



## BRAINWARE UNIVERSITY

Course – B.Sc(CS)

Database Management Systems (BCS401)

(Semester –4)

**Time allotted: 3 Hours**

**Full Marks: 70**

[The figure in the margin indicates full marks. Candidates are required to give their answers in their own words as far as practicable.]

### Group –A

(Multiple Choice Type Questions)

10 x 1 = 10

1. *Choose the correct alternative from the following*

- (i) In order to maintain the consistency during transactions database provides
- |                |               |
|----------------|---------------|
| a. View        | b. Index      |
| c. Consistency | d. Durability |
- (ii) The entity integrity constraint states that
- |   |                                   |
|---|-----------------------------------|
| a) no primary key value can be null.    | b) a part of the key may be null. |
| c) duplicate object values are allowed. | d) None of these.                 |
- (iii) In 3NF
- |                                       |  |
|---------------------------------------|--|
| a) We remove transitive dependencies. | b) There should not be any partial dependencies. |
| c) All value must be atomic.          | d) All of these.                                 |
- (iv) In SQL, the ALTER TABLE SPACE command is used
- |  |                                       |
|--|---------------------------------------|
| a. to add/rename data files.             | b. to change storage characteristics. |
| c. to take a table space online/offline. | d. None of these.                     |
- (v) In functional dependencies the Reflexive rule is
- |   |  |
|---|--|
| a) $X \supseteq Y \models X \rightarrow Y$                    | b) $X \rightarrow Y \models XZ \rightarrow YZ$ |
| c) $X \rightarrow Y, Y \rightarrow Z \models X \rightarrow Z$ | d) $X \rightarrow YZ \models X \rightarrow Y$  |
- (vi) We can use three rules to find logically implied functional dependencies. These collection of rules is called
- |              |                       |
|--------------|-----------------------|
| a. Axiom     | b. Armstrong's axioms |
| c. Armstrong | d. Closure            |

- (vii) Inst\_dept (ID, name, salary, dept name, building, budget) is decomposed into instructor (ID, name, dept name, salary) department (dept name, building, budget)  
This comes under
- Lossy-join decomposition.
  - Lossy decomposition.
  - Lossless-join decomposition.
  - Both (a) and (b).
- (viii) Cardinality ratio means
- Number of attributes associated with an entity.
  - Number of entities related with other entities via a relationship.
  - Number of attributes associated with an entity.
  - None of these.
- (ix) Normalization is a process of
- Decomposing a set of relations.
  - Successive reduction of relation schema.
  - Deciding which attributes in a relation to be grouped together.
  - All of these.
- (x) Which of the following statement is false?
- A relation with two attributes is in BCNF.
  - A relation in which every key has only one attribute is in 2NF.
  - A primary attribute can be transitively dependent on a key in 3NF.
  - A prime attribute can be transitively dependent on a key in BCNF relation.

### Group – B

(Short Answer Type Questions)

3 x 5 = 15

Answer any *three* from the following

- Explain the differences between a weak and a strong entity set. [2]
  - What is the result of first performing the cross product of student and advisor, and then performing a selection operation on the result with the predicate  $s\_id = ID$ ? [1]
  - Distinguish between lossy and lossless decomposition as used in normalization. [2]
- An E-R diagram can be viewed as a graph. What do the following mean in terms of the structure of an enterprise schema?

  - The graph is disconnected. [3]
  - The graph is acyclic. [2]

4. Consider a relation  $R(A, B, C, D)$  with the following instance;

A	B	C	D
1	1	2	3
1	2	2	3
1	3	2	3
2	4	5	6
5	6	7	8

Which of the following functional dependencies are satisfied by this relation? Justify your answer.

$A \rightarrow B, A \rightarrow C, A \rightarrow D, B \rightarrow C, B \rightarrow D, C \rightarrow D$  [5]

5. Consider the following expressions, which use the result of a relational algebra operation as the input to another operation. For each expression, explain in words what the expression does.

(a)  $\sigma_{year \geq 2009}(takes) \bowtie student$  [2]

(b)  $\Pi_{ID, Name, Course\_ID, year \geq 2009}(takes) \bowtie (student)$  [3]

6. You are given the following set of functional dependencies for a relation  $R(A, B, C, D, E, F)$ ,

$F = \{AB \rightarrow C, DC \rightarrow AE, E \rightarrow F\}$ .

[5]

What are the keys of this relation?

### Group – C

(Long Answer Type Questions)

3x 15= 45

Answer any *three* from the following

7. (a) Consider the following table in un-normalized form :  
 $Student\_Course \{ \underline{Course\_ID}, Course\_Name, Tutor\_ID, Tutor\_Name, \underline{Student\_ID}, Student\_Name, DOB, Gender, Last\_Att\_Date \}$ .

The functional dependencies are :

$\{ Course\_ID \} \longrightarrow \{ Course\_Name, Tutor\_ID, Student\_ID \}$

$\{ Student\_ID \} \longrightarrow \{ Student\_Name, DOB, Gender, Last\_Att\_Date \}$

$\{ Tutor\_ID \} \longrightarrow \{ Tutor\_Name \}$

Decompose the un-normalized table to 1NF, 2NF and 3NF. Describe logically each level of normalization. [10]

- (b) Consider a relation  $R(A, B, C)$  with FD's  $AB \rightarrow C, AC \rightarrow B, BC \rightarrow A$ .

Determine all the keys of relation R. [5]

8. (a) What is closure and minimal cover in functional dependency? What is inclusion dependency? [3+2]

(b) Define the concept of generalization, specialization and aggregation. [5]

(c) Design an ER diagram for a library database and construct the schema from this. [5]

9. *person* (*driver-id*, *name*, *address*)  
*car* (*license*, *model*, *year*)  
*accident* (*report-number*, *date*, *location*)  
*owns* (*driver-id*, *license*)  
*participated* (*driver-id*, *car*, *report-number*, *damage-amount*)
- Consider the above insurance database, where the primary keys are underlined. Construct the following SQL queries for this relational database.
- (a) Find the total number of people who owned cars that were involved in accidents in 1989. [3]
  - (b) Find the number of accidents in which the cars belonging to “John Smith” were involved. [3]
  - (c) Add a new accident to the database; assume any values for required attributes. [3]
  - (d) Delete the Mazda belonging to “John Smith”. [3]
  - (e) Update the damage amount for the car with license number “AABB2000” in the accident with report number “AR2197” to \$3000. [3]
10. The following relation schema can be used to register information on the repayments on micro loans.  
*Repayment* (*borrower\_id*, *name*, *address*, *loanamount*, *requestdate*, *repayment\_date*, *repayment\_amount*)  
A borrower is identified with an unique *borrower\_id*, and has only one address. Borrowers can have multiple simultaneous loans, but they always have different request dates. The borrower can make multiple repayments on the same day, but not more than one repayment per loan per day.
- (a) Find a candidate key for Repayment and explain. [3]
  - (b) Make the normalization to BCNF. Show the steps [7]
  - (c) Consider the following proposed rule for functional dependencies: If  $\alpha \rightarrow \beta$  and  $\gamma \rightarrow \beta$ , then  $\alpha \rightarrow \gamma$ . Prove that this rule is *not* sound by showing a relation *r* that satisfies  $\alpha \rightarrow \beta$  and  $\gamma \rightarrow \beta$ , but does not satisfy  $\alpha \rightarrow \gamma$ . [5]
11. Write a short note on the following topics :
- (a) Multivalued Dependency. [5]
  - (b) Deadlock Detection. [5]
  - (c) Three-tier architecture in DBMS [5]