

MAKE SURE THAT YOUR HANDWRITING IS READABLE

- 1a If a client did not receive a response in an RPC, explain what may have gone wrong, and how the client can see what the failure was. 6pt
- 1b Consider an RPC client who wants a remote process to act on a database local to the RPC client. What would be a good way to make this happen? 6pt
- 1c Consider a series of independent RPC calls from a single client to different servers. What would be a convenient way to maximize the client's perceived performance? 6pt
- 2a Explain what DNS redirection entails. 4pt
- 2b Content Delivery Networks (CDNs) tend to redirect clients to a replica server that is best for the CDN. Considering that ISPs usually host the client's DNS resolvers, how can an ISP deviate from the CDN's redirection policy? 8pt
- 2c What would be needed to provide a client the illusion that it is always viewing the latest version of a static Web page, assuming it accesses pages through edge servers? 6pt
- 3a Under which conditions will replication lead to a scale-down in performance? 4pt
- 3b Explain the necessary and sufficient conditions for quorum-based replication. 4pt
- 3c Assume that the cost of a read operation to a single server is 1 unit, and that of a write operation 2. If the read-to-write ratio is equal to 4, what would be the optimal read quorum in a quorum-based replication system with 10 servers? 8pt
- 4a Explain the working of a two-phase distributed commit protocol. Provide the state-transition diagrams for coordinator and participant. 6pt
- 4b What happens if a participant crashes and recovers while it was in state READY? Assume the coordinator does not maintain a log. 6pt
- 4c Explain why failing in the READY state will never lead to loss of data. 6pt
- 5a Explain what topic-based publish-subscribe entails. How would you realize it when having a message broker at your disposal? 6pt
- 5b What is the essential difference between topic-based and content-based publish-subscribe? Give an example of a subscription for a content-based publish-subscribe system. 8pt
- 5c Replication of subscriptions in a publish-subscribe system is fundamentally problematic. Why? 6pt

Grading: The final grade is calculated by accumulating the scores per question (maximum: 90 points), and adding 10 bonus points. The maximum total is therefore 100 points.