19-4-16

Indian Institute of Engineering Science and Technology, Shibpur
B.E. 6th Semester Examination, 2016
Database Management Systems (CS 601)

F.M: 70 Time: 3 hrs

Attempt question number 1 and any six from the rest.

1. a) Define Multivalued attributes and Derived attributes. (5 × 2)
   b) Define five aggregate functions used in SQL.
   c) Instances of two tables R1(A, B) and R2(A, B) are as follows:

R1	
A	**B**
a1	b1
a2	b2
a3	b3
a4	b4
a5	b5

R2	
A	**B**
a6	b6
a7	b7
a1	b1
a8	b8
a2	b2

Find Left, Right, and Full outer join of above two tables.

d) Write the following queries given in relational algebra in tuple relational query for the relation scheme R(A, B, C).
(i) $\sigma_{A=C}(R)$ (ii) $\Pi_{A,C}(\sigma_{B=50}(R))$

e) Explain with an example that Cascading schedule is not desirable in a database system.

2. a) What is the difference between logical data independence and physical data independence? Which one is harder to achieve and why? (5)
b) What are the basic functions of a Database Administrator (DBA)? (5)

3. a) Draw an ER diagram for part of a Banking Database with at least four entity sets of which one is the weak entity set. Mention in your own some attributes of the entity sets and relationship sets (if any). From the diagram, find out all relations (or tables) with primary keys and foreign keys. Give proper explanation for choosing primary keys and foreign keys of the tables from the ER diagram. (6)
b) Define Referential Integrity Constraint and discuss its usefulness in the database system. (4)

4. a) Define Natural join and Division operations in terms of basic relational Algebra operations.
b) Consider the Banking Database with following relations:
Branch(branch_name, assets, branch_city),
Customer(customer_name, street, customer_city),
Deposit(branch_name, account_number, customer_name, balance),
Borrow(branch_name, loan_number, customer_name, amount).
Write the following queries using Tuple or Domain Relational Calculus:
i) Find all customers who have a loan at the bank and the cities in which they live.

ii) Find all customers who have an account at the Shibpur branch but do not have a loan there.

iii) Find all customers who have an account at all branches located in Howrah. (4+6)

5. a) Consider the relation R(A, B, C, D, E) and the following set F of Functional Dependencies (FDs):

F = { A ---> D, {A, B} ---> C, D ---> E}

(i) Find out the candidate key(s) for R and give reason in support of your answer.

(ii) With proper reason, state whether the relation R is in 3NF and in BCNF.

(iii) Consider the decomposition of R into R1(A, B, C) and R2(A, D, E). Is the decomposition lossless? Explain. (6)

b) Compare 3NF and BCNF. (4)

6.a) What do you mean by a canonical cover of a set of functional dependencies. Find a canonical cover for the following functional dependencies:

F = {A---> {B, C}, B---> C, A---> B, {A, B}---> C} (6)

b) Define Functional Dependency (FD) and Multi Valued Dependency (MVD) for a relation R. Hence, differentiate them. (4)

7.a) Consider the three transactions T1, T2, and T3 and the schedules S1 and S2 given below.

Draw the serializability (precedence) graphs for S1 and S2, and state whether each schedule is serilizable or not. If a schedule is serializable, write down the equivalent serial schedule(s).

T1: r1(X); r1(Z); w1(X);
T2: r2(Z); r2(Y); w2(Z); w2(Y);
T3: r3(X); r3(Y); w3(Y);

S1:r1(X);r2(Z);r1(Z);r3(X);r3(Y);w1(X);w3(Y);r2(Y);w2(Z);w2(Y);
S2:r1(X);r2(Z);r3(X);r1(Z);r2(Y);r3(Y);w1(X);w2(Z);w3(Y);w2(Y);

b) Define two phase locking protocol. Prove that it ensures serializability. (6+4)

8.a) Describe the wait-die and wound-wait protocols for deadlock prevention.

b) Compare the two log-based recovery schemes in terms of ease of implementation and overhead cost. Explain the purpose of the checkpoint mechanism and list the actions taken by the recovery manager during checkpointing. (4+6)

9.a) When is it preferable to use a dense index rather than a sparse index?

b) What is the difference between a primary index and secondary index?

c) Construct a B+ tree of order p = 4 for the following set of key values:

(23, 65, 37, 60, 46, 92, 48, 71, 56, 15, 20, 31), assuming that the tree is initially empty. (2+2+6)

10. Write short notes on any two: (5 x 2)

(i) Query Optimization

(ii) Multilevel Granularity

(iii) Properties of a Transaction