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BCS403

Fourth Semester B.E./B.Tech. Degree Examination, June/July 2025
Database Management Systems

Time: 3 hrs.

Max. Marks: 100

Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.
2. M : Marks , L: Bloom's level , C: Course outcomes.

		Module – 1	M	L	C
Q.1	a.	Explain the types of attributes with example.	4	L2	CO1
	b.	Define database. Explain the main characteristics of the database approach.	8	L2	CO1
	c.	Show the ER diagram for an EMPLOYEE database by assuming your own entities (minimum 4) attributes and relationships, mention cardinality ratios wherever appropriate.	8	L3	CO2
		OR			
Q.2	a.	Describe the three schema architecture.	4	L2	CO1
	b.	Explain the component models of DBMS and their interaction with the help of diagram.	8	L2	CO1
	c.	Design ER diagram for a university database by assuming your own entities (4). Mention primary key , constraints and relationships.	8	L3	CO2
		Module – 2			
Q.3	a.	Explain relational model constraints.	6	L2	CO1
	b.	Explain the characteristics of relations with suitable example for each.	6	L2	CO1
	c.	Considering the following schema : Sailors (sid , sname , rating , age) Boats (bid , bname , color) Reserves (sid , bid , day) Write a relational algebra queries for the following : i) Find the names of sailors, who have reserved red and a green boat. ii) Find the names of sailors who have reserved a red boat. iii) Find the names of sailors who have reserved a red or green boat. iv) Find the names of sailors who have reserved all boats.	8	L3	CO1
		OR			
Q.4	a.	Explain the steps to convert the basic ER model to relational Database schema.	6	L2	CO1
	b.	Explain Unary relational operations with example.	6	L2	CO1

	c.	Consider the relation schema Employee database. EMPLOYEE (Fname ,Minit , Lname , <u>SSn</u> , Bdates , Address , Sex , Salary Super_SSn , Dno) DEPARTMENT (Dname , <u>Dnumber</u> , Mgr_SSn , Mgr_start_date) PROJECT (Pname , <u>PNumber</u> , Plocation , Dnum) WORKS_ON (<u>Essn</u> , <u>Pno</u> , Hours) DEPENDENT (<u>Essn</u> , Dependent_name , sex, Bdate , Relationship) Write relational algebra queries for the following : i) Retrieve the name and address of all employees who work for the 'Research' department. ii) List the names of all employees with 2 or more dependents. iii) Find the names of employees who work on all the projects controlled by department number 5. iv) List the names of employees who have no dependents.	8	L3	CO3

Module – 3

Q.5	a.	What is the need for normalization? Explain second and third normal form with examples.	6	L2	CO4
	b.	Outline constraints in SQL.	6	L2	CO1
	c.	Identify the given Relation R(ABCDE) and its instance, check whether FDS given hold or not. Give reasons. i) $A \rightarrow B$ ii) $B \rightarrow C$ iii) $D \rightarrow E$ iv) $CD \rightarrow E$.	8	L3	CO4

A	B	C	D	E
a_1	b_1	c_1	d_1	e_1
a_1	b_2	c_1	d_1	e_1
a_2	b_2	c_1	d_2	e_3
a_2	b_3	c_3	d_2	e_2

OR

Q.6	a.	What is Multivalued dependency? Explain 4NF and 5NF with suitable example.	6	L2	CO4
	b.	Outline the informal design guidelines for relational schema.	6	L2	CO4
	c.	Consider relation R with following function dependency : EMPPROJ (<u>SSn</u> , <u>Pnumber</u> , Hours , Ename , Pname , Plocation) SSN , Pnumber $\rightarrow$ Hours, SSN $\rightarrow$ Ename Pnumber $\rightarrow$ Pname , Plocation. Is it 2NF? Verify? If no give reason.	8	L3	CO4

Module – 4					
Q.7	a.	Consider the following schema for a company database : Employee (FName , LName , SSn , Adderss , Sex , Salary , Dno , Super_SSn) Department (Dname , Dnumber , mgr_SSn, mgr_st_date) Project (Pname , Pnumber , Plocation , Dnum) WORKS_on (Essn , Pno , Hours) DEPENDENT (Essn , Dependent name , Sex , Bdate, relationship). Write the SQL queries for the following : i) List the names of managers who have atleast one dependent (use correlated nested). ii) Retrieve the name of each employee who has a dependent with the same first name and is the same sex as the employee. iii) For each project retrieve the project number , project name and the number of employees who work on that project. iv) Retrieve the SSN of all employees who work on project number 1, 2 or 3. (Use 1N). v) Find the sum of the salaries of all employees of the 'Research' department as well as maximum salary , minimum salary , average salary in this department.	10	L3	CO3
	b.	Why concurrency control is needed? Demonstrate with an example.	10	L2	CO5
OR					
Q.8	a.	Consider the following schedule. The actions are listed in the order they are scheduled and prefixed with the transaction name. S1 : T1 : R(X) , T2 : R(X) T1 : W(Y) , T2 : W(Y) , T1 : R(Y) , T2 : R(Y) S2 : T3 : W(X) , T1 : R(X) , T1 : W(Y) , T2 : R(Z) , T2 : W(Z) , T3 : R(Z) For each schedule answer the following : i) What is the precedence graph for the schedule? ii) Is the schedule conflict_serializable? If so what are all the conflicts equivalent serial schedules? iii) Is the schedule view serializable? If so what are all the view equivalent serial schedules?	10	L3	CO5
	b.	Explain triggers with example write a trigger in SQL to call a procedure "Inform_Supervisor" whenever an employees salary is greater than the salary of his or her direct supervisor in the COMPANY database.	10	L3	CO5
Module – 5					
Q.9	a.	Describe the two – phase locking protocol for concurrency control provide example to illustrate how it ensures serializability in transaction schedule.	10	L2	CO5
	b.	Explain the characteristics of NOSQL system.	10	L2	CO6
OR					
Q.10	a.	Explain binary locks and shared lock with algorithm.	10	L2	CO5
	b.	Explain MongoDB data model, CRUD operations and distributed system characteristics.	10	L2	CO6

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