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53 (CS 401) DBMS

2015

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) We can convert any weak entity set to a strong entity set by simply adding appropriate attributes. Why, then do we have weak entity sets? 5
- (B) Explain the distinction between total and partial participation constraints. 3
- (C) Develop an E-R diagram for MODERN HOSPITAL that requires automation. The business rules are as follows : 12
 - A patient can choose one of the two types of appointments—outpatient or inpatient.

Contd.

- Patient can make an appointment with one or more doctors, and the doctors can accept appointments with many patients.
- Inpatient should be taken in without an appointment only under emergency situation. They can be recorded as "unscheduled".
- Patient who visit a diagnosis center will be advised to follow an appropriate treatment.
- The records are updated with reports after the visit, along with date and time.
- A bill is also created after the visit, and it is linked to a particular doctor.
- Bills may be paid by cash, credit card or claimed through mediclaim.

Make additional assumptions as necessary and supply reasonable attributes for the entity types.

2. (A) What is two phase locking protocol? Explain about strict two phase and rigorous two phase locking protocol.

2+3=5

(B) Consider following two transactions : 12

T1 : Read (A) ;
Read (B) ;
if A = 0 then B = B+10 ;
write (B) .

T2 : Read (B)
Read (A)
if B = 0 then A = A + 10
write (A)

Add lock and unlock instructions to T1 and T2, so that they observed the two phase locking protocol. Can the execution of these transaction result in a deadlock ?

(C) Explain ACID properties of a Transaction. 3

3. (A) In multiple-granularity locking, what is the difference between implicit and explicit locking ? 3

(B) Explain different deadlock-prevention schemes where timestamps have been used. 5

(C) Explain distinction between serial schedule and serializable schedule.

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(D) What is query evaluation plan? What is query optimization? Is it possible to convert below query expression tree to another query expression tree with less cost for university database of Fig-1

2+2+6=10

Instructor (I_id, name, salary, dept_name)

Teachers (I_id, course_id, sec_id, semester, year)

Course (course_id, title, dept_name, credits)

Fig-1

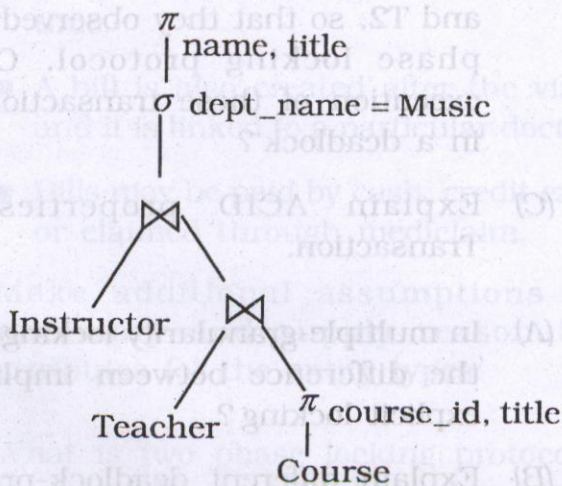


Fig-2 : expression tree

4. (A) Consider the relational database of Fig. 3 where the primary keys are underlined. Give an expression in relational algebra for each of the following queries :

$$3+3+4=10$$

Employee (person_name, street, city)

works (person_name, Company_name, salary)

Company (Company_name, city)

managers (Person_name, manager_name)

Fig-3

- (i) Find all employees who work directly for "Jones".
- (ii) Find all cities of residence of all employees who work directly for "Jones".
- (iii) Find those employees who earn more than all employees living in the city "Mumbai".

- (B) Consider the relational schema's $R(A, B, C)$ and $S(C, D, E, F)$. Give an expression in tuple relational calculus that is equivalent to each of the following

$$2+3+3+2=10$$

- (i) $\pi_{A, B, C}(R)$

- (ii) $\sigma_E = 10$ (S)
- (iii) $R \bowtie S$ (natural join)
- (iv) $\pi_C(R) \cap \pi_C(S)$ (intersection)

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

(B) What are the main functions of a database administrator? 6

(C) Explain below concepts in the respects of Entity-Relationship set. 10

(i) Super key

(ii) Candidate key

(iii) Primary key

(iv) Mapping cardinality

6. (A) Given a Relation Schema

$R = \{A, B, C, D, E, H\}$ and having the following FD's

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

$\{D \rightarrow AEH\}, \{ABH \rightarrow BD\}, \{DH \rightarrow BC\} \}$,

find the candidate keys for relation R with FD's F . 5

(B) Consider the following relation for published books : $3+7=10$

Book (Book_title, Author_name, Book_type, List_price, Author_affil, publisher)

Author_affil refers to the affiliation of author. Suppose the following dependencies exist :

Book_title \rightarrow Publisher, Book_type

Book_type \rightarrow List_price

Author_name \rightarrow Author_affil

(i) What normal form is the relation in? Explain your answer.

(ii) Apply normalization until you can not decompose the relations further. State the reasons behind each decomposition.

(C) What are inference rules of FD's? List out all of them. 5

7. (A) What do you mean by multivalued dependencies? Explain Fourth Normal Form (4NF). 4

(B) Differentiate between DML and DDL. 4

(C) Consider the library database of Fig-4.
Write the following queries in SQL.

Member (memb_no, name, age)

Book (isbn, title, authors, publisher)

borrowed (memb-no, isbn, date)

Fig-4

- (i) Print the names of members who have borrowed any book published by "Pearson".
- (ii) Print the names of members who have borrowed all books published by "Pearson";
- (iii) For each publisher, print the names of members who have borrowed more than five books of that publisher. $4+4+4=12$