INDIAN INSTITUTE OF INFORMATION TECHNOLOGY ALLAHABAD
C3 REVIEW TEST
DATABASE MANAGEMENT SYSTEM

Total Marks: 25

Time: 1 hour 30 minutes + 10 minutes for scanning and uploading the answer sheet. (**no extra time will be given**)

Note:

1. All questions are compulsory.
2. If answers are found copied then zero will be awarded for those questions.

Q1. Let us consider a relational schema R and a set of functional dependencies F
R = {A,B,C,D,E}.
F = {A→BC, C →D, DE → A}.
Find the candidate key of this relational database R.
Reduce R to 3rd normal form and identify whether decomposition is lossless and dependency preserving. Proper justification required for each. **(5 marks)**

Q2. Let us consider a relational schema R and a set of functional dependencies F
R = {P,Q,R,S,T,U,V,W,X}.
F = {P→RUX, QS →T, Q → VW}.
Find the candidate key of this relational database R. Reduce the relation R to BCNF form, also check whether decomposition is lossy or not, dependency preserved or not. Proper justification is needed. **(5 marks)**

Q3. Let us suppose we have a banking database which has following tables :
    Customer(Cust_name, Cust_street, Cust_city)
    Branch(Branch_name, Branch_city, Assets)
    Account (Branch_name, Account_number, Balance)
    Loan(Branch_name, Loan_number, Amount)
    Depositor(Cust_name, Account_number)
    Borrower(Cust_name, Loan_number)
Write an SQL query to find the names of all the customers who have taken more than 1 lakh loan from the AXIS bank. **(2 marks)**

Q4. Let us have SQL query on the schema R(A, B, C, D):

select t.A
from branch t, branch s
where t.C > s.C and s.B = 'IIITA' and t.D>5;

Write a relational algebra expression that is equivalent to this query and the optimized relational algebra expression. JUSTIFY how you reached to the optimized query. **(3 marks)**

Q5.

1) Explain serial and non-serial schedule. Also what is a conflict serializable schedule? **(2 marks)**

2) Let us suppose we have schedule S with two transactions T1 and T2, where they use shared data items A and B.

T1	T2
LOCK_S(A)	
READ(A)	
	LOCK_X(B)
	READ(B)
	WRITE(B)
LOCK_S(B)	
READ(B)	
	LOCK_X(A)

LOCK_S=shared lock
LOCK_X=exclusive lock

Here, is this schedule S perfect to execute these transactions (T1 and T2) concurrently? If yes or no, why? Explain. **(3 marks)**

Q6. Five MCQ questions:

1) Let a database contain two relation schemas STUD (Id, Name, DeptId), and DEPT(DeptName, DeptId). The DepId can be permitted to be NULL in the relation STUD.

Consider the following queries on the database expressed in tuple relational calculus.Find all the queries that are SAFE

I. {t | ∃ u ∈ STUD (t[Name] = u[Name] ∧ ∀ v ∈ DEPT (t[DeptId] ≠ DeptId]))}

II. {t | ∃ u ∈ STUD (t[Name] = u[Name] ∧ ∃ v ∈ DEPT (t[DeptId] ≠ DeptId]))}

III. {t | ∃ u ∈ STUD (t[Name] = u[Name] ∧ ∃ v ∈ DEPT (t[DeptId] = DeptId]))}

(A) I and II only
(B) I and III only
(C) II and III only
(D) I, II, and III

2) Given a B+-tree and the maximum number of keys in a node is given as 7. Find the minimum number of keys in any non-root node?
(A) 1
(B) 2
(C) 3
(D) 4

3) The given table has two attributes Lobby1 and Lobby2 where Lobby1 is the primary key and Lobby2 is the foreign key referencing Lobby1 with on-delete cascade.

Lobby1	Lobby2
2	4
3	4
4	3
5	2
7	2
9	5
6	4

Find The set of all tuples that must be additionally deleted to preserve referential integrity when the tuple (2,4) is deleted is:
(A) (3,4) and (6,4)
(B) (5,2) and (7,2)
(C) (5,2), (7,2) and (9,5)
(D) (3,4), (4,3) and (6,4)

4) Let two relations be P(A,B,C) and Q(D,E,F) having primary keys A and D respectively. P contains 400 tuples and Q contains 450 tuple . The maximum number of tuples obtained when P natural join Q is performed , will be :
(A) 450

(B) 400

(C) 850

(D) 180000

5) Given two relations P(A, B) and Q(C, D), the result of following query

Select distinct A, B

from P, Q

is guaranteed to be the same as P provided one of the following conditions is satisfied.

(A) P has no duplicates and Q is empty.

(B) P has no duplicates and Q is non - empty.

(C) Both P and Q have no duplicates.

(D) Q has no duplicates and P is non - empty.