29/4/16

Indian Institute of Engineering Science and Technology, Shibpur
B.Tech-M.Tech Dual Degree 5^{th} Semester (CST) Examination, 2016
Database Management Systems (CS 501)
Answer any 5 questions

F.M. 70 Time: 3 hrs

1. (a) Explain the term *ACID properties of transactions.*

(b) Consider the three transactions T_1, T_2, and T_3 and schedules S_1 and S_2 given below. Draw the precedence graphs for S_1 and S_2 and state whether each schedule is serializable or not. If a schedule is serializable, write down the equivalent serial schedule(s).

$T_1 : r_1(X); r_1(Z); w_1(X);$
$T_2 : r_2(Z); r_2(Y); w_2(Z); w_2(Y);$
$T_3 : r_3(X); r_3(Y); w_3(Y);$
$S_1 : r_1(X); r_2(Z); r_1(Z); r_3(X); r_3(Y); w_1(X); w_3(Y); r_2(Y); w_2(Z); w_2(Y);$
$S_2 : r_1(X); r_2(Z); r_3(X); r_1(Z); r_2(Y); r_3(Y); w_1(X); w_2(Z); w_3(Y) : w_2(Y);$ [6 + 8]

2. (a) Discuss the problem of deadlock in respect of *DBMS* and the different approaches to dealing with this problem.

(b) Apply the timestamp ordering algorithm to the schedule as given below and determine whether the algorithm will allow the execution of the schedule.
$S_1 : r_2(Z); r_2(Y); w_2(Y); r_3(Y); r_3(Z); r_1(X); w_1(X); w_3(Y); w_3(Z); r_2(X); r_1(Y); w_1(Y); w_2(X);$

[5 + 9]

3. (a) Mention the different steps followed during query optimization. Discuss the sort-merge algorithm.

(b) A file of 4096 blocks is to be sorted with an available buffer space of 64 blocks. How many passes will be needed in the merge phase of the external sort-merge algorithm? [(4 + 5) + 5]

4. (a) Consider the following relation for published books:
BOOK(Book-title, Authorname, Book-type, Listprice, Author-affil, Publisher) Author-affil refers to the affiliation of the author. Suppose the following dependencies exist: Book-title → (Publisher, Book-type), Book-type → Listprice, Authorname → Author-affil
(i) What normal form is the relation in? Explain your answer.
(ii) Apply normalization until you cannot decompose the relations further. State the reasons behind each decomposition.

(b) What is the dependency preservation property for a decomposition? Why is it important? [(4 + 6) + 4]

5. (a) What are checkpoints? List the actions taken by the recovery manager during checkpointing.

(b) Suppose that we use the deferred update protocol for the example given below. Show how the log would be different in case of deferred update by removing the unnecessary log entries; then describe the recovery process, using modified log. Assume that only *REDO* operations are applied and specify which operation in the log are redone and which are ignored.

[start, T1]
[read, T1, A]
[read, T1, D]
[write, T1, D, 20, 25]
[commit, T1]
[checkpoint]
[start, T2]
[read, T2, B]
[write, T2, B, 12, 18]
[start, T4]
[read, T4, D]
[write, T4, D, 25, 15]
[start, T3]
[read, T3, C]
[write, C, 30, 40]
[read, T4, A]
[write, T4, A, 30, 20]
[commit, T4]
[read, T2, D]
[write, T2, D, 15, 25] ← system crash

[5 + 9]

6. (a) Define *partial key* and *foreign key.*

(b) Compare OLTP data and OLAP data.

(c) What are the different steps used for data cleaning.

(d) Mention one widely used schema for data warehouse and explain it with an example.

[3 + 3 + 3 + 5]

7. Write short notes on the following:

(i) Shadow Paging

(ii) Database Trigger

[6 + 8]