

B.TECH/AEIE/ECE/8TH SEM/CSEN 4281/2018
FUNDAMENTALS OF RDBMS
(CSEN 4281)

Time Allotted : 3 hrs

Full Marks : 70

Figures out of the right margin indicate full marks.

Candidates are required to answer Group A and any 5 (five) from Group B to E, taking at least one from each group.

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

Group - A
(Multiple Choice Type Questions)

1. Choose the correct alternative for the following: **10 × 1 = 10**
- (i) A relation R(A,B,C,D) is decomposed into R1(A,B) and R2(A,C,D), where A is the candidate key of R1. So, the decomposition is
(a) lossy (b) lossless (c) both (a) and (b) (d) none of these.
- (ii) In relational algebra, _____ is an unary operator.
(a) project (b) rename (c) natural join (d) both (a) and (b).
- (iii) A set of one or more attributes, whose no proper subset can uniquely identify an entity in the entity set is called
(a) super key (b) primary key
(c) candidate key (d) foreign key.
- (iv) A trivial FD is
(a) $A \rightarrow BC$ (b) $AB \rightarrow A$
(c) $A \rightarrow C$ (d) none of the above.
- (v) A superkey set consists of {AB, A, BC, ABC}. Out of this the minimal super keys are
(a) {A, BC, AB} (b) {ABC}
(c) {A, AB} (d) {A, BC}.
- (vi) TCL statements are
(a) grant and revoke (b) commit and rollback
(c) commit, rollback and savepoint (d) none.
- (vii) In ACID property, the letter "C" stands demotes
(a) commitment (b) consistency
(c) concurrency (d) collective.

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- (viii) Which of the following is the way to **undo** the effects of an aborted transaction?
(a) Compensation transaction (b) Roll back
(c) Recovery (d) Error control.
- (ix) Which of the following operations is used if we are interested in only certain columns of a table?
(a) PROJECTION (b) SELECTION
(c) UNION (d) JOIN.
- (x) In a relational model, **relations** are termed as
(a) tuples (b) attributes (c) tables (d) rows.

Group - B

2. (a) Describe the **3-schema architecture** for database development along with an illustrative diagram. Clearly mention the functionalities of each level.
(b) Explain **logical data independence** and **physical data independence** with the help of examples.
(c) State what is meant by **DDL, DML, DCL**. Give an example for each.

5 + 4 + 3 = 12

3.

SCENARIO

Consider two shopping sites "**FLIPON**" and "**AMKART**" who maintain records of different products and customers.

- Each **PRODUCT** can be distinctly identified by (**manufacturer_name, product_name, variant**) OR **product_id**, all products have a *price, discount, category* and *specification*.
- Any product may be sold by one or more **SELLERS**. Each seller may be identified by **seller_id**. Each seller has a *name, location, address* and *contact_information*. A seller may sell one or more products.
- For each product sold a seller receives some commission.
- Each product has a set of **REVIEWS**. Reviews are left by customers. Each review has a *heading, description, and rating*.
- Each review can be distinctly identified by (**product_id, customer_id**).
- For each product bought a customer may leave at the most one review.
- Each **CUSTOMER** can be identified by *registered_phone* OR *registered_mail id* OR *customer_id*.
- Each customer has a set of **ORDER_RECORDS, WALLET** and a **CART**.
- Each order is identified by *order_id*. Each order has *details of products purchased, quantity of each product, price of each product, total amount of the order, cancelled date, modified date, and delivery date*. [Cancel Date or modify date cannot be later than delivery date].

- Each cart belongs to one and only one customer. Cart has a *list of products, quantity of each product, price of each product and total amount.*
- The wallet may be identified by the **customer_id**. Each wallet has record of *top_up_added, payment_for_order_id and refund_for_order_id, refund_status, refund_date, refund_amount.*

- (a) Draw a clean and precise **ER diagram** to model the scenario given above. You may assume any additional conditions if you think necessary. State such assumptions clearly. Provide brief explanations for your diagram.
- (b) Differentiate between **candidate key** and **super key** with proper reasons. Give an illustrative example of each from the above scenarios.

10 + 2 = 12

Group - C

4. (a) Considering the scenario given in *question 3*: Write **relational algebra** (Not SQL) expressions for the following:
- Identify which product from “*electronics*” category has the highest number of units sold on *AMKART*.
 - List out the names of customers of *FLIPON* who have cancelled or modified their orders more than “10” times.
- Suggest some technique to identify which products are sold on both *FLIPON* and *AMKART*. State your assumptions clearly. [*Hint: comparing some attribute values in two different tables*]

- (b) Based on your assumptions, write relational algebra expression to find out which platform offers any particular product at a lower price.

(3 + 3) + (3 + 3) = 12

- 5.(a) Consider a relational database as given below:

Train (train-no, train_name, start_station)

Berth_Seat (SeatNo, train-no, coach_type, price_perKm) where the

underlined attributes are the primary keys. Write down the expressions in SQL for the following queries:

- i) List all the train names starting from source station “Kolkata.
- ii) List the train number and price of a seat under “SL” type of coach for those train originating from “Howrah” Station and terminating at “Delhi”.
- iii) Display the train name whose price/km under “3AC” type of coach is maximum.

- (b) Distinguish the terms referential integrity, entity integrity and domain integrity with examples.

(2+ 3 +3) +4 = 12

Group - D

6. A relation R (X, P, C, T, G) with attributes is given.

The given set of Functional Dependencies denoted as **F** are as follows:

$$X \rightarrow P$$

$$C \rightarrow T$$

$$(X, P) \rightarrow G$$

$$T \rightarrow G$$

- i) Find out the candidate keys from of R.
- ii) Find the minimal cover of **F**.
- iii) Determine the current normal form of the relation R.
- iv) Convert the relation to 3rd normal form such that dependency is preserved and lossless decomposition occurs – explain the steps.

3+ 3 + 3 + 3 = 12

7. (a) Define **BCNF**. How does it differ from 3NF and why is it considered a stronger from 3NF?

Consider the following relation **REFRIGERATOR (MdlNo, Year, Price, Man_plant, Color)** and with the following dependencies:

F = {MdlNo → Man_plant,

(MdlNo,Year) → Price,

Man_plant → Color}

- i) Evaluate each of the following as a candidate key for REFRIGERATOR, giving reasons why it can or cannot be a key: {MdlNo}, {MdlNo,Year}, {MdlNo, Color}
- ii) Based on the above key determination, state whether this relation is in BCNF or in 3NF, giving proper reasons.

- (b) Discuss various insert anomalies based on normalization.

3 + 5 + 4 = 12

Group - E

8. (a) Consider 2 transaction T1 and T2 running in a centralized environment such that

T1 : R1(A) W1(A) R1(B) W1(B)

T2 : R2(A) W2(A) R2(C) W2(C)

Consider the schedule

S : R1(A) W1(A) R2(A) W2(A) R1(B) W1(B) R2(C) W2(C)

- i) Find out whether the given schedule is conflict serializable or not
- ii) Find whether the given schedule is view serializable or not.

- (b) i) Two phase locking does not ensure freedom from deadlock - justify this using an example. ii) Briefly explain wait-wound protocol for deadlock prevention.

(3 + 3) +(4 +2) = 12

9. (a) Draw the **Precedence Graph** for the following schedule.
 Test whether the given schedule is Conflict Serializable or not.
 If it is Conflict Serializable, then write down the equivalent Serial schedule.

T ₁	T ₂	T ₃
		R(y)
		R(z)
R(x)		
W(x)		
		W(y)
		W(y)
	R(z)	
R(y)		
W(y)		
	R(y)	
	W(y)	
	R(x)	
	W(x)	

- (b) Describe the concurrency problems **Dirty-Read** and **Non-Repeatable Read** with the help of examples.
- (c) Explain **ACID** properties of a transaction.

$$4 + 4 + 4 = 12$$