Ph.D. Qualifying Exam : Database (Spring 2014)

Answer only four problems and clearly mark these four problems. Only marked problems will be graded. In case you mark more than four problems, only four problems in the order of the problem number will be graded.

1. Discuss the relationship between data redundancy and functional dependency in relational databases using the terms "trivial dependency", " nontrivial dependency", and "key dependency"(A→B is a key dependency if A is a superkey).

   Show an example for each discussion point. (30)

2. a) State the definition of the database transaction.

   b) Describe at least three important properties of a transaction. (30)

3. State the definitions of the following terms (30)

   a) A schedule consisting of n transactions

   b) A serial schedule

   c) A serializable schedule

4. About hierarchical locking (30)

   a) What is hierarchical locking?

   b) What is intention lock and why is it necessary?

   c) State the lock protocol (warning protocol) in hierarchical locking (we assume there are only two lock modes : Lock and Intention Lock)

5. Discuss advantages and disadvantages of the following recovery schemes. Give at least one answer for each category (30)

a) Shadow mechanism

adv.:

disadv.:

b) Deferred update

adv.:

disadv.:

c) Write-ahead Logging (WAL)

adv.:

disadv.:

6. Consider the following schema (30)

SUP-INFO (Sname, Saddr, Item, Price)

Sname : Supplier's name

Saddr : Supplier's address

Item : Item sold

Price : Price of the Item

A nontrivial functional dependency (FD) (Sname→Saddr) holds in this schema.

a) Describe each type of anomaly that can occur in this schema : update anomaly, insertion anomaly, and deletion anomaly

b) Example how you can remove these anomalies