

## SECTION 1: MULTIPLE CHOICE QUESTION (10 Questions, 1 Marks each)

Bloom's Taxonomy Level: 3

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### Topic: Entity-Relationship (E-R) Modeling and Relational Database Design

*Subtopic: Basic concept of normalization*

Q1: Which of the following best describes the primary goal of the first normal form (1NF) in database normalization?

- (a) Eliminating redundant data across multiple tables. ☐
- (b) Ensuring each column contains atomic values. ☐
- (c) Removing transitive dependencies. ☐
- (d) Reducing data redundancy by creating separate tables for related data. (1 Marks)

Q2: A table is in 2NF if it is in 1NF and:

- a) All non-key attributes are functionally dependent on the entire primary key. ☐
- b) All non-key attributes are functionally dependent on a candidate key. ☐
- c) It contains no redundant data. ☐
- d) It has a composite primary key. (1 Marks)

Q3: Consider a table with attributes (StudentID, StudentName, CourseID, CourseName, Grade). What normal form is this table *\*not\** in, and why?

- a) 1NF, because it contains repeating groups. ☐
- b) 2NF, because of transitive dependency between CourseID and CourseName. ☐
- c) 3NF, because of transitive dependency between StudentID and StudentName. ☐
- d) BCNF, because of redundant data. (1 Marks)

Q4: The primary goal of normalization is to:

- a) Increase the number of tables in a database. ☐
- b) Reduce data redundancy and improve data integrity. ☐
- c) Simplify the database design process. ☐
- d) Improve query performance regardless of data redundancy. (1 Marks)

Q5: Which of the following is NOT a benefit of normalization?

- a) Reduced data redundancy
- b) Improved data integrity
- c) Increased storage space required
- d) Easier data modification and update

**\*\*Answer Key:\*\*** 1: c, 2: a, 3: b, 4: b, 5: c (1 Marks)

*Subtopic: Decomposition using functional dependencies*

Q6: A relation R(A, B, C, D) has functional dependencies  $A \rightarrow B$ ,  $B \rightarrow C$ , and  $C \rightarrow D$ . Which of the following decompositions of R is lossless-join and dependency-preserving?

- a) R1(A, B), R2(B, C), R3(C, D)
- b) R1(A, B, C), R2(C, D)
- c) R1(A, B, D), R2(B, C)
- d) R1(A, B, C, D) (No decomposition) (1 Marks)

Q7: Given the relation R(A, B, C) with functional dependency  $A \rightarrow BC$ , which statement is TRUE regarding decomposing R to preserve functional dependencies and avoid lossy joins?

- a) R can be decomposed into R1(A, B) and R2(A, C) without loss of information.
- b) R must be decomposed into R1(A, B) and R2(B, C) to avoid information loss.
- c) R cannot be decomposed without losing information.
- d) R can be decomposed into R1(A, B) and R2(B, C), but this decomposition is lossy. (1 Mark)

Q8: Relation schema R(SSN, Name, Address, City, Phone) with functional dependencies  $SSN \rightarrow Name, Address, City, Phone$  and  $Name \rightarrow Phone$ . Which decomposition would be considered the most appropriate based on normalization principles?

- a) R1(SSN, Name), R2(Name, Address, City, Phone)
- b) R1(SSN, Name, Address, City, Phone) (No decomposition)
- c) R1(SSN, Name, Address, City), R2(SSN, Phone)
- d) R1(SSN, Name, Address, City), R2(Name, Phone) (1 Marks)

Q9: A relation R(P, Q, R, S) has functional dependencies  $P \rightarrow Q$ ,  $Q \rightarrow R$ , and  $R \rightarrow S$ . If we decompose R into R1(P, Q) and R2(Q, R, S), which normalization form is \*guaranteed\* to be achieved for R1 and R2?

- a) 3NF ☐
- b) BCNF ☐
- c) 2NF ☐
- d) 1NF (1 Marks) ☐

Q10: You have a relation with the functional dependency  $X \rightarrow YZ$ . Which of the following decompositions will *\*always\** lead to a lossless join decomposition?

- a)  $R_1(X,Y), R_2(Y,Z)$  ☐
- b)  $R_1(X,Z), R_2(X,Y)$  ☐
- c)  $R_1(X,Y,Z)$  (No decomposition) ☐
- d)  $R_1(X,Y), R_2(X,Z)$  ☐

These questions require students to apply their understanding of functional dependencies and