

Full Name:
Andrew ID:

**CS 15-440: Distributed Systems
Mock Quiz 2
November 10, 2015**

Total Time: 20 minutes

Instructions:

- Write your answers in the spaces provided below each problem. If you make a mess, clearly indicate your final answers.
- The quiz has a maximum score of 20 points.
- Keep up with time.

Good Luck!

Question No	Max. Points	Earned Points
1	4	
2	10	
3	6	
Total	20	

1. No-Brainers (4 Points) :

This section tests your understanding and recollection of the basic concepts we discussed in the class about programming models, and the replication and consistency concepts. *Answer the following precisely and concisely, or choose the correct answers.*

(a) A causally consistent distributed data-store is always sequentially consistent:

- True
- False

(b) The shared memory programming model can be applied over a machine with a Uniform Memory Access (UMA) architecture:

- True
- False

(c) For which of the following reasons is replication usually used?

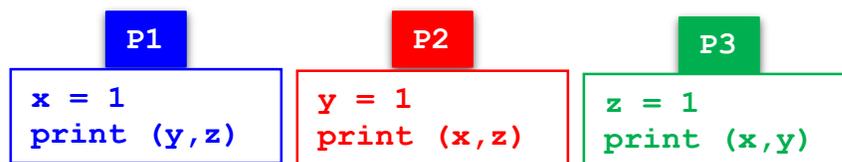
- For performance reasons
- For fault tolerance reasons
- For scalability reasons
- For concurrency reasons
- For availability reasons
- For security reasons
- For redundancy reasons
- For all of the above

(d) Briefly explain why programmers parallelize sequential programs.

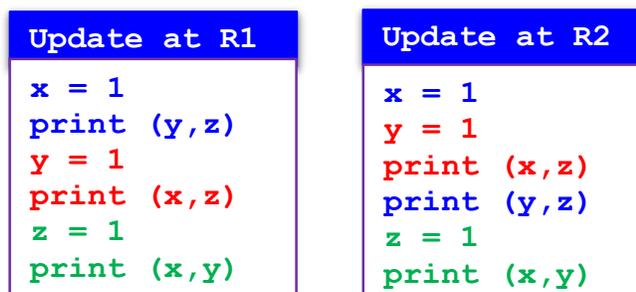
2. Consistency & Replication (10 Points):

(a) Why is *continuous consistency* used and how can it be measured? Can continuous consistency be used for client-centric models? Explain. **(Points: 4)**

(b) Consider three processes **P1**, **P2** and **P3** executing multiple instructions on three shared variables x , y and z . There are two replicas **R1** and **R2** that store x , y and z . Assume that all the variables are initialized to zero. **(Points: 3)**



Given that the operations are executed at the replicas in the following order, answer the following:



- a. Is the order of updates at each individual replica sequential? Explain why (or why not).
- b. By looking at the ordering across the replicas, identify if the data-store is sequentially consistent. Explain why (or why not).

(c) Imagine in the future, you decide to program your own web-browser which you proudly name *Tartanet*. Given that browsers implement caching, describe how you would implement read-your-rights consistency. The model shall ensure that an up-to-date web-page is displayed when the web-page is updated. **(3 Points)**

3. Programming Models (6 Points):

(a) Running an application P on two processors yields a speedup of S_2 . Use **Amdahl's Law** to derive a formula for S_n , the speedup on n processors, in terms of n and S_2 . **(Points: 2)**

(b) Typically, with parallelization, programmers observe only a sub-linear performance improvement. Discuss two reasons of why this is the case. **(2 Points)**

(c) Discuss two main conditions by which deadlocks in MPI can happen. **(2 points)**