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Name: _____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

Fourth Semester B.Tech Degree (S,FE) Examination August 2021 (2015 Scheme)

Course Code: CS208**Course Name: PRINCIPLES OF DATABASE DESIGN (CS, IT)**

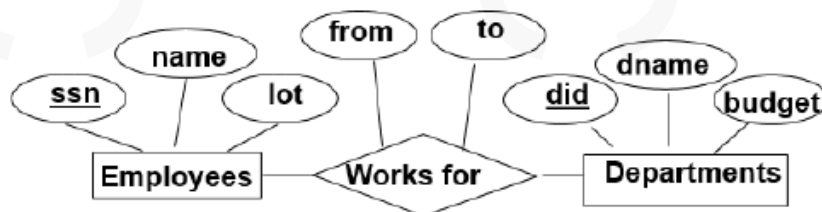
Max. Marks: 100

Duration: 3 Hours

Limit answers to the required points.**PART A***Answer all questions, each carries 3 marks.*

Marks

- 1 Differentiate between structured and semi-structured data (3)
- 2 (3)



Given the ER schema for employee works for department. Suppose an employee will work for some department for two or more periods. How can you re-design the schema in a better way?

- 3 What are the conditions to be full filled for two relations to be involved in UNION operation. (3)
- 4 Given the relational schema (3)
- BOOKS (ACC-NO, ISBN, TITLE, EDITION, YEAR)
- MEMBERS (MEMBERID, MEMBERNAME, MEMBERTYPE)
- ISSUEDTO (ACC-NO, MEMBERID, DATE OF ISSUE)

Draw the ER-schema corresponding to the given relational schema. Properly assume and state the key, cardinality and participation constraints.

PART B*Answer any two full questions, each carries 9 marks.*

- 5 a) Suppose you are planning to create a database software for a library management system. Describe the steps involved in terms of three schema architecture of a database system. (5)
- b) Differentiate between physical and logical data independence. (4)

- 6 a) Design an Entity-Relationship Diagram for a car race database with the following requirements.

- We have cars, for each car we keep its VIN number (unique ID), engine type, color, make, and model
- We have drivers, for each driver we keep ID (unique), name, DoB, and age (derived attribute)
- Drivers use cars to enter races, each race has some attributes such as the race number (unique ID), race type, the number of rounds, and date.
- Each driver can enter many races and can use the same car or different one in each race. Thus the same car can participate in many races.
- In the design, we want to capture which car is used by which driver and in which race.
- We also need to capture the winner of each race (the driver who won the race) and the winning time (the time taken to finish and win the race).

(5)

- b) Convert the ER schema as described in question 6 a) to a relational schema.

(4)

- 7 a) For the relation schema given below, identify the primary key and foreign keys of the relations. Represent the foreign key- primary key relationships between the tables.

Hospital tables:

patients (patient-id, name, insurance, date-admitted, date-checked-out)
 doctors (doctor-id, name, specialization)
 test (testid, testname, date, time, result)
 doctor-patient (patient-id, doctor-id)
 test-log (testid, patient-id)
 performed-by (testid, doctor-id)

(4)

- b) What is a join operator in relational algebra? Describe Equi-join, Natural join and Left outer join

(5)

PART C

Answer all questions, each carries 3 marks.

- 8 What is a correlated subquery in SQL? Give example.

(3)

- Write SQL DDL commands to construct the 'Catalog' table in the following relations (3)
- 9 Suppliers(sid: integer, sname: string, address: string)
Parts(pid: integer, pname: string, color: string)
Catalog(sid: integer, pid: integer, cost: real)
- Include the primary key and referential integrity constraints in the table.
- 10 State the Armstrong's Axioms of functional dependency. Why the first three rules are called sound and complete? (3)
- 11 What is a view in SQL? Give an example. (3)

PART D

Answer any two full questions, each carries 9 marks.

- 12 a) Find a minimal cover of the following sets of functional dependencies. (3)
- (1) $A \rightarrow BC$ (2) $B \rightarrow C$ (3) $A \rightarrow B$ (4) $AB \rightarrow C$
- b) For the following relation schema: (6)
- employee(employee-name, street, city)
works(employee-name, company-name, salary)
company(company-name, city)
manages(employee-name, manager-name)
- Write SQL commands corresponding to the following queries
- 1) Find the names, street, and cities of residence for all employees who work for 'Wipro' and earn more than Rs. 50,000.
- 2) Find the names of all employees who live in the same cities as the companies for which they work.
- 3) Find the names of all employees who earn more than the average salary of all employees of their company. Assume that all people work for at most one company.
- 13 a) Justify the intuition behind the term 'Functional' in the concept called functional dependency. (2)
- b) Differentiate between prime and non-prime attributes. Give examples (3)
- c) What is a lossless join decomposition? Suppose that we decompose the schema $R = (A, B, C, D, E)$ into $R_1 = (A, B, C)$ and $R_2 = (A, D, E)$. Show that this decomposition is a lossless-join decomposition if the following set F of functional dependencies holds: $A \rightarrow BC$, $CD \rightarrow E$, $B \rightarrow D$, and $E \rightarrow A$ (4)
- 14 a) What is the need of normalization in database design? (3)

- b) Define 2NF and 3NF. Given a relation R(A, B, C, D, E) with the following functional dependencies: $A \rightarrow B$, $B \rightarrow C$, $C \rightarrow D$. Identify the key and highest normal form of the relation. (6)

PART E

Answer any four full questions, each carries 10 marks.

- 15 a) What are the different record storage format for storing files in disk? (2)
- b) How does multilevel indexing improve the efficiency of searching an index file? (3)
- Consider a file of 16384 records. Each record is 32 bytes long and its key field is of size 6 bytes. The file is ordered on a non-key field, and the file organization is (5)
- c) unspanned. The file is stored in a file system with block size 1024 bytes, and the size of a block pointer is 10 bytes. If the secondary index is built on the key field of the file, and a multi-level index scheme is used to store the secondary index, find the number of first-level and second-level blocks in the multi-level index.
- 16 a) Justify the advantage of a B tree structure over a binary search tree for building indexes for database systems. (4)
- b) Give the structure of a B+ tree data structure. What is its significance in database indexing over a B tree. (6)
- 17 a) What are the steps in converting an initial query tree to an optimized query tree during heuristic optimization (4)
- b) Consider a database (6)
- Student (sid, name, age, address)
- Book(bid, title, author)
- Checkout(sid, bid, date)
- Given the following SQL query:
- SELECT S.name
- FROM Student S, Book B, Checkout C
- WHERE S.sid = C.sid AND B.bid = C.bid AND B.author = 'Navathe'
- AND S.age > 15 AND S.age < 25
- Show an initial query tree and and optimize it using the rules of heuristic optimization
- 18 a) Explain with example any three problems that may happen when multiple transactions are execute concurrently. (5)
- b) Differentiate between a conflict-serializable and a non-serial schedule. (2)

Check whether the given schedule S is conflict serializable or not-

c) $S : R_1(A) , R_2(A) , R_1(B) , R_2(B) , R_3(B) , W_1(A) , W_2(B)$ (3)

19 a) Consider the following two transactions: (4)

```
T1: read(A);
    read(B);
    if A = 0 then B := B + 1;
    write(B).
T2: read(B);
    read(A);
    if B = 0 then A := A + 1;
    write(A).
```

Add lock and unlock instructions to transactions T1 and T2, so that they observe the two-phase locking protocol.

b) What is check pointing? How it is used in database recovery process? (3)

c) Differentiate between deferred update and immediate update. (3)

20 a) What is a semantic web? How RDF is related to semantic web? (4)

b) List the properties of big data. Give any three sources of big data and justify why the data generated from those sources are called big data. (6)
