2 4 / 6 points

Which of the following statements about transactions and concurrency control are correct? Select correct statement(s).

- ✓ [x] In order to recover from an aborting transaction, a transaction must not commit if it has done a dirty read from a transaction that subsequently aborted.
- [ ] In optimistic concurrent control, backward validation checks a write set of the transaction undergoing validation with read sets of other later transactions, which are still active.
- [ ] To prevent cascading aborts, a transaction must suspend its commit operation if it has performed a dirty read.
- ✗ [x] In concurrent control based on timestamp ordering, a read operation of a current transaction T_c does conflict with previous write operations done by other transactions, T_i, whose timestamps indicate that they should be later than T_c, i.e., $T_i > T_c$

Selected Answer - Incorrect

- ✓ [x] In concurrent control based on timestamp ordering, a write operation of a current transaction T_c conflicts with previous read and write operations done by other transactions, T_i, whose timestamps indicate that they should be later than T_c, i.e., $T_i > T_c$
- ✓ [x] A serially equivalent interleaving is an interleaving of the operations of transactions in which the combined effect is the same as if the transactions had been performed one at a time in some order.
- [ ] With the strict two-phase locking, a transaction acquires all locks it needs in the first phase (a "growing phase"), and releases the locks in the second phase (a '"shrinking phase") before the transaction commits or aborts.

3 8 / 8 points

Which of the following statements about distributed transactions are correct? Select correct statement(s).

- ✓ [x] If a participant replies to the coordinator with its vote "No" on a "*canCommit?*" request, the participant aborts immediately.
- ✓ [x] If servers, using parallel validation, simply perform independent validations, different servers in a distributed transaction may serialize the same set of transactions in different orders.
- ✓ [x] When a coordinator has failed, the participants can decide to commit or abort the transaction cooperatively instead of contacting the coordinator. However, if all the participants are in the uncertain state, they will be unable to decide until the coordinator or a participant with the necessary knowledge is available.
- [ ] In the first phase of the two-phase commit protocol, when a participant receives a "*canCommit?*" request from the coordinator, the participant first prepares to commit by saving objects in permanent storage and then sends its vote ("Yes" or "No") to the coordinator.
- [ ] In distributed optimistic transactions, each server applies a parallel validation protocol, an extension of either backward or forward validation to disallow multiple transactions to be in the validation phase on different servers simultaneously.
- ✓ [x] If transaction *T* is before transaction *U* in their conflicting access to objects at one of the servers, they must be in that order at all of the servers whose objects are accessed in a conflicting manner by both *T* and *U*.

7 2 / 2 points

We sometimes want to include the behavior of faulty nodes in our requirements and talk about *uniform agreement* for multicast. What do we mean by uniform agreement?

- ( ) If a node, including faulty, sends a message then it also delivers the message.
- ( ) If any node, including faulty, deliver a message then all nodes, including faulty, deliver the message.
- ( ) A node, including faulty, delivers a message at most once and only messages that have been sent.
- ✓ (•) If any node, including faulty, deliver a message then all correct nodes deliver the message.

9 6 / 6 points

Which of the following statements about coordination problems in a distributed system are correct? Select correct statement(s)

- [ ] In the total order multicast, messages are delivered in *happened before* order
- [x] The bully election algorithm allows processes to crash during an election, although it assumes reliable message delivery and requires reliable failure detectors.
- [x] In a quorum based algorithm the quorum is often chosen to be the majority of processes. Alternatively, processes can be divided into smaller quorums where any two quorums overlap in at least one process to prevent two quorums from being formed simultaneously.
- [ ] The benefit of a reliable multicast is that the sender will not crash during an operation.
- [ ] In the total order multicast, messages are delivered in real time order.
- [x] Ricart and Agrawala's mutual exclusion algorithm performs better than a central solution under high lock contention since only one message is needed to release the lock by a process exiting the critical section and obtain the lock by the next process waiting for the lock.

10 4 / 4 points

Select correct statement(s).

- [ ] In distributed systems, a replicated service always appears to the end user as a single non-replicated service.
- [x] View-synchronous communication extends the semantics of reliable multicast to account for changing group views.
- [x] Sequential consistency is more practical than linearizability because measuring real-time in practice accurately is difficult.
- [ ] In active replication, there exists one active replica manager and one or more backup replica managers.

25 1 / 1 point

What is provided by TCP?

- ( ) a guarantee that messages will always reach its destination
- ( ) a best effort delivery of messages
- (•) a full-duplex stream between two processes
- ( ) transactional control and persistence

28 6 / 6 points

Which of the following statements about remote invocation techniques for communication in distributed systems are correct? Select correct statement(s)

- [x] With *at-most-once* semantics, the caller receives either a result, in which case the caller knows that the procedure was executed exactly once, or an exception informing it that no result was received, in which case the procedure will have been executed either once or not at all.
- [x] On receiving an object reference as an input/output parameter or a return result in a remote method invocation, a process can then access this object using remote method invocation instead of transmitting the object value across the network.
- [ ] Even if a failure has been reported, the caller knows that the remote procedure with *at-least-once* RPC semantics has been executed at least once.
- [ ] Unlike a regular procedure call, a call to a *void* remote procedure returns as soon as the call request is sent to the destination computer where the procedure is to be executed.
- [ ] A non-idempotent operation is an operation that can be performed repeatedly with the same effect as if it had been performed exactly once.
- [x] Each remote procedure call is executed in a separate process (thread) on the server side.

31 2 / 2 points

In an active replicated server, how do we know that the replicas are in a consistent state?

- ( ) a coordinator uses two-phase commit for each request
- ( ) the primary replica sends update messages to all other
- ( ) they do not change state and are thus by definition consistent
- (•) they reliably receive all requests in a total order

Feedback

General Feedback

Section 18.3.2

34 4 / 4 points

Select correct statement(s).

- [x] In a distributed file system, both Read and Write remote access operations require an additional parameter specifying a position in the remote file. This allows clients to use repeatable operations with at-least-once semantics and servers to be stateless by not keeping track of the file access positions.
- [ ] In group communication, FIFO ordering guarantees that if a message is delivered before another message at one process, then the same order will be preserved at all processes.
- [ ] In a distributed file system, the directory service is responsible for creating files and allocating the file identifier.
- [x] Publish-Subscribe is a form of indirect communication that is both time- and space-uncoupled