DDBS Homework 3: Transaction

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1 Analysing transaction schedules

S1 = W2(x), W1(x), R3(x), R1(x), C1, W2(y), R3(y), R3(z), C3, R2(z), C2
S2 = R3(z), R3(y), W2(y), R2(z), W1(x), R3(x), W2(x), R1(x), C1, C2, C3
S3 = R3(z), W2(x), W2(y), R1(x), R3(x), R2(z), R3(y), C3, W1(x), C2, C1
S4 = R2(z), W2(x), W2(y), C2, W1(x), R1(x), A1, R3(x), R3(z), R3(y), C3

1.1 Conflict equivalence

Only S1 and S4 are conflict equivalent.

1.2 Serializability

S1, S3, and S4 are serializable with the following serial orders:
S1: T2, T1, T3
S2: T2, T3, T1
S3: T2, T1, T3

2 Centralised and hierarchical deadlock detection

2.1 Centralised deadlock detection

Centralised Deadlock Detection has one site designated as the deadlock detection for the system. Each scheduler periodically sends its local Wait-For-Graph (WFG) to the central site which merges them to a global WFG to determine cycles.

2.2 Hierarchical deadlock detection

Hierarchical Deadlock Detection organises sites into a hierarchy and deadlock detector in each site sends local WFG to parents in hierarchy.

2.3 Comparison

1. Centralised approach is good if the concurrency control algorithm for the distributed DBMS is also centralised. Similarly, hierarchical approach is good if access patterns are localised, for example based on geographical region, because the hierarchy of deadlock detectors in each site is able to check for deadlocks where they are most likely to happen.

2. Centralised approach is able to detect all deadlocks with low delay by having the deadlock detector at the central site communicate with all other sites, especially if the scheduler at each site sends its local WFG at short periodic intervals. However, this comes at the expense of higher communication costs.

3. Hierarchical approach is more efficient as it is able to distribute the task and burden of deadlock detection across different deadlock detectors at different sites.

3 Local deadlock detector

If a cycle in the modified local WFG does not involve T_{ex}, I can conclude that the deadlock can be handled locally, otherwise if there exists a cycle involving T_{ex}, I can conclude that there is potentially a global deadlock.

4 Guarantee of finding global deadlock in distributed deadlock detection

Yes, the scheme is guaranteed to find a global deadlock if one exists before the first WFG is sent, and the global deadlock will be uncovered before a local site gets back the WFG containing its own node.