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CSE201 Enrol. No. A0231198 20027

[ET]

END SEMESTER EXAMINATION : APRIL-MAY 2022

DATABASE MANAGEMENT SYSTEMS

Time : 3 Hrs. *Maximum Marks : 60*

Note: ***Attempt questions from all sections as directed.***

SECTION – A (24 Marks)

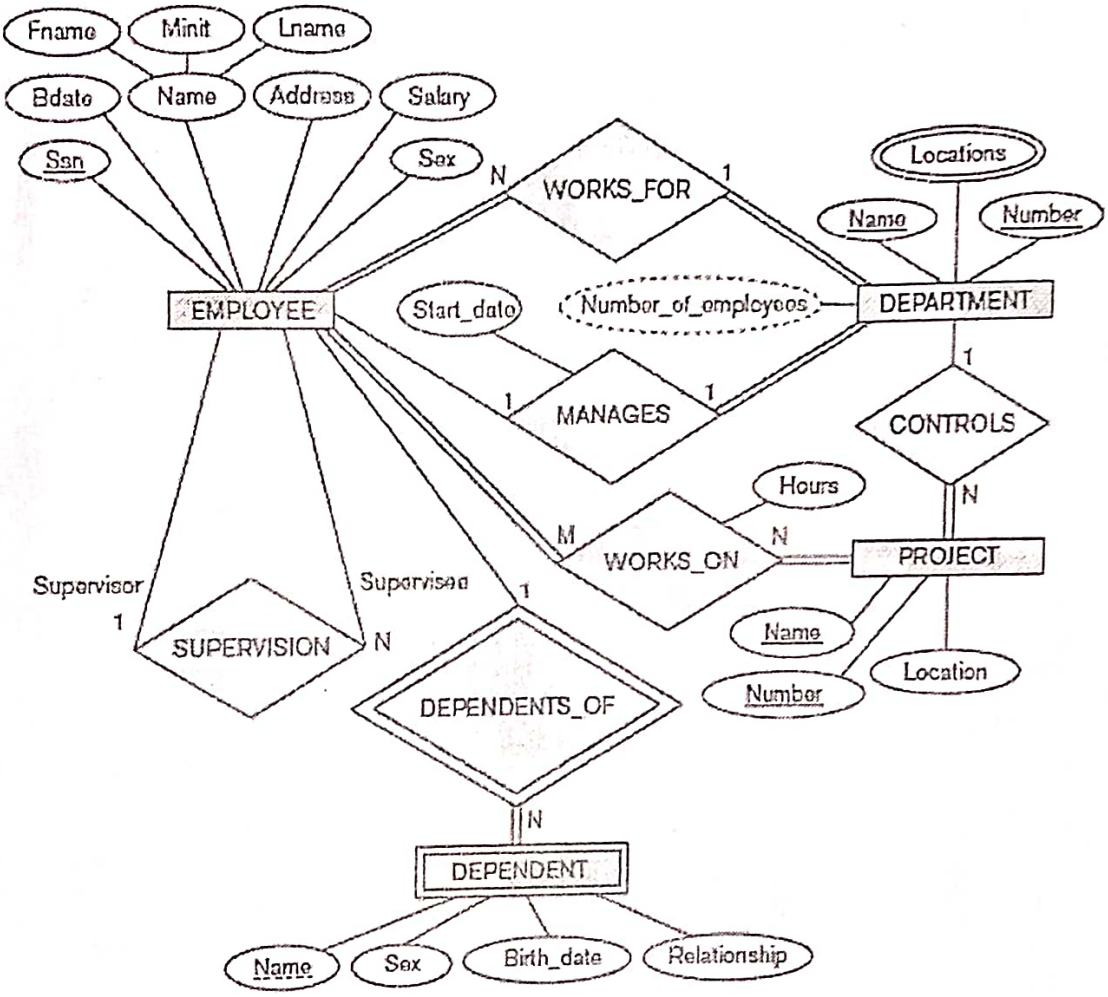
Attempt any **four** *questions out of* **five.**

Each question carries **06** *marks.*

1. Construct an E-R diagram for a car-insurance company whose customers own one or more cars each. Each car has associated with it zero to any number of recorded accidents.

P.T.O.

2.



Convert the above ER model into relational schema.

3. Compute the closure of the following set F of functional dependencies for relation schema R = (A, B, C, D, E, F, G, H). $CH \rightarrow G$, $A \rightarrow BC$, $B \rightarrow CFH$, $E \rightarrow A$, $F \rightarrow EG$. List the candidate keys for R.

4. Define Boyce-Codd normal form with help of suitable example. How does it differ from 3NF? Why is it considered a stronger form of 3NF?

5. How does a query tree represent a relational algebra expression? What is meant by an execution of a query tree? Discuss the rules for transformation of query trees and identify when each rule should be applied during optimization.

SECTION – B (20 Marks)

Attempt any **two** *questions out of* **three.**

Each question carries **10** *marks.*

6. Consider a relational database about hotels, customers (guests) and their bookings that is maintained by an online hotel booking company. The database consists of the following tables (where the primary keys are underlined):

Hotel(hId, hName, hAddress, hCity)

Guest(gId, gName, gAddress, gCity)

Room(hId, roomNo, type, price)

Booking(gId, hId, roomNo, fromDate, year, noOfDays)

Where, hid and gId are identifiers for the hotels and the guests, and the Booking relation indicates that a guest booked a hotel room for a specified number of days (noOfDays) starting from Date of a given year.

P.T.O.

For instance, a tuple < g12345, h5555, 220, Jan05, 2005, 8> in Booking indicates that guest g12345 booked room 220 of the h5555 hotel for 8 days starting on Jan 5, 2005.

(i) Write a relational algebra expression that returns the ids of the hotels located in Vancouver which were not booked at all in the year 2005.

(ii) Write a relational algebra expression that returns the ids of the guests who have booked at least one room of type "suite" in every hotel located in Vancouver.

(iii) Write a Tuple Relational Calculus (TRC) query that finds the ids and names of the hotels for which every one of our guests had made a booking during the year 2004.

7. Consider the universal relation R = {A, B, C, D, E, F, Q, H, I, J} and the set of functional dependencies F = {{A, B} → {C}, {A} → {D, E}, {B} → {F}, {F} → {G, H}, {D} → {I, J}}. What is the key for R? Decompose R into 2NF and then 3NF relations.

8. Consider the three transactions T1, T2, and T3, and the schedules S1 and S2 given below. Draw the

serializability (precedence) graphs 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).

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);

SECTION – C (16 Marks)

(Compulsory)

9. (a) Consider SQL following queries

```
Q1: SELECT Fname, Lname, Address
    FROM EMPLOYEE, DEPARTMENT
    WHERE Dname = 'Research' AND Dnumber=Dno;
Q2: SELECT E.Fname, E.Lname, S.Fname, S.Lname
    FROM EMPLOYEE AS E, EMPLOYEE AS S
    WHERE E.Super_ssn=S.Ssn;
```

P.T.O.

Q3: SELECT E.Fname, E.LName, E.Address
FROM EMPLOYEE E, DEPARTMENT D
WHERE D.DName='Research' AND D.Dnumber= E.Dno;

(i) Draw at least two query trees that can represent each of these queries. Under what circumstances would you use each of your query trees?

(ii) Draw the initial queny tree for each of these queries, and then show how the queny tree is optimized. (12)

(b) Discuss the problems of deadlock and starvation, and the different approaches to dealing with these problems. (4)