**Carnegie Mellon University in Qatar**

Distributed Systems

15-440 - Fall 2019

# Mock Quiz 1

Name: _____

Andrew ID: _____

**Total time:** 50 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 7 questions over 6 pages, for a total of 20 points.
- Keep up with time. We recommend you to approximately spend 1 minute per point.

| Question | Points | Score |
|---|---|---|
| 1 | 5 | |
| 2 | 2 | |
| 3 | 3 | |
| 4 | 2 | |
| 5 | 2 | |
| 6 | 3 | |
| 7 | 3 | |
| Total: | 20 | |

5pts 1. Answer the following questions by selecting **True** or **False**:

(a) (**True** / **False**) The communication module in RPC is responsible for marshaling and un-marshaling messages.

(b) (**True** / **False**) A solo tier in a multi-tier architecture can involve a maximum of one machine.

(c) (**True** / **False**) More latency and less concurrency can be induced with more tiers in a multi-tiered distributed system.

(d) (**True** / **False**) A distributed system designer can layer RPC on top of TCP to avoid incorporating reliability measures at the middleware.

(e) (**True** / **False**) With overlay networks, logical and physical paths are typically equivalent.

(f) (**True** / **False**) With a home-based naming approach, whenever an object moves from address space A to address space B, it leaves behind a client stub in its old place at A and installs a server stub that refers to it in B.

(g) (**True** / **False**) In a linear Chord system, whenever a node P receives a request to resolve key K, it can forward the request to $m$ nodes, assuming an $m$-bit identifier space.

(h) (**True** / **False**) The IP layer is not needed for LAN-based distributed systems (i.e., distributed systems deployed only over LANs).

(i) (**True** / **False**) The data-link layer uses a flat naming protocol.

(j) (**True** / **False**) Programmers are free to bypass layers in a layered architecture.

2pts 2. How can heterogeneity be masked in distributed systems? Explain.

*Mock Quiz continues on the next page(s)*

3pts 3. What is the difference between *layered* and *tiered* architectures? Give an example of when you would you use a layered architecture, but not a tiered one?

2pts 4. Assume you have been asked to design and implement a distributed system for video processing, which requires high Quality-of-Service. Would you use TCP or UDP for your middleware implementation? Justify your answer.

2pts 5. What is the weakest RPC semantic (i.e., *exactly-once*, *at-most-once*, or *at-least-once*) that can be used for the following scenario: Requesting taxi from an application online (e.g. *Uber*). Discuss.

3pts 6. Why are marshaling and unmarshaling important in exchanging data between communicating entities in a distributed system? What is the method that is usually used to enable any two computers to exchange binary data values? List at least one approach that is widely used to achieve that.

3pts 7. If a mobile computer is to remain accessible to clients when it moves between local networks and wireless networks, 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 com-munication continues normally when a mobile computer moves between subnets at different locations).