2019

DATABASE MANAGEMENT SYSTEM

Paper : CS 401

Full Marks : 100

Time : Three hours

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

*Answer **any five** questions.*

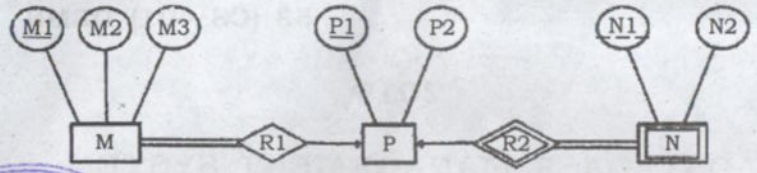
1. *(a)* What is two-phase locking protocol? Explain conservative, strict and rigorous two-phase locking protocols. 2+6=8

   (b) Why concurrency control is needed? Explain the lost update problem with a suitable example. 2+7=9

   (c) What are the desirable properties of a transaction? 3

Contd.

2. *(a)* Consider the following ER diagram



Find the minimum number of tables needed to represent M, N, P, R1 and R2. Justify your answer writing the schema for each of the tables. 1+3=4

(b) Write a relational algebra expression which is equivalent to the following tuple calculus expression :

$$\{t \mid t \in r \wedge (t[A] = 10 \wedge t[B] - 20\}$$ 2

(c) A relation R with FD set

$$\{A \to BC, B \to A, A \to C, A \to D, D \to A\}$$

Find the simple candidate keys of R. 3

(d) What do you mean by participation constraints? What are its types? Explain with suitable examples. 2+4=6

(e) Explain ER to relational mapping algorithm for mapping binary M:N relationship types with suitable example. 5

3. Consider the following relational schema and answer the following queries in relational algebra and tuple relational calculus : 4×5=20

Employee (person_name, street, city)

Works (person_name, company_name, salary)

Company (company_name, city)

(i) Find the names of all employees who work for the company "ABC".

(ii) Find all employees who earn more than every employee of "ABC".

(iii) Find the names and cities of residence of all employees who work for "ABC".

(iv) Find all employees who live in the same city as that in which the company for which they work is located.

(v) Find all employees who do not work for the company "ABC".

4. *(a)* Consider the relational schema of Question No. 3 and write SQL queries for the following : 2×3=6

(i) Find companies whose employees earn a higher salary, on average, than the average salary at the company "ABC".

(ii) Give all employees of "ABC" a 10% rise.

(iii) Find all employees who live in the city "Guwahati" and the company for which they work is also located in "Guwahati".

(b) Prove the following inference rules :

(i) $\{X \rightarrow YZ\} \models X \rightarrow Y$

(ii) $\{X \rightarrow Y, WY \rightarrow Z\} \models WX \rightarrow Z$

2+3=5

(c) Given two sets of function dependencies

$F1 : A \rightarrow B,\ AB \rightarrow C,\ D \rightarrow AC,\ D \rightarrow E$

$F2 : A \rightarrow BC,\ D \rightarrow AE$

Are the two sets equivalent ? 4

(d) Find canonical cover for the following set F of functional dependencies : 5

$F = \{A \rightarrow BC, B \rightarrow C, A \rightarrow B, AB \rightarrow C\}$

5. *(a)* Define super key, key, candidate key and primary key. 6

(b) Explain 3NF and BCNF with suitable examples. 10

(c) What is the dependency preservation property for a decomposition ? Why is it important ? 3+1=4

6. *(a)* Describe the three-schema architecture. Why do we need mappings between schema levels ? 5+2=7

(b) What are the responsibilities of a database administrator ? 4

(c) Write the differences between : 3×3=9

(i) Database schema and database state

(ii) Composite and multivalued attributes

(iii) Procedural and non-procedural DML.

7. Write short notes on the following : *(any four)* 5×4=20

(i) DBMS Languages

(ii) Query optimization

(iii) Data independence

(iv) Fourth normal form

(v) DBMS approach *vs* traditional file processing

(vi) Schedules of transaction.