# Tutorial Sheet No. 5 Database Normalization

1. Which normal form is considered adequate for normal relational database design?

 a)  2NF          b) 5NF          c) 4NF          d) 3NF

Solution: A relational database table is often described as "normalized" if it is in the Third Normal Form because most of the 3NF tables are free of insertion, update, and deletion anomalies.

2.  A table has fields F1, F2, F3, F4, and F5, with the following functional dependencies:

F1->F3, F2->F4, (F1,F2)->F5 in terms of normalization, this table is in

 (a) 1NF          (b) 2NF                    (c) 3NF                    (d) None of these Solution:

Since the primary key is not given we have to derive the primary key of the table. Using the closure set of attributes we get the primary key as (F1,F2). From functional dependencies, "F1->F3, F2->F4", we can see that there is partial functional dependency therefore it is not in 2 NF. Hence the table is in 1NF.

3. Which of the following is TRUE?

 a) Every relation in 2NF is also in BCNF

 b) A relation R is in 3NF if every non-prime attribute of R is fully functionally dependent on every key of R

 c) Every relation in BCNF is also in 3NF

d) No relation can be in both BCNF and 3NF

Solution: c) 3NF tables , No partial or transitive dependency

4. Consider the following functional dependencies in a database.

Date_of_Birth->Age

Age->Eligibility

Roll_number->Name

Course_number->Course_name

Course_number->Instructor

(Roll_number, Course_number)->Grade

The relation (Roll_number, Name, Date_of_birth, Age) is:

a) 2NF but not in 3NF

b) 3NF form but not in BCNF

 c) BCNF

 d) None of the above

5. The relation schema Student_Performance (name, courseNo, rollNo, grade) has the following FDs:

 name,courseNo->grade

rollNo,courseNo->grade

rollNo->name

The highest normal form of this relation scheme is

a) 2NF          b) 3NF                    c) 1NF                    d) 4NF

Solution: Option (c)

6. The relation EMPDT1 is defined with attributes empcode(unique), name, street, city, state, and pincode. For any pincode, there is only one city and state. Also, for any given street, city and state, there is just one pincode. Find the Normal form of the table.

Explanation: empcode is unique, therefore it is the primary key. Since the primary key consists of a single attribute there will be no partial dependency, hence the relation is in 2NF. From the question we get the FDs as below: pincode -> city, state street,city,state -> pincode From the FDs we can see that there are transitive dependencies, hence the table is not in 3NF.

7. Consider the following relational schemes for a library database: Book (Title, Author, Catalog_no, Publisher, Year, Price) Collection (Title, Author, Catalog_no) With the following functional dependencies:

Title Author -> Catalog_no

Catalog_no -> Title Author Publisher Year

Publisher Title Year -> Price

Assume {Author, Title} is the key for both schemes. Which of the following statements is true?

a) Both Book and Collection are in BCNF

b) Both Book and Collection are in 3NF only

c) Book is in 2NF and Collection is in 3NF

d) Both Book and Collection are in 2NF only

Solution: Option (c)

Explanation: The relation Collection is in BCNF: Its given that {Author, Title} is the key and there is only one functional dependency (FD) applicable to the relation Collection {i.e. Title Author –> Catalog_no}.

As per the definitions of the normal forms Book is in 2NF.

8. Let R(A,B,C,D,E,P,G) be a relational schema in which the following FDs are known to hold:

AB->CD, DE->P, C->E, P->C, B->G

The relation schema R is

a) BCNF

b) 3NF, but not in BCNF

c) 2NF, but not in 3NF

d) Not in 2NF

Solution: option (d)

From the closure set of attributes we can see that the key for the relation is AB. The FD B->G is a partial dependency; hence it is not in 2NF.


9. Find the super key and candidate key for given FDs:

AB -> C

C -> D

B ->E

Solution: Candidate key =AB

Super key = ABCDE, ABC, ACD, ABE etc.