M.TECH/CSE/2ND SEM/CSEN 5202/2015
2015

Advanced Operating System
(CSEN 5202)

Time Allotted : 3 hrs **Full Marks : 70**

Figures out of the right margin indicate full marks.

Candidates are required to answer Group A and any 5 (five) from Group B to E, taking at least one from each group.

Candidates are required to give answer in their own words as far as practicable.

Group – A
(Multiple Choice Type Questions)

1. Choose the correct alternative for the following: **10 x1 =10**

(i) In distributed systems, a logical clock is associated with
- (a) Each resister (b) Each process
- (c) Each instruction (d) None of the above.

(ii) In Processor Pool model of Distributed System the ratio of number of processor to number of users is normally
(a) =1 (b) < 1 (c) > 1 (d) None of these.

(iii) In AND deadlock model
- (a) Only one deadlock may occur at a time
- (b) No false deadlock occur
- (c) Multiple deadlocks may occur at a time
- (d) No more than three deadlocks may occur at a time.

(iv) Characteristics of a DFS is
- (a) Login transparency and access transparency
- (b) Files need to contain information about their physical location
- (c) No multiplicity of users
- (d) No multiplicity of files.

(v) In the P-out-of Q request model of deadlock , if P=Q then it becomes
- (a) AND (b) OR
- (c) AND-OR (d) All of these.

(vi) Which of the following is for global snapshot algorithm?
- (a) Chandy Lamport (b) Lamport's Logical clock
- (c) Ricart- Agarwala (d) None of the above.

(vii) An example of non-token based algorithm is
- (a) Ricart-Agrawal (b) Singhal
- (c) Chandy-Lamport (d) All of these.

(viii) Phantom deadlock occurs in the distributed system only when there is
(a) False cycle (b) False path
(c) False knot (d) None of these.

(ix) A process executes the code
fork();
fork();
fork();
The total number of **child** processes created is
(a) 3 (b) 4 (c) 7 (d) 8.

(x) In rate monotonic scheduling
(a) shorter duration job has higher priority
(b) longer duration job has higher priority
(c) priority does not depend on the duration of the job
(d) none of the mentioned.

Group – B

2.(a)

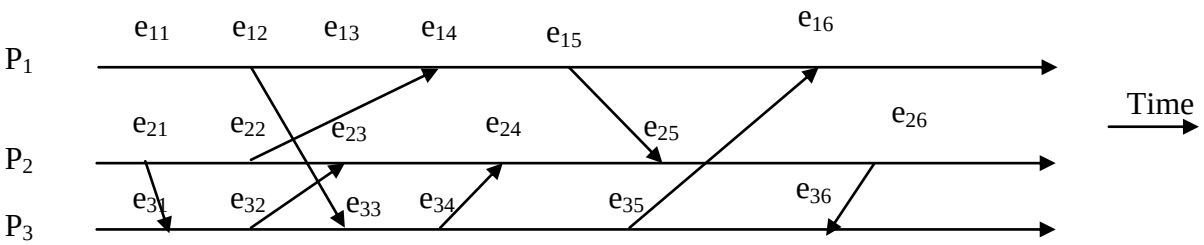

Fig1

Fig 1. above shows events of three processes P_1, P_2 and P_3. Let e_{ij} denotes the jth event of process P_i. Arrows indicate transmission of message. Assume the processes use Lamport's logical clocks where C_i denotes the local clock at process P_i. The initial value of $C_i = 0$ for every process P_i. Assume that the increment value is d=1 for all processes. To each event shown in the figure, assign the correct clock value.

5+7=12

(b) What is the advantage of vector clock over logical clock? Write instruction rule for the vector clock. For the above **Fig 1** draw the vector clock.

3.(a) Explain Lamport's Logical clock.

(b) Consider nodes A, B, C that all use Lamport's logical clock concept. The notation A4 C2 will mean that A sent a message to C and that when the message was sent A's logical clock read 4 and when the message was received C's logical clock read 2.
Which of the following are legal sets of events? Explain your answers.
i) A5 C7, C8 A10 ii) C12 A5, A6 C11

(c) Explain the limitations of the Lamport's logical clock with the help of a diagram. How it can be solved in Vector Clock?

4+4+4=12

Group – C

4.(a) There is, one distributed mutual exclusion algorithm, which gives the impression that the message complexity of a distributed mutual exclusion can be $O(\sqrt{N})$ instead of O(N). Why this algorithm needs $3\sqrt{N}$ messages per CS execution? Derive how each request set's size becomes $\sqrt{N}$.

(b) "In a simple solution to distributed mutual exclusion, a *control site* is assigned the task of granting permissions for the CS execution. To request the CS, a site sends a REQUEST message to the control site. The control site queues up the requests for the CS and grants them permission, one by one. This method to achieve mutual exclusion in distributed systems requires only 3 messages per CS execution."

Discuss what prompted Lamport to develop mutual exclusion algorithm, though it requires more messages [3(N-1)] per CS invocation.

6+6 = 12

5.(a) Write the edge chasing distributed deadlock detection algorithm for the AND model. Show with one example how the probe message propagation along each edge determines whether any deadlock exists there or not.

(b)

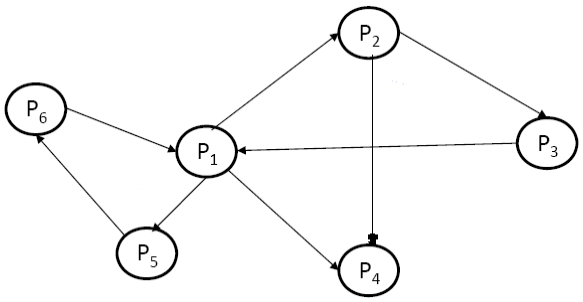

Fig 2

By Following OR model of deadlock detection find out whether there exist a KNOT in a wait for graph in Fig 2. Also find out the dependency set of each node.

6+6 = 12

Group – D

6.(a) Discuss a sequential, processor consistency memory coherence protocol to maintain consistency in distributed shared memory (DSM) with example.

(b) Explain the central server algorithm and full replication algorithm for implementing DSM.

6+6 =12

7.(a) Explain why the write-invalidate protocol is suitable to maintain coherence, if several updates occur between reads or when a program exhibits per-node locality of reference.

(b) Explain why a page is transferred twice when a double fault occurs in IVY's coherence protocol.

6+6 = 12

Group – E

8.(a) Discuss the issues in designing a distributed operating system.

(b) What are the issues in client server binding? Explain how these issues handled in RPC.

6+6 = 12

9.(a) Consider the following set of three periodic real-time tasks: T1=(10,20), T2=(15,60), T3=(20,120) to be run on a uniprocessor. Determine whether the task set is schedulable under RMA.

(b) Consider the following three periodic real-time tasks to be scheduled using EDF on a uniprocessor: T1 = (e1=10, p1=20), T2 = (e2=5, p2=50), T3 = (e3=10, p3=35). Determine whether the task set is schedulable.

(c) State difference between RMA and EDF.

6+3+3=12