Quiz Assignment-III Solutions: Distributed Systems (Week-3)

Q. 1 Under heavy load, the Raymond's Tree Algorithm requires exchange of only ___________ messages per critical section execution.

A) N, where N is the sites

B) 4

C) 3

D) 0

Ans: B) 4

Explanation: In heavy load, the algorithm requires exchange of only four messages per CS execution.

Q. 2 Consider the following statement:

"In Suzuki-Kasami's Broadcast Algorithm, if a site does not hold the token when it makes a request, the algorithm requires 5N-1 messages to obtain the token."

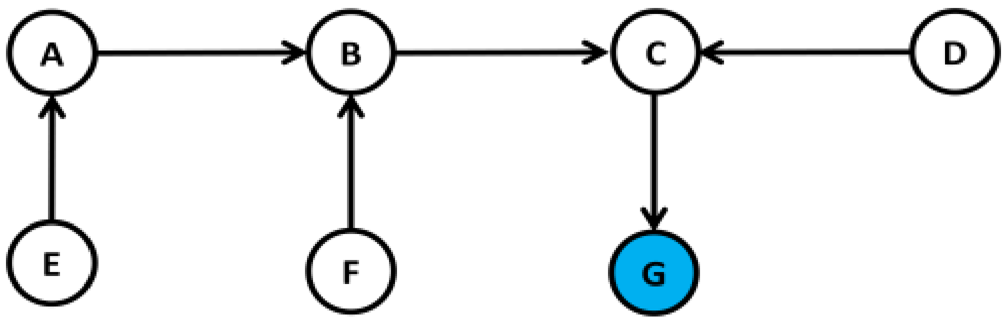
A) True

B) False

Ans: B) False

Explanation: If a site does not hold the token when it makes a request, the algorithm requires N messages to obtain the token.

Q. 3 Consider the given tree of Raymond's Tree Algorithm as shown in figure, where node 'G' is the privileged node. Calculate the content of holder variables for various nodes



A. $HOLDER_A$ = E , $HOLDER_B$ = A, $HOLDER_C$ = B, $HOLDER_D$ = C, $HOLDER_E$ = F , $HOLDER_F$ = E, $HOLDER_G$ = F

B. $HOLDER_A$ = B , $HOLDER_B$ = C, $HOLDER_C$ = G, $HOLDER_D$ = C, $HOLDER_E$ = A , $HOLDER_F$ = B, $HOLDER_G$ = self

C. $HOLDER_A$ = B , $HOLDER_B$ = F , $HOLDER_C$ = B , $HOLDER_D$ = C , $HOLDER_E$ = A , $HOLDER_F$ = self , $HOLDER_G$ = C

D. $HOLDER_A$ = B , $HOLDER_B$ = C, $HOLDER_C$ = G, $HOLDER_D$ = C, $HOLDER_E$ = A , $HOLDER_F$ = B, $HOLDER_G$ = G

Ans: B. $HOLDER_A$ = B , $HOLDER_B$ = C, $HOLDER_C$ = G, $HOLDER_D$ = C, $HOLDER_E$ = A , $HOLDER_F$ = B, $HOLDER_G$ = self

Explanation:

Each node maintains a **HOLDER** variable that provides information about the placement of the privilege in relation to the node itself.

•A node stores in its **HOLDER** variable the identity of a node that it thinks has the privilege or leads to the node having the privilege.

•For two nodes X and Y, if **HOLDER*X* = Y**, we could redraw the undirected edge between the nodes X and Y as a directed edge from X to Y. In same way we can find:
$HOLDER_A$ = B, $HOLDER_B$ = C, $HOLDER_C$ = G, $HOLDER_D$ = C, $HOLDER_E$ = A , $HOLDER_F$ = B, $HOLDER_G$ = self

Q. 4 Consider the following regarding the Log-based Rollback Recovery Schemes

Scheme	Paradigm
(P) Pessimistic Logging	(i) Low failure free overhead and simpler recovery
(Q) Optimistic Logging	(ii) It reduces failure free overhead, but complicates recovery.
(R) Casual Logging	(iii) It simplifies recovery but hurts the failure-free performance.

Match the scheme to the paradigms they are based on.

A. (P): (i), Q: (ii), R: (iii)
B. (P): (iii), Q: (ii), R: (i)
C. (P): (ii), Q: (iii), R: (i)
D. (P): (iii), Q: (i), R: (ii)

Ans: B. (P): (iii), Q: (ii), R: (i)

Explanation: Refer the definitions of Log-based Rollback Recovery Schemes

Q.5 Consider the following statement:

"Pease showed that in a fully connected network, it is impossible to reach an agreement if number of faulty processors '*f*' exceeds $\lfloor (n-1)/3 \rfloor$ where *n* is the number of processors"

A. True
B. False

Ans: A. True

Explanation: Pease statement is correct

Q. 6 “Koo-Toueg algorithm is a uncoordinated checkpointing and recovery technique that takes a consistent set of checkpointing and avoids domino effect and livelock problems during the recovery”

A. True
B. False

Ans: B. False

Explanation: Koo and Toueg (1987) proposed a coordinated checkpointing and recovery technique that takes a consistent set of checkpointing and avoids ‘domino effect’ and ‘livelock problems’ during the recovery

Q 7. Messages whose ‘send’ is done but ‘receive’ is undone due to rollback are called

A. In-transit message
B. Lost messages
C. Orphan messages
D. Duplicate messages

Ans: B. Lost messages

Explanation:

Lost messages –messages whose ‘send’ is done but ‘receive’ is undone due to rollback

Q. 8 Consider the following statements related to Process Failure Models

i. Fail-stop: In this model, a properly functioning process may fail by stopping execution from some instant thenceforth. Additionally, other processes can learn that the process has failed.

ii. Crash: A properly functioning process may fail by intermittently receiving only some of the messages sent to it, or by crashing.

iii. Receive omission: In this model, a properly functioning process may fail by stopping to function from any instance thenceforth. Unlike the fail-stop model, other processes do not learn of this crash.

iv. Send omission: A properly functioning process may fail by intermittently sending only some of the messages it is supposed to send, or by crashing.

A. Only (i) & (ii) are true
B. Only (i), (ii) and (iii) are true
C. Only (i) & (iv) are true
D. All are true

Ans: Only (i) & (iv) are true

Explanation: The correct definitions are:

i. Fail-stop: In this model, a properly functioning process may fail by stopping execution from some instant thenceforth. Additionally, other processes can learn that the process has failed.

ii.Crash: In this model, a properly functioning process may fail by stopping to function from any instance thenceforth. Unlike the fail-stop model, other processes do not learn of this crash.

iii.Receive omission: A properly functioning process may fail by intermittently receiving only some of the messages sent to it, or by crashing.

iv. Send omission: A properly functioning process may fail by intermittently sending only some of the messages it is supposed to send, or by crashing.

Q. 9 Cascaded rollback which causes the system to roll back to too far in the computation (even to the beginning), in spite of all the checkpoints is known as:

A. Rollback
B. Phantom Effect
C. Livelock
D. Domino Effect

Ans: D. Domino Effect

Explanation: Refer the definition of Domino Effect

Q. 10 Consider the given table of agreement problems and match the correct pair:

Agreement Problem	Agreement Condition
(P) Byzantine Agreement Problem	(i) All processes have an initial value and All non-faulty processes must agree on the same (single) value.
(Q) Consensus Problem	(ii) All processes have an initial value and All non-faulty processes must agree on the same array of values $A[v_1 . . . v_n]$.
(R)Interactive Consistency Problem	(iii) Single source has an initial value and All non-faulty processes must agree on the same value.

A. (P): (i), (Q): (ii), (R): (iii)
B. (P): (iii), (Q): (ii), (R): (i)
C. (P): (iii), (Q): (i), (R): (ii)
D. (P): (ii), (Q): (iii), (R): (i)

Ans: C. (P): (iii), (Q): (i), (R): (ii)
Explanation: Refer the definitions of Agreement Problem