RollNo: ----------

Thapar Institute of Engineering & Technology, Patiala
Computer Science and Engineering Department
END-SEMESTER EXAMINATION

Course Code: UCS310	Course Name: Database Management Systems
B.E. (Second Year), Semester-II	Branch: COE, CSE
May 15, 2024	Wednesday, 9.00 AM – 12 Noon
Time: 3 Hours, M. Marks: 40	Name of Faculty: RKR, MK, RRN, SKH, CHP, SRO, AAD, VAP

(Note: Answer any Four questions with valid points only, which are most appropriate for your answers. Unnecessary answers or answers written in pencil will not be evaluated. Assume the missing information (if any) suitably. All the symbols used here have their usual meaning.)

Q1. (a) Consider a relation R (M, N, O, P, Q, R). Find the minimal cover of the following functional dependencies holds in R. Show clearly all the steps while finding the minimal cover. **2M**

M→NO, OP→Q, Q→O, P→MQR, MNR→NP, PR→NO

Q1. (b) Consider a relation *EMP(emp_id, dept_id, ename, mgr_id, age)* where the following functional dependencies hold. (emp_id, dept_id) → ename. emp_id→mgr_id, emp_id→age, mgr_id→age. (Assume all the attributes having atomic values.)

(i) State whether an update anomaly can occur in the relation EMP or not with *proper reason*. **2M**

(ii) State in which normal form is EMP now by identifying the prime and non-prime attributes. Convert it to higher normal forms till BCNF, stating that *lossless join is satisfied* at each normal form. **4M**

(iii) Does multi-value dependency (MVD) exist in the following relation R (A, B, C)? If YES, then justify why such MVDs exist and list them all. If NO, then justify why not exist in R. **2M**

A	B	C
3	3	3
1	1	1
1	1	2
1	2	1
1	2	2
2	2	1
2	2	2
4	4	4
3	3	1

Q2. (a) Consider the schedule S1 given below having three transactions T1, T2, and T3.

S1: R2(A), R1(B), W2(A), W1(B), C1, R3(A), W3(A), R2(B), W2(B), C2, C3.

(i) Show that whether the schedule S1 satisfying 2PL by adding lock and unlock instructions to T1, T2 and T3. **2M**

(ii) Explain with examples how Strict and Rigorous 2-PL ensures cascadeless but not able to handle deadlock. Check whether schedule S1 is satisfying the strict-2PL locking protocol or not with proper justification. **6M**

Q2. (b) Consider the schedule S2 given below having five transactions T1, T2, T3, T4 and T5.

S2: R1(A), W1(A), R3(A), W3(A), R5(A), R4(B), W4(A), W2(A), C1, C2, C3, C4, C5.

Suppose T1 transaction fails just before its commit (*C1*) point, what are the other transactions which will be forced to be rollback, and explain why such rollback happened? **2M**

Q3. (a) Consider the following schedule S3 having four transactions T1, T2, T3, and T4.

S3: R1(A), W3(A), W3(B), R2(A), W1(A), W1(B), W2(A), W2(B), W4(A), W4(B)

(i) State whether S3 is conflict serializable or not by using the precedence graph. **2M**

(ii) Check for the view serializability by explaining the view serializability conditions. List all the equivalent serial schedules. **2M**

Q3. b) (i) Consider the schedule S4 given below having three transaction T1, T2, and T3.

S4: R1(X), R3(Z), R2(Y), W2(Y), W1(X), W3(Z), W1(Y), C1, R3(X), C2, C3.

Check whether the schedule S4 is cascadeless recoverable or not with proper justification. Convert the schedule to strict recoverable schedule by changing the order of commit operations (*Note: do not change the order of the read and write operations*). **4M**

(ii) Explain with suitable example why blind writes are not allowed in strict cascadeless schedule. **2M**

Q4. Consider a relation EMP (emp_id: integer, ename: string, jod_id: string, dept_id: integer, salary: integer, bonus: integer), where bonus is initially NULL for all the employee records of EMP.

(a)Write a stored procedure which will update the bonus (by 10% of the salary) of those employees in the EMP table who earn less salaries than the average salary of their respective departments, and who are not working as 'Manager' or 'Supervisor' in their department. Finally, the procedure computes the total updated bonus and the number of the employees who received the bonus, and send it to the calling environment for printing them as output. **8M**

(b)Write a database trigger on the relation EMP to ensure that the job_id of any new employee being hired to department 40 or updated in department 40 is either 'Salesperson' or 'Clerk'. Add exception handling and provide an appropriate message so that the update fails if the new job_id is not 'Salesperson' or 'Clerk'. **2M**

Q5. Given the following four relational schemas, and answer the following SQL queries. (*Note: No partial marking will be considered for any of the SQL queries.*) **(5 x 2 = 10M)**

Employee (ssn: integer, fname: string, lname: string, bdate: date, Address: string, salary: integer, supervisor_ssn: integer, dno: integer), where supervisor_ssn is the self-referential foreign key and dno is the foreign key referencing to Department.

Department (dno: integer, dname: string, Mgr_ssn: integer, Mgr_start: date), where dname has unique constraint and Mgr_ssn is the foreign key referencing to Employee.

Project (pno: integer, pname: string, plocation: string, dno: integer), where pname has unique constraint and dno is the foreign key referencing to Department.

Works_on (essn:integer, pno: integer, hours: time), where essn is the foreign key referencing to Employee and pno is the foreign key referencing to Project.

(i) Find the average salary of those employees who work on the projects managed by their own department's manager.

(ii) Find the total number of hours worked by employees on projects managed by supervisors with a salary higher than $100,000.

(iii) Find the departments where the average employee salary is greater than the average salary of departments managed by supervisors with a salary greater than $80,000.

(iv) List the names of projects with at least one employee who works more than 40 hours on that project.

(v) List the names of employees who work on more than one project.

****