

# CS550 Homework #3

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## **Instructions:**

- *Assigned date: Thursday October 24<sup>th</sup>, 2019*
- *Due date: 11:59PM on Friday November 1<sup>st</sup>, 2019*
- *Maximum Points: 100%*
- *This homework can be done in groups up to 3 students*
- *Please post your questions to the Piazza forum*
- *Only a softcopy submission is required; it will automatically be collected through GIT after the deadline; email confirmation will be sent to your HAWK email address*
- *Late submission will be penalized at 20% per day; an email to the TA with the subject "CS550: late homework submission" must be sent*

**5.5. (10 points)** Outline an efficient implementation of globally unique identifiers.

**6.1. (10 points)** Name at least three sources of delay that can be introduced between broadcasting the time over the network and the processors in a distributed system setting their internal clocks.

**6.2. (10 points)** Consider the behavior of two machines in a distributed system. Both have clocks that are supposed to tick 1000 times per millisecond. One of them actually does, but the other ticks only 990 times per millisecond. If UTC updates come in once a minute, what is the maximum clock skew that will occur?

**6.3. (10 points)** One of the modern devices that have (silently) crept into distributed systems are GPS receivers. Give examples of distributed applications that can make use of GPS information.

**6.7. (10 points)** Consider a communication layer in which messages are delivered only in the order that they were sent. Give an example in which even this ordering is unnecessarily restrictive.

**7.2/7.7. (10 points)** Explain in your own words what the main reason is for actually considering weak consistency models. It is often argued that weak consistency models impose an extra burden for programmers. To what extent is this statement actually true?

**7.9. (10 points)** What kind of consistency would you use to implement an electronic stock market? Explain your answer.

**7.10. (10 points)** Consider a personal mailbox for a mobile user, implemented as part of a wide-area distributed database. What kind of client-centric consistency would be most appropriate?

**7.14. (10 points)** We have stated that totally ordered multicasting using Lamport's logical clocks does not scale. Explain why.

**7.18. (10 points)** For active replication to work in general, it is necessary that all operations be carried out in the same order at each replica. Is this ordering always necessary?