53 (IT 402) DBMS

2014

DATABASE MANAGEMENT SYSTEMS

Paper : IT 402

Full Marks : 100

Pass Marks : 30

Time : Three hours

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

*Answer **any five** questions.*

1. *(a)* Draw a state diagram and discuss the typical states that a transaction goes through during execution. 3+5=8

   (b) What are the problem faced when concurrent transactions are executed in an uncontrolled manner ? Explain with examples. 12

2. *(a)* Consider the *three* transactions T1, T2 and T3 and the schedules S1 and S2 given below. Draw the serializability (precedence) graph for S1 and S2, and state whether each schedule is serializable or not. If a schedule is serializable, write down the equivalent serial schedule(s). 8

$T1 : r1(X) ; r1(Z) ; W1(X) ;$

$T2 : r2(Z) ; r2(Y) ; W2(Z) ; W2(Y) ;$

$T3 : r3(X) ; r3(Y) ; W3(Y) ;$

$S1 : r1(X) ; r2(Z) ; r1(Z) ; r3(X) ; r3(Y) ;$
$W1(X) ; W3(Y) ; r2(Y) ; W2(Z) ; W2(Y) ;$

$S2 : r1(X) ; r2(Z) ; r3(X) ; r1(Z) ; r2(Y) ;$
$r3(Y) ; W1(X) ; W2(Z) ; W3(Y) ; W2(Y) ;$

(b) Why is serializable schedule considered correct ? 2

(c) Consider the following tables : 2×5=10

Works (Pname, Cname, Salary)

Lives (Pname, Street, City)

Located_In (Cname, City)

Manager (Pname, Mgrname)

Where Pname = Person name,

Cname = Company name,

and Mgrname = Manager name

Write the SQL query for the following :

(i) List the names of the people who work for the company Wipro along with the cities they live in.

(ii) Find the people who work for the company 'Infosys' with a salary more than Rs. 50000/-. List the names of the people, along with street and city addresses.

(iii) Find the names of the persons who live and work in the same city.

(iv) Find the persons whose salaries are more than that of all of the 'Oracle' employees.

(v) Find the names of the companies that are located in every city where the company 'Infosys' is located.

3. (a) What is two phase locking protocol ? How does it guarantee serializability ? 2+3=5

(b) What is a timestamp ? How does Thomas's write rule modify check for the write-item (X) operation ? 2+3=5

(c) A company has decided to store in a database information on the musicians who perform for its albums. Draw an ER diagram. The following information describes the situation on which the company database must be modelled. Indicate all keys and cordinality constraint and any assumptions that are made. The information provided is as follows : 10

(i) Each musician who records at this company has an SSN, a name, an address, and a phone number.

(ii) Each instrument that is used in the songs has a name and a musical key.

(iii) Each album that is recorded on the company label has a title, a copyright date, a format, and an album identifier.

(iv) Each song recorded at the company has a title and an author.

(v) Each musician may play several instruments, and several musicians may play a given instrument.

(vi) Each album has a number of songs on it, but no song may appear in more than one album.

(vii) One or more musicians perform each song ; and a musician may perform in a number of songs.

(viii) Each album has exactly one musician who acts as its producer. A musician may produce several albums.

4. (a) Given a relation $R = \{A, B, C, D, E, H\}$ and having the following Functional Dependencies

$$F = \{\{A \rightarrow BC\}, \{CD \rightarrow E\}, \{E \rightarrow C\}, \{D \rightarrow AEH\}, \{ABH \rightarrow BD\}, \{DH \rightarrow BC\}\},$$

Find the key for relation R with Functional Dependency F. 3

(b) What undesirable dependencies are avoided when a relation is in 3*NF* ? 3

(c) Consider the following relations for an order processing application database at ABC Inc. 2+1+3+2+2=10

ORDER (Orderno, Orderdate, Customerno, Total-amount)

ORDER_ITEM (Orderno, Itemno, Qty-ordered, Total_price, Discount%)

Assume that each item has a different discount. The Total_price refers to one item and Total_amount is the amount of the order. If natural join is applied on the relations ORDER and ORDER_ITEM in this database, what does the resulting relation schema look like ? What will be its key ? Show the Functional Dependencies in this resulting relation. Is it in 2*NF* ? Is it in 3*NF* ? Why or why not ? (State assumptions if you make any.)

(d) Consider the universal relation $R=\{A,B,C,D,E,F,G,H,I,J\}$ and the set of functional dependencies 4

$$F=\{\{AB\rightarrow C\},\{A\rightarrow DE\},\{B\rightarrow F\},\{F\rightarrow GH\},\{D\rightarrow IJ\}\}.$$

Now determine whether following decomposition of R has

(i) the dependency preservation property

(ii) the lossless join property with respect to F.

$$D=\{R1,R2,R3,R4,R5\};$$

$$R1=\{A,B,C,D,\},\ R2=\{D,E\},\ R3=\{B,F\}$$

$$R4=\{F,G,H,\},\ R5=\{D,I,J\}$$

5. (a) How are the Outer Join Operations different from the Inner Join Operations ? 3

(b) Consider the following relations for a database that keeps track of business trips of salespersons in a sales office : 2

Salesperson (SSn, Name, Start_year, Dept_No) Trip (SSn, From_city, To_city, Departure_date, Return_date, Trip_id)

Expense (Trip_id), Account No, Amount)

Specify the foreign keys for this schema, stating any assumption made.

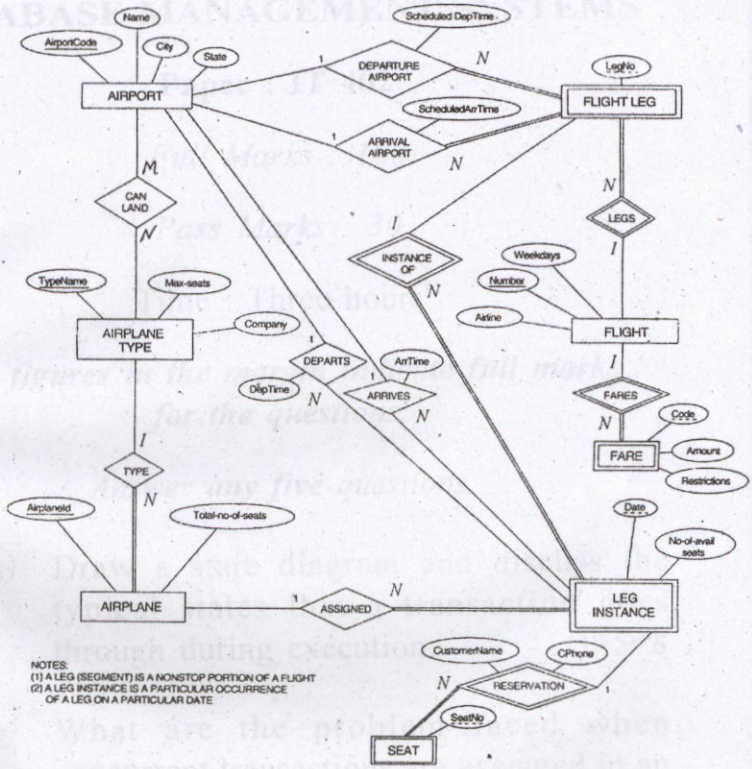
(c) What is the difference between a key and a superkey ? 3

(d) State the difference between a database schema and a database state. 2

(e) Discuss the main characteristics of the database approach and how it differs from traditional file system. 5+5=10

6. (a) Explain with example the concept of a sub class and a super class. 5

(b) Map the AIRLINE ER schema of the figure below into a relational schema. Specify all primary keys and foreign keys. 15



7. Write short notes on : ***(any two)*** 10×2=20

(a) Query Optimization

(b) Three Schema Architecture

(c) Category (EER model)

(d) Relational Calculus.
