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RV COLLEGE OF ENGINEERING®

(An Autonomous Institution Affiliated to VTU)

V Semester B. E. Examinations April/May -2024

Introduction to Database Systems

Common to CSE / ISE

Time: 03 Hours ***Maximum Marks: 100***

Instructions to candidates:

1. Answer all questions from Part A. Part A questions should be answered in first three pages of the answer book only.
2. Answer FIVE full questions from Part B. In Part B question number 2 is compulsory. Answer any one full question from 3 and 4, 5 and 6, 7 and 8, 9 and 10.

PART-A

			M	BT	CO
1	1.1	Give any 4 characteristics of Database approach as opposed to traditional file approach.	02	2	1
	1.2	Define the types of data independence.	02	1	1
	1.3	Differentiate between DDL and DML.	02	1	1
	1.4	Give examples for the following attributes: Single Valued, Multivalued, Stored, Derived	02	2	2
	1.5	When a transaction T updates a data item X and fails immediately. T2 accesses X meanwhile before rollback. Identify the Problem	02	3	2
	1.6	If the waiting scheme is unfair give any two problems that can occur.	02	3	2
	1.7	"All locking operations precede the first unlock operation". Identify the protocol.	02	2	2
	1.8	Transaction T1 requires Data item Y to continue execution. However Y is not available and T1 fails. Identify the category of problem	02	3	2
	1.9	What is the expected result of recovery, when a system crashes during recovery?	02	2	2
	1.10	There are many database server instances. Sharding has to be done .On which kind of network can it be achieved?	01	3	3
	1.11	Checking to ensure serializability is a part of _____concurrency control scheme.	01	1	2

PART-B

2	a	Design a database for a college based on the following criteria: i) Many students seek admission in the college. ii) The college has a number of departments and students can be enrolled to these departments. iii) The department also offers a number of courses to the students, each with an associated credit. CIE has to be conducted for every course. iv) Each department has its HOD and many teachers under him. v) The syllabus of each course is also defined. vi) Teachers are recruited by the college for teaching the said courses to the students. vii) The teachers may have different qualifications and experience. They may also teach different subjects if required			

		viii) Each student in the college has a unique ID. The database should be designed to store the information related to students, teachers, college, department etc which satisfies the criteria given. Also, the courses offered by the departments, the syllabus, the duration and the course ID which is associated with every course has to be stored. With the above information: 1) Depict the complete ER Diagram for the above database. Identify appropriate entities, attributes and cardinality for relationships. 2) Identify and depict at least two multivalued attributes and composite attributes. Justify the same. 3) Identify and depict at least one weak entity and justify the same.	10	3	3
	b	Outline any six advantages of using DBMS approach in detail.	06	2	2
3	a	For a Relation R, with tuples $t1, t2, t3$…etc. What are the types of constraints violated by the insert, delete and update operations?. Explain.	08	2	3
	b	**EMPLOYEE** Fname | Minit | Lname | Ssn | Bdate | Address | Sex | Salary | Super_ssn | Dno **DEPARTMENT** Dname | Dnumber | Mgr_ssn | Mgr_start_date **DEPT_LOCATIONS** Dnumber | Dlocation **PROJECT** Pname | Pnumber | Plocation | Dnum **WORKS_ON** Essn | Pno | Hours **DEPENDENT** Essn | Dependent_name | Sex | Bdate | Relationship Fig 3b : Database schema for COMPANY Database. Consider the database in fig 3b and Give relational algebraic expressions for the following queries: i) For every project located in 'Stafford', list the project number, the controlling department number, and the department manager's last name, address, and birth date. ii) Find the names of employees who work on all the projects controlled by department number 5 iii) Make a list of projects numbers for projects that involves an employee whose last name is 'Smith', either as a worker or as a manger of the department that controls the project iv) List the names of all employees with two or more dependents.	08	3	2
		OR			

4	a	Give the approaches for mapping the following relationship types in ER to Schema i) Mapping of Binary 1:1 Relationship Types ii) Mapping of Binary 1:N Relationship Types	08	2	3
	b	For the Schema specified in the Fig 3b, give the following relational algebraic expressions: i) Retrieve the details of the manager of each department using Join operation. Display the Department name, Last name and First name of every manager retrieved. ii) Retrieve the names of employees who work on all the projects that 'John Smith' works on using Division operation	08	3	2
5	a	Write SQL Query for the following condition considering the database in the Fig 3b and NOT EXISTS clause appropriately i) List the names of managers who have at least one dependent (using EXISTS clause) ii) Retrieve the name of each employee who works on all the projects controlled by department number 5 (using NOT EXISTS clause)	08	3	3
	b	Consider the following decomposition $R(A,B,C,D,E,G)$ for the relation schema R and the following set F of functional dependencies. i) $R1(A,D)\ R2(A,B)\ R3(B,E)\ R4(C,D,E)\ R5(A,E)$ $A \rightarrow C, B \rightarrow C, C \rightarrow D, DE \rightarrow C, CE \rightarrow A$ ii) $R1(A,B,C)\ R2(A,C,D,E)\ R3(A,D,G)$ $F = \{AB \rightarrow C, AC \rightarrow B, AD \rightarrow E, B \rightarrow D, BC \rightarrow A, E \rightarrow G\}$ Determine whether the above decomposition has lossless join property.	08	3	3
		OR			
6	a	Using the database in Fig 3b write SQL queries that satisfies the following statements: i) Find the sum of the salaries of all employees, the maximum salary, the minimum salary and the average salary. (Use Aggregate functions) Display appropriate column names for the retrieved data. ii) For each project on which more than two employees work, retrieve the project number, the project name, and the number of employees who work on the project. (Use GROUP BY and HAVING clause)	08	3	3
	b	Consider a relational schema R with attributes A,B,C,D,E and set of functional dependencies $A \rightarrow CD, B \rightarrow CE, E \rightarrow B$. i) Give a lossless-join decomposition of R into BCNF. ii) Give a lossless-join decomposition of R into 3NF preserving FD	08	3	3
7	a	Check whether the given schedule S is conflict serializable or not. Show all steps and draw precedence graph for the same.	08	3	3

T_1	T_2	T_3
R(x)		
		R(y)
		R(x)
	R(y)	
	R(z)	
		W(y)
	W(z)	
R(z)		
W(x)		
W(z)		

	b	Construct the timestamps assigned to restarted transactions when timestamps are used for deadlock prevention versus when timestamps are used for concurrency control. Give an example for each.	08	3	3
		OR			
8	a	Outline the step involved in determining conflict serializability of two schedules	08	2	3
	b	Consider the three transactions T1, T2 and T3 and 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 schedules. $T1: r1(X); r1(Z); w1(X)$ $T2: r2(Z); r2(Y); w2(Z); w2(Y)$ $T3: r3(X); r3(Y); w3(Y)$ $S1: r1(X); r2(Z); r1(Z); r3(X); r3(Y); w1(X); w3(Y); r2(Y); w2(Z); w2(Y)$ $S2: r1(X); r2(Z); r3(X); r1(Z); r2(Y); r3(Y); w1(X); w2(Z); w3(Y); w2(Y)$	08	3	3
9	a	Outline characteristics of NOSQL system as related to data models and query languages. Elaborate on CAP theorem for NOSQL systems.	08	2	4
	b	What is Shading and Replication? Why is Sharding required and how does it work?	08	2	4
		OR			
10	a	Differentiate between structured and unstructured data with the help of appropriate application examples.	08	2	4
	b	What is Big Data? Outline the three V's characterization of Big data as per Gartner group specification	08	2	4