



ANSWERS TO THE THIRD COSC 6360 QUIZ

Fall 2020



Time, clocks and the ordering of events

- A system of physical clocks consists of two clocks, namely, one that is slow and loses two minutes every hour and another that neither fast nor slow. Assuming that the clocks are managed by Lamport's physical clock protocol, what will be the time marked by each clock at **3 pm** given that:
 - Both clocks indicated the correct time at noon;
 - The processors on which the clocks reside continuously exchanged messages until ***one pm***;
 - Message transmission delays are negligible.



Answer

- We note first that both clocks will indicate the correct time until 1 pm as the slow clock receives continuous updates from the other clock.
 - After that, each of the two clocks runs independently of the other.

- ***At 3:00pm, the slow clock will indicate 2:56pm***
- ***The other clock will indicate 3:00pm***



Raft

- When can the leader of a Raft cluster safely update its state machine?



Answer

- When can the leader of a Raft cluster safely update its state machine?
 - ***The leader of a Raft cluster can—and should—update its state machine as soon as it knows its log update has been accepted by a majority of the servers in the cluster.***



Raft

- How does Raft ensure that the log of a newly elected leader always contains all previously committed entries?



Answer

- How does Raft ensure that the log of a newly elected leader always contains all previously committed entries?
 - ***Raft ensures that servers will never elect as new leader a server that is less up to date than they are.***



SSH

- How does SSH verify the integrity of the packets transmitted between a server and its clients?



Answer

- How does SSH verify the integrity of the packets transmitted between a server and its clients?
 - ***SSH transmits along with its data packets digitally signed secure hashes of their contents (SHA-1)***



Video streaming

- According to Shah et al., why is the original BitTorrent *tit-for-tat* policy poorly suited to video streaming applications?



Answer

- According to Shah et al., why is the original BitTorrent *tit-for-tat* policy poorly suited to video streaming applications?
 - ***Because the tit-for-tat policy of the original BitTorrent protocol does not let incoming peers receive their first data from their neighbors fast enough.***



RAID arrays

- What is the major advantage of RAID level 5 organizations over RAID level 4 organizations?



Answer

- What is the major advantage of RAID level 5 organizations over RAID level 4 organizations?
 - ***RAID level 4 stores all its parity blocks on a single parity disk, which can cause a bottleneck at high update rates.***
 - ***RAID level 5 eliminates this bottleneck by distributing its parity blocks among all the disks in the array.***



RAID arrays

- Which combination of events is the most likely to result in a permanent data loss in a RAID level 5 disk array?



Answer

- Which combination of events is the most likely to result in a permanent data loss in a RAID level 5 disk array?
 - ***Irrecoverable data losses are most likely to result from the simultaneous occurrence of a single disk failure and one or more irrecoverable reads errors—“bad blocks”—in the surviving disks.***



Log-structured file systems

- According to Rosenblum and Ousterhout, what is the minimum write cost for a log-structured file system? (5 points)

- Is this value realistic? (5 points)



Answer

- According to Rosenblum and Ousterhout, what is the minimum write cost for a log-structured file system? (5 points)
 - **Two disk accesses per write.**
- Is this value realistic? (5 points)
 - ***This value is totally unrealistic because it assumes that none of the segments being cleaned contained any live data.***



Log-structured file systems

- How does Sprite LFS retrieve the addresses of its i-nodes after a crash?



Answer

- How does Sprite LFS retrieve the addresses of its i-nodes after a crash?
 - ***Sprite LFS will go first to the checkpoint area to get the addresses all all i-node map blocks at the time of the last checkpoint.***
 - ***It will then scan through the log segments that were written after the last checkpoint and update its i-node map each time a summary block indicates presence of a new i-node.***