Reg. No.															

SRM Institute of Science and Technology
College of Engineering and Technology
School of Computing

BATCH -1

SRM Nagar, Kattankulathur – 603203, Chengalpattu District, Tamilnadu
Academic Year: 2022-2023 (EVEN)

Test: CT-3 **Date: 02-05-2023**
Course Code & Title: 18CSC303J DATABASE MANAGEMENT SYSTEM **TIME: 8:00am to 9:40am**
Year & Sem: III Year / VI Sem **Max. Marks: 50**
Instructions: MCQs to be collected within first fifteen minutes

Course Articulation Matrix: ***(to be placed)***

S.No.	Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1	**CO5**	H	H	L	M	L	-	-	-	M	M	M	L
2	**CO6**	H	L	L	L	L	-	-	-	H	L	L	L

Part - A
(10 x 1 = 10 Marks)

Instructions: Answer all

Q. No	Question	Marks	BL	CO	PO	PI Code
1	In which normal form there can be no interdependencies among non-key attributes A. 1 NF B. 2 NF **C. 3 NF** D. BCNF	1	1	5	1	1.6.1
2	If A->B and B->C holds then A->C Using which rule above fact is justified A. Reflexivity rule. B. Decomposition rule. C. Augmentation rule. D. **Transitivity rule.**	1	2	5	1	1.6.1
3	Extraneous attributes in given functional dependency is removed by_____ A. Closure set of Functional Dependency B. Fourth Normal form C. **Canonical cover** D. First Normal form	1	1	5	1	1.6.1
4	The FDs are listed here. Which option is wrong? PQ->RS PU->S ST->U R->V U->T V->P A. **PQ^+ = {PQRSV}** B. PQ^+ = {VS} C. PQ^+ = {PSV} D. PQ^+ = {PQRS}	1	2	5	1	1.6.1

<table>
<tr><td>5</td><td>5NF is designed to cope with

1. Transitive dependency
2. join dependency
3. multi valued dependency
4. inconsistency</td><td>1</td><td>2</td><td>5</td><td>1</td><td>1.6.1</td></tr>
<tr><td>6</td><td>The “all-or-none” property is commonly referred to as _____

1. Isolation
2. Durability
3. Atomicity
4. Consistency</td><td>1</td><td>2</td><td>6</td><td>2</td><td>2.7.2</td></tr>
<tr><td>7</td><td>Find the correct match for terms in Column I to those in Column II
<table>
<tr><th colspan="2">Column I</th><th colspan="2">Column II</th></tr>
<tr><td>A)</td><td>Rollback</td><td>P)</td><td>Relationship</td></tr>
<tr><td>B)</td><td>Atomicity</td><td>Q)</td><td>Checkpoint</td></tr>
<tr><td>C)</td><td>Entity</td><td>R)</td><td>Attribute</td></tr>
<tr><td>D)</td><td>Domain</td><td>S)</td><td>Transaction</td></tr>
</table>
1) A-S,B-P,C-R,D-Q
2) A-Q,B-P,C-R,D-S
3) A-S,B-Q,C-R,D-P
4) A-Q,B-S,C-P,D-R</td><td>1</td><td>1</td><td>6</td><td>1</td><td>1.6.1</td></tr>
<tr><td>8</td><td>A transaction successfully completed its execution is said to be

1. Saved
2. Committed
3. Partially committed
4. Rolled</td><td>1</td><td>1</td><td>6</td><td>2</td><td>2.6.1</td></tr>
<tr><td>9</td><td>Which of the following is the block that is not permitted to be written back to the disk?
a) Dead code
b) Read only
c) Pinned
d) Zapped</td><td>1</td><td>2</td><td>6</td><td>2</td><td>2.6.1</td></tr>
<tr><td>10</td><td>The rigorous two-phase locking protocol permits releasing all locks at the
A. Beginning of transaction
B. During Execution of transaction
C. End of transaction
D. Never in the life-time of transaction</td><td>1</td><td>1</td><td>6</td><td>2</td><td>2.6.1</td></tr>
</table>

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Part – B (Answer any four) (4 x 4 = 16 Marks)						
11	What are some potential pitfalls we might encounter when designing a Relational database. Redundancy, Inconsistency, Inefficiency, Complexity.	4	4	5	2	2.7.2
12	Consider the following dependencies, FD={A->B,B->D, C->DE, CD-> AB} Calculate the closure of attributes A^+, $(CD)^+$ A+ = {ABD} (CD)+ = {CDABE}	4	3	5	1	1.6.1
13	Write a Relational Algebraic Expression for the following Queries. Player Id | Team Id | Country | Age | Runs | Wickets 1001 | 101 | India | 25 | 10000 | 300 1004 | 101 | India | 28 | 20000 | 200 1006 | 101 | India | 22 | 15000 | 150 1014 | 105 | Pakistan | 21 | 3599 | 205 a. Find all tuples from player relation for which country is India. $\sigma_{\text{"country" = "India"}}(\text{Player})$ b. Select all the tuples for which runs are greater than or equal to 15000. $\sigma_{\text{"runs" >= "15000"}}(\text{Player})$ c. List all the countries in Player relation $\pi_{\text{"country"}}(\text{Player})$ d. List all the team ids and countries in Player Relation $\pi_{\text{Team Id, Country}}(\text{Player})$	4	3	5	2	2.6.1
14	To ensure the transaction is reliable and secure, the bank requires that it adheres to the ACID properties. Brief the properties of the transaction.	4	4	6	2	2.6.1

	Atomicity, Consistency, Isolation, Durability.					
15	Differentiate wound wait scheme with wait die scheme in deadlock prevention strategies. **wait-die** scheme — non-preemptive Older transaction may wait for younger one to release data item (older means smaller timestamp). Younger transactions never wait for older ones; they are rolled back instead. a transaction may die several times before acquiring needed data item. **wound-wait** scheme — preemptive Older transaction *wounds* (forces rollback) of younger transaction instead of waiting for it. Younger transactions may wait for older ones. May be fewer rollbacks than *wait-die* scheme.	4	3	6	2	2.6.1
Answer all (2*12=24 marks)						
16	a. Write the following queries in relational algebra, using the University Schema: classroom(building, room number, capacity) department(dept name, building, budget) course(course id, title, dept name, credits) instructor(ID, name, dept name, salary) section(course id, sec id, semester, year, building, room number, time slot id) teaches(ID, course id, sec id, semester, year) student(ID, name, dept name, tot cred) takes(ID, course id, sec id, semester, year, grade) a. Find the titles of courses in the Comp. Sci. department that have 3 credits. $\Pi_{title}(\sigma_{dept\_name\ =\ \text{'Comp. Sci'}\ \wedge\ credits=3}(course))$ b. Find the highest salary of any instructor. $\mathcal{G}_{\mathbf{max}(salary)}(instructor)$ c. Find the enrolment of each section that was offered in Autumn 2009. $_{course\_id,section\_id}\mathcal{G}_{\mathbf{count}(*)\ \mathbf{as}\ enrollment}(\sigma_{year=2009\wedge semester=\text{Autumn}}(takes))$ d. Find the names of all students who have taken at least one Comp. Sci. course. π name(σ dept_name='Comp. Sci.'(student $\bowtie$ takes $\bowtie$ course)) **(or)** b. Suppose you are designing a database for a university that includes information about courses, students, and professors. Each course is taught by a	12	4	5	3	3.6.2

	single professor, and each professor can teach multiple courses. Additionally, each course can have multiple students enrolled in it, and each student can be enrolled in multiple courses. You have already designed tables for Courses, Students, and Professors, which are all in 3NF. However, you realize that there is a potential issue with redundancy in your database. Specifically, you notice that there could be multiple rows in the enrolment table for a single student if that student is enrolled in multiple courses. How would you modify your database to eliminate this redundancy and bring it up to 4NF? Discuss the concept of Multivalued dependency related to 4NF. **Ans:** To eliminate redundancy and bring the database up to 4NF, we would need to create a new table to represent the relationship between students and courses. The new table, called Enrollments, would store information about the enrolment of each student in each course and would have the following columns: StudentID: a foreign key that references the Students table CourseID: a foreign key that references the Courses table EnrollmentDate: the date on which the student enrolled in the course With this new table in place, we can eliminate the redundancy in the original enrollment table, as each student/course combination will only appear once in the Enrollments table. Additionally, we have eliminated the possibility of anomalies that could arise if we were to update, insert, or delete data in the original enrollment table. The new Enrollments table is in 4NF because it has no multi-valued dependencies and is free of redundant data. A table is said to be in 4NF if the following conditions are met, The table is in Boyce-Codd Normal Form (BCNF). The table is not any having an independent multi-valued dependency. Multivalued dependency would occur whenever two separate attributes in a given table happen to be independent of each other. And yet, both of these depend on another third attribute. The multivalued dependency contains at least two of the attributes dependent on the third attribute. ID →→ street, city					

17	a."Any transaction cannot read or write data until it acquires an appropriate lock on it ", Illustrate the statement with example using the types of locks used to implement concurrency control and discuss the two phase locking protocol in detail. **Ans:** Types: 4 marks, Two phase with example:8marks A lock is a mechanism to control concurrent access to a data item. Data items can be locked in two modes : 1. *exclusive (X) mode*. Data item can be both read as well as written. X-lock is requested using **lock-X** instruction. 2. *shared (S) mode*. Data item can only be read. S-lock is requested using **lock-S** instruction. The Two-Phase Locking Protocol:This protocol ensures conflict-serializable schedules. • Phase 1: Growing Phase – Transaction may obtain locks – Transaction may not release locks • Phase 2: Shrinking Phase – Transaction may release locks – Transaction may not obtain locks The protocol assures serializability. It can be proved that the transactions can be serialized in the order of their **lock points** (i.e., the point where a transaction acquired its final lock). **(or)** b. i.)Provide an example of Serial and Non serial Schedules in transactions. (6 marks) Serial and non-serial schedules with example(3+3 marks) ii.)Consider the following schedules involving two transactions. Find out which schedule is conflict serializable. Also check its conflict equivalent.(6 marks) S1:R1(X) R1(Y) R2(X) R2(Y) W2(Y) W1(X) S2: R1(X) R2(X) R2(Y) W2(Y) R1(Y) W1(X) Two transactions of given schedules are: T1: $R_1(X)$ $R_1(Y)$ $W_1(X)$ T2: $R_2(X)$ $R_2(Y)$ $W_2(Y)$ Let us first check serializability of S1: S1: $R_1(X)$ $R_1(Y)$ $R_2(X)$ $R_2(Y)$ $W_2(Y)$ $W_1(X)$ To convert it to a serial schedule, we have to swap non-conflicting operations so that S1 becomes equivalent to serial schedule T1->T2 or T2->T1. In this case, to convert it to a serial schedule, we must	12	4	6	3	3.6.2

	have to swap $R_2(X)$ and $W_1(X)$ but they are conflicting. So S1 can't be converted to a serial schedule. Now, let us check serializability of S2: S2: **$R_1(X)$ $R_2(X)$** $R_2(Y)$ $W_2(Y)$ $R_1(Y)$ $W_1(X)$ Swapping non conflicting operations $R_1(X)$ and $R_2(X)$ of S2, we get S2': $R_2(X)$ **$R_1(X)$ $R_2(Y)$** $W_2(Y)$ $R_1(Y)$ $W_1(X)$ Again, swapping non conflicting operations $R_1(X)$ and $R_2(Y)$ of S2', we get S2'': $R_2(X)$ $R_2(Y)$ **$R_1(X)$ $W_2(Y)$** $R_1(Y)$ $W_1(X)$ Again, swapping non conflicting operations $R_1(X)$ and $W_2(Y)$ of S2'', we get S2''': $R_2(X)$ $R_2(Y)$ $W_2(Y)$ $R_1(X)$ $R_1(Y)$ $W_1(X)$ which is equivalent to a serial schedule T2->T1. Only S2 is conflict serializable.					

Course Outcome (CO) and Bloom's level (BL) Coverage in Questions