

Assignment-I Solution

1 Solution

Correct Option: If events a and b are causally related, then event a happened before event b.

Explanation:

Scalar clocks satisfy the monotonicity and hence the consistency property: for two events e_i and e_j , $e_i \rightarrow e_j \Rightarrow C(e_i) < C(e_j)$.

2 Solution

Correct Option: a: 6, b: 7, c: 6, d: 7, e: 8, f: 9

Explanation: Solved by the property of Scalar Time

3 Solution

Correct Option: (P): (iii), Q: (iv), R: (i), (S): (ii)

Explanation:

(P) Access transparency hides differences in data representation on different systems and provides uniform operations to access system resources.

(Q) Migration transparency allows relocating resources without changing names.

(R) Failure transparency refers to the system being reliable and fault-tolerant.

(S) Relocation transparency is the ability to relocate the resources as they are being accessed is relocation transparency.

4 Solution

Correct Option: True

Explanation: There is no anonymous leader election algorithm for synchronous ring systems that is uniform

5 Solution

Correct Option: n-1, d

Explanation: There is an asynchronous convergecast algorithm with message complexity (n-1) and time complexity d, when a rooted spanning tree of n nodes with depth d is known in advance.

6 Solution

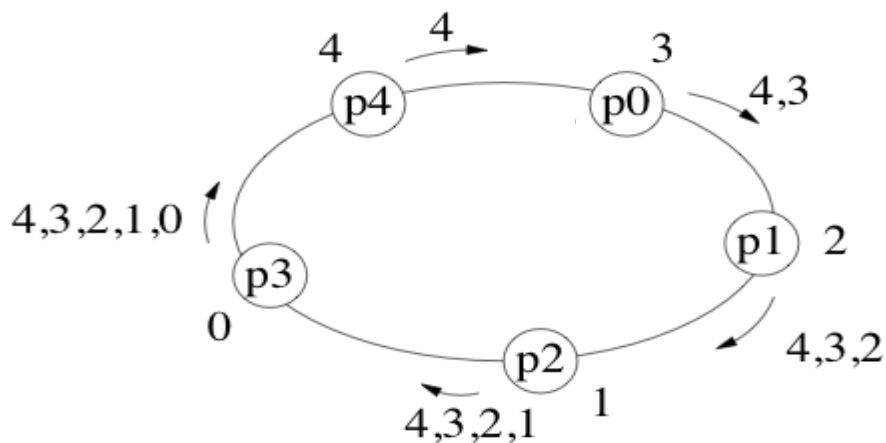
Correct Option: $O(m)$, $O(m)$

Explanation: There is an asynchronous algorithm to find a depth-first search spanning tree of a network with m edges and n nodes, given a distinguished node, with message complexity $O(m)$ and time complexity $O(m)$

7 Solution

Correct Option: 15

Explanation:



Total number of messages is $n + (n-1) + (n-2) + \dots + 1$

largest id travels all around the ring (n messages)

2nd largest id travels until reaching largest

3rd largest id travels until reaching largest and so on

$5 + (5-1) + (5-2) + (5-3) + (5-4) = 15$ messages

8 Solution

Correct Option: $2k+1$, $4 \cdot 2^k$

Explanation:

k -neighbourhood of a processor p_i in the ring to be the set of processors that are at distance at most k from p_i in the ring (either to the left or to the right). Note that the k -neighbourhood of a processor includes exactly $2k+1$ processors.

Probe distance in phase k is 2^k and Number of messages initiated by a processor in phase k is at most $4 \cdot 2^k$ (probes and replies in both directions)

9 Solution

Correct Option: (1, 7, 4)

Explanation: If we do an element-by element comparison:

(1, 7, 4) is neither \geq nor \leq to (2, 7, 3)

$1 < 2, 7 = 7, 4 > 3$.

10 Solution

Correct Option: A5: (4, 3, 3), B3: (1, 3, 0), C2: (1, 2, 2)

Explanation: Solved by the property of vector clock

11 Solution

Correct Option: Layered, Middleware

Explanation: The distributed system uses a layered architecture to break down the complexity of system design. The Middleware is the distributed software that drives the distributed system, while providing transparency of heterogeneity at the platform level.

12 Solution

Correct Option: Asynchrony

Explanation: Asynchrony: Absolute & relative timings of events cannot always be known precisely.

13 Solution

Correct Option: Broadcast, Convergecast

Explanation:

Broadcast is used to send the information to all.

Convergecast is used to collect the information.

14 Solution

Correct Option: Both are true

Explanation:

A uniform algorithm does not use the ring size (same algorithm for each size ring)

A non-uniform algorithm uses the ring size (different algorithm for each size ring)

15 Solution

Correct Option: Both are false

Explanation:

Correct statements are:

By the property of scalar clocks and vector clocks:

The system of scalar clocks is not strongly consistent; that is, for two events e_i and e_j , $C(e_i) < C(e_j) \Rightarrow e_i \not\rightarrow e_j$

The system of vector clocks is strongly consistent; thus, by examining the vector timestamp of two events, we can determine if the events are causally related.