Name: 
Andrew ID: 

**Total time:** 45 minutes

**Instructions:**
- Write your answers in the spaces provided below the problems. If you make a mess, clearly indicate your final answers.
- This quiz has 8 questions over 5 pages, for a total of 25 points.
- Keep up with time.

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1. Answer the following questions by selecting **True** or **False**:

(a) (**True** / **False**) RPC allows passing parameters by value only.

(b) (**True** / **False**) Marshalling and un-marshalling are performed within the stubs and skeletons of RPC.

(c) (**True** / **False**) A workable distributed file system can be built without incorporating a naming service.

(d) (**True** / **False**) The distributed Bellman-Ford algorithm uses essentially a flat naming service protocol for locating machines over the Internet.

(e) (**True** / **False**) Blockchain uses an unstructured peer-to-peer architecture.

(f) (**True** / **False**) Broadcasting is an effective naming service especially in WAN settings.

(g) (**True** / **False**) An approach to locating mobile entities is to use forwarding pointers, whereby an entity moving from location A to location B can leave behind a server stub (or a skeleton) to its new location at B.

(h) (**True** / **False**) No fault-tolerance measures need to be taken in RPC if it is layered on top of TCP.

(i) (**True** / **False**) The at-least-once semantic in RPC can only be used with idempotent operations.

(j) (**True** / **False**) Latency is a measure of throughput.

(k) (**True** / **False**) If a server crashes before all the actions of a non-idempotent operation are done, the system has to redo all the actions that were executed before the crash.

(l) (**True** / **False**) It is better to use synchronous RPC for operations like training a deep learning model (or what is referred to as batch processing).

*Mock Quiz continues on the next page(s)*
2. What is the difference between *layered* and *tiered* architectures? Give an example of when you would use a layered architecture, but not a tiered one?

3. You have been asked to design and implement a distributed system for video streaming, which requires high Quality-of-Service. Would you use TCP or UDP for your middleware implementation? Justify your answer.

4. What is the weakest RPC semantic (i.e., *exactly-once*, *at-most-once*, or *at-least-once*) that you would suggest for requesting a taxi through *Uber*. Discuss.
5. Why are marshaling and unmarshaling important in exchanging data between communicating entities in a distributed system?

6. What are the three major problems that blockchain tries to solve? Discuss briefly how it solves only *one* of them?
7. If a mobile computer is to remain accessible to clients when it moves across LANs, it must retain a single IP number. However, IP routing is subnet-based. Subnets are at fixed locations, and the correct routing of packets to them depends upon their positions on the network. Discuss a way of how location transparency can be achieved in such an environment (i.e., IP communication continues normally when a mobile computer moves between subnets at different locations).

8. How to ensure the durability of non-idempotent operations?