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. \(\text{HOLDER}_A = E\), \(\text{HOLDER}_B = A\), \(\text{HOLDER}_C = B\), \(\text{HOLDER}_D = C\), \(\text{HOLDER}_E = F\), \(\text{HOLDER}_F = E\), \(\text{HOLDER}_G = F\)

B. \(\text{HOLDER}_A = B\), \(\text{HOLDER}_B = C\), \(\text{HOLDER}_C = G\), \(\text{HOLDER}_D = C\), \(\text{HOLDER}_E = A\), \(\text{HOLDER}_F = B\), \(\text{HOLDER}_G = \text{self}\)
C. \text{HOLDER}_A = B\, , \text{HOLDER}_B = F\, , \text{HOLDER}_C = B\, , \text{HOLDER}_D = C\, , \text{HOLDER}_E = A\, , \text{HOLDER}_F = \text{self}\, , \text{HOLDER}_G = C

D. \text{HOLDER}_A = B\, , \text{HOLDER}_B = C\, , \text{HOLDER}_C = G\, , \text{HOLDER}_D = C\, , \text{HOLDER}_E = A\, , \text{HOLDER}_F = B\, , \text{HOLDER}_G = \text{self}

Ans: B. \text{HOLDER}_A = B\, , \text{HOLDER}_B = C\, , \text{HOLDER}_C = G\, , \text{HOLDER}_D = C\, , \text{HOLDER}_E = A\, , \text{HOLDER}_F = B\, , \text{HOLDER}_G = \text{self}

Explanation:

Each node maintains a \text{HOLDER} variable that provides information about the placement of the privilege in relation to the node itself.

• A node stores in its \text{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 \(\text{HOLDER}_X = Y\), 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:

\text{HOLDER}_A = B\, , \text{HOLDER}_B = C\, , \text{HOLDER}_C = G\, , \text{HOLDER}_D = C\, , \text{HOLDER}_E = A\, , \text{HOLDER}_F = B\, , \text{HOLDER}_G = \text{self}

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

<table>
<thead>
<tr>
<th>Scheme</th>
<th>Paradigm</th>
</tr>
</thead>
<tbody>
<tr>
<td>(P) Pessimistic Logging</td>
<td>(i) Low failure free overhead and simpler recovery</td>
</tr>
<tr>
<td>(Q) Optimistic Logging</td>
<td>(ii) It reduces failure free overhead, but complicates recovery.</td>
</tr>
<tr>
<td>(R) Casual Logging</td>
<td>(iii) It simplifies recovery but hurts the failure-free performance.</td>
</tr>
</tbody>
</table>

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:

<table>
<thead>
<tr>
<th>Agreement Problem</th>
<th>Agreement Condition</th>
</tr>
</thead>
<tbody>
<tr>
<td>(P) Byzantine Agreement Problem</td>
<td>(i) All processes have an initial value and All non-faulty processes must agree on the same (single) value.</td>
</tr>
<tr>
<td>(Q) Consensus Problem</td>
<td>(ii) All processes have an initial value and All non-faulty processes must agree on the same array of values $A[v_1, \ldots, v_n]$.</td>
</tr>
<tr>
<td>(R) Interactive Consistency Problem</td>
<td>(iii) Single source has an initial value and All non-faulty processes must agree on the same value.</td>
</tr>
</tbody>
</table>

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