

CS/B.TECH/IT/EVEN/SEM-6/IT-601/2015-16

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Paper Code : IT-601

DATABASE MANAGEMENT SYSTEM

Time Allotted : 3 Hours

Full Marks : 70

The figures in the margin indicate full marks.

Candidates are required to give their answers in their own words as far as practicable.

GROUP - A

(Multiple Choice Type Questions)

1. Choose the correct alternatives for any *ten* of the following : 10 × 1 = 10

i) Let $R (X, Y)$ and $S (Y)$ be two relations as given below :

| R | |
|----|----|
| X | Y |
| x1 | y1 |
| x1 | y2 |
| x2 | y2 |
| x2 | y3 |
| x3 | y2 |
| x3 | y1 |

| S |
|----|
| Y |
| y2 |
| y3 |

What would be the result of the relational algebra :

$R \div S$?

- a) $X = \{ x_1, x_2, x_3 \}$ b) $X = \{ x_1 \}$
 c) $X = \{ x_2 \}$ d) $X = \{ x_3 \}$.

- ii) In E-R diagram double lines indicate
 a) Total participation b) Multiple participation
 c) Cardinality N d) None of these.
- iii) The keyword to eliminate duplicate rows from the query result in SQL is
 a) DISTINCT
 b) NO DUPLICATE
 c) UNIQUE
 d) Automatically eliminated.
- iv) In SQL, testing whether a sub-query is empty is done using
 a) DISTINCT b) ISEMPY
 c) EXISTS d) ISNULL.
- v) Precedence graphs help to find a
 a) Serializable schedule
 b) Recoverable schedule
 c) Deadlock free schedule
 d) Cascade less schedule.
- vi) If a transaction T has obtained an exclusive lock on item Q , then T can
 a) read Q
 b) write Q
 c) write Q but not read Q
 d) both read and write Q .

vii) A functional dependency of the form $X \rightarrow Y$ is trivial if

- a) $X \subseteq Y$ b) $Y \subseteq X$
- c) $X \subset Y$ d) $Y \subset X$.

viii) The FD $A \rightarrow B, DB \rightarrow C$ implies

- a) $DB \rightarrow A$ b) $A \rightarrow C$
- c) $B \rightarrow A$ d) $DA \rightarrow C$.

ix) The drawback of shadow paging technique is

- a) Commit overhead b) Data fragmentation
- c) Garbage collection d) All of these.

x) Which of the following is true for relational calculus ?

- a) $\forall x (P(x)) \equiv \neg (\exists x) (\neg P(x))$
- b) $\forall x (P(x)) \equiv \neg (\exists x) (P(x))$
- c) $\forall x (P(x)) \equiv (\exists x) (\neg P(x))$
- d) $\forall x (P(x)) \equiv (\exists x) (P(x))$.

xi) Wait-for graph is used for

- a) deadlock prevention
- b) deadlock detection
- c) detecting view serializability
- d) detecting conflict serializability.

GROUP - B

(Short Answer Type Questions)

Answer any *three* of the following 3 × 5 = 15

2. You are given an initial table as follows :

| Scroll | Sname | Saddress | Paper_id |
|--------|-------|----------|----------|
| 111 | S1 | SaltLake | CS601 |
| | | | CS602 |
| 112 | S2 | DumDum | CS601 |
| | | | CS602 |
| | | | CS605A |

| Paper_name | Author | S_grade |
|------------|---------|---------|
| DBMS | Navate | A |
| OS | Galvin | B |
| DBMS | Navate | E |
| OS | Galvin | A |
| M.M. | Pakhira | B |

Assume that there is only one author for a particular paper. Draw the FD diagram and normalize the table up to 3 NF.

3. Describe the following phases of database design :

- a) Mini-word or UoD
- b) Functional requirements and Data requirements
- c) Functional analysis
- d) Conceptual design and conceptual schema
- e) Physical design and physical schema.

4. Differentiate between the following :

- a) Partial key and Primary key
- b) Multi-valued attributes and Composite attributes
- c) Subclasses with disjoint constraints and overlapping constraints. 2 + 1 + 2

- 5. i) Explain Right outer join with an example.
- ii) Explain ACID property. 2 + 3
- 6. i) What is view ? Give one advantage of view.
- ii) Write a PL/SQL code to calculate the total salary of first n records of emp(eno, ename, salary) table. The value of n is passed to cursor as parameter. (1 + 1) + 3

GROUP - C

(Long Answer Type Questions)

Answer any *three* of the following. 3 × 15 = 45

- 7. i) The following relational schema is given :
Employee(eno, name, age, mgr_no, dno, salary)
Dept (dno, dname)
Work_on (eno, pno)
Answer the following queries as directed :
 - a) Find the employee names who are involved in "Web Application" project. (Relational algebra)
 - b) Find the employee names whose manager name is "Mr. M. Ghosh" (SQL)
 - c) Find all employees along with their department name and project name. (Tuple relational calculus)
 - d) Find the employee names who are involved in all the projects. (SQL or Relational algebra)
 - e) Find the 3rd highest salary (SQL). 5 × 2
- ii) Prove the following by Armstrong's axioms : 2
 $X \rightarrow Y$ and $WY \rightarrow ZFWX \rightarrow Z$
- iii) What is weak entity ? How such type of entity is represented in database table ? What do you mean by discriminator ? Give example. 3

- 8. i) Consider a relation $R (ABCDEFGHIJ)$ which is initially in 1 NF with functional dependencies $F = \{ AB \rightarrow C, A \rightarrow DE, B \rightarrow F, F \rightarrow GH, D \rightarrow IJ \}$.
 - a) What is the key of R ?
 - b) Decompose it into 2 NF and then 3 NF. 1 + 4
- ii) Consider a relation $R (ABCD)$ with FDs $F = \{ AC \rightarrow D, BC \rightarrow D, A \rightarrow B, B \rightarrow A \}$
 - a) Is this relation in 3 NF ?
 - b) Check for it to be in BCNF.
Justify your answer and decompose the table if required in both the above cases. 4
- iii) You are given the following table :
Vehicle (reg_no, make, colour)
Person (eno, name, address)
Owner (eno, reg_no)
Consider the following query :
SELECT eno, name, reg_no FROM Person, Owner
WHERE Person.eno = Owner.eno and Person.name = 'Raju'
 - a) Draw the initial query tree.
 - b) Optimize the query and draw the optimized query tree. 6

9. i) Differentiate between Serial schedule and Serializable schedule. 2
- ii) Let T_1 , T_2 and T_3 be transactions that operate on the same data items A , B and C . Let $r_1(A)$ means that T_1 reads A , $w_1(A)$ means that T_1 writes A and so on for T_2 and T_3 . Consider the following schedule :
- $S_1 : r_2(C), r_2(B), w_2(B), r_3(B), r_3(C), r_1(A), w_1(A), w_3(B), w_3(C), r_2(A), r_1(B), w_1(B), w_2(A)$.
- Is the schedule serializable ? If yes, find the equivalent serial schedule. 3 + 1
- iii) Show with proper example that 'view serializability checking is more powerful than conflict serializability checking'. 4
- iv) What is dirty read problem ? Explain the difference between dirty read and unrepeatable read problem with example. 2 + 3
10. i) How can you differentiate between the process recovery and restoration ? Give example. 2 + 2
- ii) What is integral backup ? Explain redo and undo log. 1 + 3
- iii) Why do we use index in a database table, although we have candidate key to identify a row uniquely ? What is sparse index ? 2 + 1
- iv) Explain the process of checkpoint based recovery with suitable example. 4

11. i) Let the relation $R (A_1, A_2, A_3, A_4, A_5)$ is decomposed into
- $R_1(A_1, A_2, A_3, A_5),$
 $R_2(A_1, A_3, A_4),$
 $R_3(A_4, A_5)$
- with the functional dependencies
- $FD_1: A_1 \rightarrow A_3 A_5,$
 $FD_2: A_5 \rightarrow A_1 A_4,$
 $FD_3: A_3 A_4 \rightarrow A_2.$
- Check whether the above decomposition is lossless or lossy. 3
- ii) Consider the relation $R (A, B, C)$ with functional dependencies
- $F = \{ A \rightarrow BC, B \rightarrow C, A \rightarrow B, AB \rightarrow C \}.$
- Compute the canonical cover for F . 3
- iii) What do you mean by shared and exclusive lock ? Explain lock up-gradation. 2 + 1
- iv) Explain 'Two Phase Locking' protocol for concurrent transactions. What do you mean by transaction deadlock ? 4 + 2