

## Assignment - 3

### Section - A

1. What is database normalization, and why is it important?

ans Normalization is the process of organizing data to minimize redundancy and improve data integrity. It helps in efficient data storage, easy updates, and eliminates anomalies.

2. What is the First Normal Form (1NF)?

ans A relation is in 1NF if all attributes have atomic (indivisible) values and each record is unique. It eliminates repeating groups.

3. What is the Third Normal Form (3NF)?

ans A relation is in 3NF if it is in 2NF and has no transitive dependency (non-prime attributes depend only on the primary key).

4. What is the purpose of Fourth Normal Form (4NF)?

ans 4NF ensures no multi-valued dependencies exist. It is used when a table has two or more independent multi-valued facts about the same key.

### Sec - B

1. Explain the inference rule:

Inference rules define how new functional dependencies can be derived from existing ones.

Armstrong's Axioms are a set of inference rules like:

- Reflexivity
- Augmentation
- Transitivity

2. Explain 2NF in DBMS?

ans A relation is in Second Normal Form (2NF) if:

- It is already in First Normal Form (1NF);
- All non-prime attributes are fully functionally dependent on the entire primary key.

Key Concepts:

- Non-Prime attributes: An attribute that is not part of any candidate key.
- Full functional dependency: An attribute depends on the whole composite key, not just part of it.

Example

Consider a table

StudentID	CourseID	CourseName
1	C1	DBMS
1	C2	OS



Primary key : (StudentID, CourseID)

Functional Dependencies:

- (StudentID, CourseID)  $\rightarrow$  CourseName
- CourseID  $\rightarrow$  CourseName (Partial dependency)

Conversion to 2NF:

Split into two tables:

1. Student - Course (StudentID, CourseID)
2. Course (CourseID, CourseName)

### Section - c

1. What is BCNF? How to convert 3NF to BCNF with Example?

ans BCNF (Boyce - Codd Normal Form) is a stricter version of 3NF. A relation is in BCNF if every non-trivial functional dependency  $X \rightarrow Y$ ,  $X$  is a superkey.

Conversion:

- Identify violating dependencies.
- Decompose the relation into smaller relations

Satisfying BCNF.

Example

•  $R(A, B, C)$ , FDs:  $A \rightarrow B$ ,  $B \rightarrow C$

- $A$  is not a superkey, so decompose:  
 $R_1(B, C)$ ,  $R_2(A, B)$

2. Given  $R(A, B, C, D, E)$ ,  $FD = \{A \rightarrow B, B \rightarrow E, C \rightarrow D\}$ ,  
check 2NF

- Candidate key:  $\{A, C\}$
- $B, E$ , and  $D$  are dependent on parts of the key.
- NOT in 2NF

Convert to 2NF:

$R_1(A, B), R_2(B, E), R_3(C, D), R_4(A, C)$