Solution

Question 1: Serializability

[Q1.1] S1 is not serial.

[Q1.2] S1 is not conflict serializable because the dependency graph has a cycle.

[Q1.3] S2 is conflict serializable. The conflict equivalent serial schedule is T3-T2-T1.
Question 2: Two Phase Locking

[Q2.1]
Yes, the schedule is permitted by 2PL.
Transaction 1 can lock the objects A, B, and D at time 5. Then, transaction 1 releases the locks A, B, and D at times 7, 17, and 21, respectively.
Transaction 2 locks A at time 10, unlock at time 13.
Transaction 3 locks C and B at time 1 and 30, respectively, and releases all locks at time 32.

[Q2.2]
No, the schedule is not permitted by strict 2PL.
The reason is that Transaction 2 is waiting for the exclusive lock on A at time 8, but the lock is not released until the time Transaction 1 commits.

Question 3: Hierarchical Locking

[Q3.1]
IS[D], IS[M], S[M:3], U[M:3], U[M], U[D]

[Q3.2] We give full scores for either of the solutions.
(solution 1) IS[D], IS[P], S[P:1], S[P:2], S[P:3], U[P:3], U[P:2], U[P:1], U[P], U[D]
(solution 2) IS[D], S[P], U[P], U[D]

[Q3.3]
IS[D], IS[M], S[M:1], S[M:2], U[M:2], U[M:1], U[M], U[D]

[Q3.4]
SIX[D], SIX[M], X[M:4], X[M:5], U[M:5], U[M:4], U[M], U[D]

Question 4: B+ Tree Locking

[Q4.1]
S A, S B, U A, S E, U B, S K, U E, U K

[Q4.2]
X A, X C, U A, X G, X N

[Q4.3]
X A, X B, X D, X I, U A, U B, U D, U I
Question 5: Deadlock Detection

[Q5.1]
(g=granted, n=blocked)
S1: g, g, g, n, g, n, n, g
S2: g, g, n, g, g, n, n, n

[Q5.2]
S1: there will not be a deadlock.

S2: there will be a deadlock.