vExam 2 - CS 682 - Fall 2014

Name:

Question	Awarded Points	Maximum Points
Question 1		10
Question 2		5
Question 3		10
Question 4		10
Question 5		5
Question 6		5
Question 7		10
Question 8		5
Question 9		10
Question 10		5
Question 11		10
Question 12		5
Question 13		5
Question 14		5
Total		100

1. (10 points) Give ***four*** serially equivalent interleavings of the following transactions T and U. For full credit, give at least one interleaving that is the equivalent of T before U and at least one interleaving that is the equivalent of U before T.

T: x=read(i); y=read(j); write(k,40);
U: write(j,10); write(i,20); z=read(l);

2. (5 points) Which of your interleavings for Question 1 would be possible if using strict two-phase locking?

3. (10 points) Consider a distributed transaction with a coordinator and three participating servers. Suppose the coordinator begins phase 1 of two-phase commit and gets a vote of commit from server 1. Immediately after server 1 fails. Will the transaction commit or abort? Explain your answer.

4. (10 points) In a decentralized variant of the two-phase commit protocol the participants communicate directly with one another instead of indirectly via the coordinator. In phase 1, the coordinator sends it vote to all the participants. In phase 2, if the coordinator's vote is *No*, the participants just abort the transaction; if it is *Yes*, each participant sends its vote to the coordinator and the other participants, each of which decides on the outcome according to the vote and carries it out. Calculate the number of messages and the number of rounds it takes. What are its advantages and disadvantages in comparison with the centralized variant?

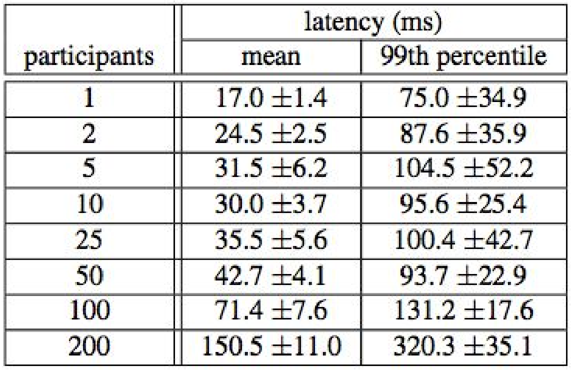
5. (5 points) The Project 2 eventual consistency implementation required the front end to maintain a vector timestamp returned by the backend after a write request. When the front end performs a read it provides the timestamp and the backend will only reply if its timestamp is greater than or equal to the front end timestamp. If there are no failures in the system, does this provide a consistency guarantee stronger than eventual? Explain your answer.

6. (5 points) Discuss one disadvantage of strong consistency over eventual consistency.

7. (10 points) In his talk, Sri Sridharan from Yelp gave a brief description of their Service Oriented Architecture. He noted that while their main system is built in python using a fairly typical LAMP stack, new services have their own stack and are built using the most appropriate tools and languages. Discuss at least one advantage ***and*** one disadvantage of this approach.

8. (5 points) Recall that the Spanner time synchronization algorithm uses a poll interval of 30 seconds. Discuss why that interval was chosen and its effect on time synchronization in the system.

9. (10 points) Table 4 from the Spanner paper (below) shows the latency to complete the two-phase commit protocol. Does the table demonstrate the the two-phase commit protocol is scalable? Explain your answer.



participants	latency (ms)	
	mean	99th percentile
1	17.0 ±1.4	75.0 ±34.9
2	24.5 ±2.5	87.6 ±35.9
5	31.5 ±6.2	104.5 ±52.2
10	30.0 ±3.7	95.6 ±25.4
25	35.5 ±5.6	100.4 ±42.7
50	42.7 ±4.1	93.7 ±22.9
100	71.4 ±7.6	131.2 ±17.6
200	150.5 ±11.0	320.3 ±35.1

Table 4: Two-phase commit scalability. Mean and standard deviations over 10 runs.

10. (5 points) Explain why locks are not necessary for read-only transactions in Spanner.

11. (10 points) Discuss one similarly ***and*** one difference between the implementation of a scalable web system and the VPN Gate system.

12. (5 points) Consider the VPN Gate system. Would it be possible to implement collaborative spy detection without implementing innocent IP mixing? Explain your answer.

13. (5 points) What is UDP hole punching and why is it necessary?

14. (5 points) Write and answer your own question. Your grade will depend on the accuracy of your answer, appropriateness with respect to the class, and your creativity.