2019

DBMS

Paper : CS 401

Full Marks : 100

Time : Three hours

The figures in the margin indicate full marks for the questions.

*Answer **any five** questions.*

1. *(A)* Consider the relation schema $r(A, B, C, D, E)$ and following set F of functional dependencies holds

$F = \{A \rightarrow BC,\ CD \rightarrow E,\ B \rightarrow D,\ E \rightarrow A\}$

Give a lossless join decomposition into BCNF of the schema. 10

(B) Why are certain functional dependencies called trivial functional dependencies ? 2

(C) What is the dependency preservation property for a decomposition ? Why is it important ? 4

Contd.

(D) Define multivalued dependency. What is 4NF? 4

2. (A) Consider the bank database : 3×5=15

branch (branch_name, branch_city, assets)

customer (customer_name, customer_street, customer_city)

Loan (Loan_number, branch_name, amount)

borrower (customer_name, Loan-number)

Account (account_number, branch_name, balance)

Depositor (customer_name, account_number)

Primary keys are underlined.

Construct the following SQL queries for this relational database.

(i) Find all customers of the bank who have an account but not a loan.

(ii) Find the names of all customers who live on the same street and in the same city as "John".

(iii) Find the names of all branches with customers who have an account in the bank and who live in "Harrison".

(iv) Find out the total sum of all loan amounts in the bank.

(v) Find the names of all branches that have assets greater than those of at least one branch located in "Brooklyn".

(B) Explain about outer-join with examples. 5

3. (A) A database is being constructed to keep track of the teams and games of a sports league. A team has a number of players, not all of whom participate in each game. It is desired to keep track of the players participating in each game for each team, the positions they played in that game, and the result of the game. Design an E-R diagram for this application, stating any assumptions you make. 10

(B) Explain the distinctions among the terms primary key, candidate key, and superkey with example. 3

(C) List significant differences between a file processing system and a DBMS. 7

4. *(A)* Explain the concept of physical data independence, and its importance in database systems. 4

(B) Explain the differences between a weak and a strong entity set. 4

(C) Explain the distinction between total and partial constraints. 3

(D) List the ACID properties. Explain the usefulness of each. 9

5. *(A)* Explain the distinction between the terms serial schedule and serializable schedule with example. 6

(B) In multiple granularity locking, what is the difference between implicit and explicit locking? 4

(C) Consider the following two transactions : 10

T_1 : read (A)
read (B)
if $A = 0$ then $B = B + 1$
write (B)

T_2 : read (B)
read (A)
if $B = 0$ then $A = A + 1$
write (A)

Add lock and unlock instructions to transaction T_1 and T_2, so that they observe the two-phase locking protocol. Can the execution of these transactions result in a deadlock?

6. *(A)* What benefit does strict two-phase locking protocol provide? What disadvantages results? 4

(B) Explain query processing steps in details. What is query optimization? 10

(C) Explain about specialization and generalization of E-R diagram with the help of example. 6

7. *(A)* Explain about following relational algebra operations : 6

Select, Project, Union, Set difference, Rename.

(B) Let the following relation schemas be given : 8

$R = (A, B, C)$

$S = (D, E, F)$

Let relation $r(R)$ and $s(S)$ be given. Give an expression in the tuple relational calculus that is equivalent to each of the following :

(i) $\pi_{A,B}(r)$

(ii) $\sigma_B = 20(r)$

(C) Explain the differences between two-tier and three-tier architecture. 6