

NAME: \_\_\_\_\_ (FIRST NAME FIRST)

SCORE: \_\_\_\_\_

COSC 6360

QUIZ #4

NOVEMBER 14, 2011

This exam is closed book. You can have one page of notes.

1. Consider a **Chord** node whose **finger table** is **out of date** and only contains invalid node addresses. What should the node do with the lookup() requests it receives? (10 points)

The node should forward the request to one of the  $r$  nodes in its successor list.

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2. Under the best possible circumstances how many read operations can be executed in parallel

a) By a RAID level 3 array with eight disks? (5 points)

Answer:   1  

b) By a RAID level 5 array with the same number of disks? (5 points)

Answer:   8  

3. What is the main advantage of RAID level 6 arrays over RAID level 5 arrays? (10 points)

RAID level 6 arrays can tolerate the failures of two disks without data loss while RAID level 5 arrays can only

tolerate the failure of a single disk.

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4. What is the purpose of the **i-node map** of a log-structured file system? (5 points)

The i-node map contains the addresses of the i-node blocks.

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Where is it stored? (5 points) On the log (along with all other data.)

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How can we retrieve it when the system reboots after a crash? (10 points)

**Step 1:** We retrieve from the checkpoint region the addresses of all blocks in the i-node map at the time the last checkpoint was taken.

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**Step 2:** We scan through the log segments that were written after the last checkpoint and look for new i-node blocks. When we find one, we update the i-node map.

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5. Consider a diskless client trying to access a file named `"/usr/joe/paper.doc"` that is stored on its NFS server.
- a) Assuming that the client already has a handle for its root directory, how many **lookup()** requests will it issue? (5 points)

Answer: 3 requests

- b) What does NFS do to speed up these requests? (5 points)

It caches file handles.

6. What is a **stale file handle**? (10 points)

A stale file handle is a file handle that points to the i-node of a file that was deleted. Our main problem is that the i-node could now be used by another file.

What does NFS do to detect them? (10 points)

NFS compares the generation number of the file handle with the generation number of the i-node. If the numbers do not match, it knows that the file handle is stale.

7. How do the two **journaling file systems** described by Seltzer *et al.* ensure that metadata blocks are always written on the log before being written at their ultimate destination on disk? (10 points)

The buffer header of each modified block in the I/O buffer identifies the first and last log entries describing an update to the block. The file system uses the last log entry to ensure that all relevant log entries are written to disk before the block is flushed from the cache.

8. In soft updates, in which order should we write to disk (2×5 points)

- a) The **directory block D** containing a **file f** to be *removed* and the **block H** containing the **i-node of file f**?

We should write to disk the updated directory block D before the updated i-node block H.

- b) The **directory block E** containing a **file g** to be **added** and the **block I** containing the **i-node of file g**?

We should write to disk the updated i-node block I before the updated directory block D.