CS392 Database System Concept

Assignment 8 (Ch14, 15, 16, 17)

Due May 12th, 2014

1. Suppose that a B+-Tree index on (branch_name, branch_city) is available on relation branch. That would be the best way to handle the following selection?

$$\sigma_{(branch\_city<"Brooklyn")\wedge(assets<5000)\wedge(branch_{name}="Downtown")}(branch)$$

2. Explain the distinction between the terms serial schedule and serializable schedule.
3. Consider the following two transactions:

T1: Read(A);
Read(B);
If A = 0 then B := B + 1;
Write(B).

T2: Read(B);
Read(A);
If B = 0 then A := A + 1;
Write(A)

Let the consistency requirement be A = 0 $\vee$ B = 0, with A = B = 0 the initial value.

   a. Show that every serial execution involving these two transactions preserves the consistency of the database.
   b. Show a concurrent execution of T1 and T2 that produces a nonserializable schedule.
   c. Is there a concurrent execution of T1 and T2 that produces a serializable schedule?

4. Why do database systems support concurrent execution of transactions, in spite of the extra programming effort needed to ensure that concurrent execution does not case cause any problems?
5. Consider the following two transactions:

T31: Read(A)
Read(B)
If A = 0 then B := B + 1
Write(B)

T32: Read(B)
Read(A)
If B = 0 then A := A + 1
Write(A)

a. Add lock and unlock instructions to transactions T31 and T32, so that they observe the two-phase locking protocol.
b. Can the execution of these transactions result in a deadlock?

6. What benefits does strict two-phase locking provide? What disadvantages result?

7. When a transaction is rolled back under timestamp ordering, it is assigned a new timestamp. Why can it not simply keep its old timestamp?

8. If deadlock is avoided by deadlock-avoidance schemes, is starvation still possible? Explain your answer.

9. Explain the difference between the three storage types – volatile, nonvolatile and stable – in terms of I/O cost.

10. Stable storage cannot be implemented.
    a. Explain why it cannot be.
    b. Explain how database systems deal with this problem.

11. Explain the difference between a system crash and a “disaster”.