine Generals, with 21 Generals in total, and 10 dishonest ones.

- ○ What happens if every honest general receives "Attack" from the other 10 honest generals, and "Retreat" from all 10 dishonest ones?
- ○ What property of consensus may be violated?

Question 9

Ref : Week 1 Lectures

Suppose there are 30 generals in a standard “Attack”/“Retreat” Byzantine Generals Problem.

What is the **minimum number of Honest generals** needed in this case to ensure a valid consensus?

Question 10

Ref : Week 1 Lectures

Recall : PBFT is “safe in asynchrony and live in synchrony”. Is it possible to design a consensus that is “live in asynchrony” too?

In other words, can the Liveness property be guaranteed under the asynchrony assumption?

Justify your answer, briefly.