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MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL

A Constituent Institution of Manipal University

V SEMESTER B.TECH. (COMPUTER AND COMMUNICATION ENGINEERING)

END SEMESTER EXAMINATIONS, NOV/DEC 2016

SUBJECT: DATABASE SYSTEMS [ICT 3154]

REVISED CREDIT SYSTEM
(01/12/2016)

Time: 3 Hours MAX. MARKS: 50

Instructions to Candidates:

- Answer ALL the questions.
- Missing data may be suitably assumed.

1A. Consider the following order database:
Customer (CustomerId, Name, City, Country, Phone)
Order (Order_Id, OrderDate, OrderNumber, CustomerId, TotalAmount)
Write SQL query for the following requirements
i. List the number of customers in each country (except the USA) sorted in ascending order. Include only countries with 9 or more customers.
ii. List customers who placed orders that are greater than the average of each customer order. 5

1B. What is the difference between Checks and Assertions in database? Explain with suitable example. 3

1C. Let E1 and E2 be two entities in an E-R diagram with simple single-valued attributes. R1 and R2 are two relationships between E1 and E2, where R1 is one-to-many and R2 is many-to-many. R1 and R2 do not have any attributes of their own. What is the minimum number of tables required to represent this situation in the relational model? Justify your answer. 2

2A. What are the drawbacks of the File Management System? How is it addressed using Database System. Differentiate between Actors on the scene and users behind the scene of the database system. 5

2B. Consider the following schema where Pre_Id refers to C_Id of the Course table.
Student(S_Id, Name, tot_credit)
Takes(S_Id, C_Id, grade, sem)
Course(C_Id, Title,credits)
Prereq(C_Id, Pre_Id)
Create a procedure which performs the following operation for a given course: Set the student's grade to 'A' if student has taken prerequisite for the course else display the message saying that 'student-name has not taken prerequisite for the course-title'. 3

2C. What is view in database? Specify the conditions under which a view can be updated. 2

3A. Discuss two phase locking protocol and its variations. What benefit does rigorous two-phase locking provide as compared to other variations of two-phase locking? Describe the deferred update technique of recovery. 5

3B. What are the problems faced when concurrent transactions are executed in an uncontrolled manner? Explain with suitable examples. 3

3C. Consider the following order database:
Order (Id, OrderDate, OrderNumber, CustomerId, TotalAmount)
Write a SQL query to list all customer with average orders between $1000 and $1200. 2

4A. Suppose we have a database for an investment firm, consisting of the following attributes: B – Broker, O – Office of a broker, I – Investor, S – Stock, Q – Quantity of stock owned by an investor , D – dividend paid by a stock, T-Transaction and P-Price . Hence, the overall schema is R = (B, O, I, S, Q, D, T, P). Assume that the following FDs are required to hold on this DB.

$T \rightarrow P$, $I \rightarrow B$, $Q \rightarrow O$, $S \rightarrow D$, $IS \rightarrow Q$

Answer the following questions with respect to the above mentioned FDs.

i. List all the candidate keys for R.
ii. Normalize the above relation till BCNF.
iii. Check whether the above relation is lossless decomposition based on the following decomposition. R1 (IB), R2 (ISQ), R3 (ISDO), R4 (QSO), R5 (TP). 5

4B. Answer the following with justification.

i. Schedule1: r1(x); r2(x); w2(x); r2(y); w1(x); r1(y); w2(y) is serializable.
ii. Schedule2: r1(x); r1(y); w1(x); r2(x); w2(x); r3(x); a1; is cascade-less schedule.
iii. Schedule3: r1(x);r2(z);r1(z);r3(x);r3(y);w1(x);w3(y);r2(y);w2(y);c1;c2;c3; is recoverable. 3

4C. Differentiate between 3NF and BCNF with suitable example. 2

5A. The Computer Science Department frequent fliers have been complaining to the local airport officials about the poor organization at the airport. As a result, the officials decided that all information related to the airport should be organized using a DBMS, and you have been hired to design the database. Your first task is to organize the information about all the airplanes stationed and maintained at the airport. The relevant information is as follows: - Every airplane has a registration number, and each airplane is of a specific model. - The airport accommodates a number of airplane models, and each model is identified by a model number (e.g., DC-10) and has a capacity and a weight. - A number of technicians work at the airport. You need to store the name, SSN, address, phone number, and salary of each technician. - Each technician is an expert on one or more plane model(s), and his or her expertise may overlap with that of other technicians. This information about technicians must also be recorded. - Traffic controllers must have an annual medical examination. For each traffic controller, you must store the date of the most recent exam. - All airport employees including technicians belong to a union. You must store the union membership number of each employee. You can assume that each employee is uniquely identified by a social security number. - The airport has a number of tests that are used periodically to ensure that airplanes are still airworthy. Each test has a Federal Aviation Administration (FAA) test number, a name, and a maximum possible score. - The FAA requires the airport to keep track of each time a given airplane is tested by a given technician using a given test. For each testing event, the information needed is the date, the number of hours the technician spent doing the test, and the score the airplane received on the test.

Draw an ER diagram for the above scenario. Make sure to indicate the various attributes of each entity, relationship set along with the key for each entity type and cardinality constraints. 5

5B. Find the minimal cover of the following functional dependencies: 3
$AB \rightarrow CD$, $BC \rightarrow D$.

5C. Prove or disprove the following statements using inference rules.
i. $\{P \rightarrow N, M \rightarrow Q\} = \{PM \rightarrow N\}$
ii. $\{M \rightarrow N, MN \rightarrow Q\} = \{M \rightarrow Q\}$ 2