

# Jaypee Institute of Information Technology

## Database Systems & Web (15B11CI312)

### Tutorial 10 & 11 (Normalization)

1. Suppose you are given a relation  $R(A,B,C,D)$ . For each of the following sets of FDs, assuming they are the only dependencies that hold for  $R$ , do the following:
  - (a) Identify the candidate key(s) for  $R$ .
  - (b) State whether or not the proposed decomposition of  $R$  into smaller relations is a good decomposition and briefly explain why or why not.

1.  $B \rightarrow C, D \rightarrow A$ ; decompose into  $BC$  and  $AD$ .

2.  $AB \rightarrow C, C \rightarrow A, C \rightarrow D$ ; decompose into  $ACD$  and  $BC$ .

3.  $A \rightarrow BC, C \rightarrow AD$ ; decompose into  $ABC$  and  $AD$ .

4.  $A \rightarrow B, B \rightarrow C, C \rightarrow D$ ; decompose into  $AB$  and  $ACD$ .

5.  $A \rightarrow B, B \rightarrow C, C \rightarrow D$ ; decompose into  $AB, AD$  and  $CD$ .

2. Consider the following two sets of functional dependencies. Check whether they are equivalent.
  - a)  $FD1 = \{A \rightarrow B, B \rightarrow C, AB \rightarrow D\}$  and  $FD2 = \{A \rightarrow B, B \rightarrow C, A \rightarrow C, A \rightarrow D\}$
  - b)  $F = \{A \rightarrow C, AC \rightarrow D, E \rightarrow AD, E \rightarrow H\}$  and  $G = \{A \rightarrow CD, E \rightarrow AH\}$
3.  $F = \{AB \rightarrow C, C \rightarrow A, BC \rightarrow D, ACD \rightarrow B, D \rightarrow E, D \rightarrow G, BE \rightarrow C, CG \rightarrow B, CG \rightarrow D, CE \rightarrow A, CE \rightarrow G\}$ . Find the minimal cover of  $F$ .
4. A relation  $EMP$  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. Empcode is primary key. Identify the highest normal form the relation satisfies.
5. Consider the following collection of relations and dependencies. Assume that each relation is obtained through decomposition from a relation with attributes  $ABCDEFGHI$  and that all the known dependencies over relation  $ABCDEFGHI$  are listed for each question. (The questions are independent of each other, obviously, since the given dependencies over  $ABCDEFGHI$  are different.) For each (sub)relation:
  - (a) State the strongest normal form that the relation is in.
  - (b) If it is not in BCNF, decompose it into a collection of BCNF relations.

1.  $R1(A, C, B, D, E), A \rightarrow B, C \rightarrow D$
2.  $R2(A, B, F), AC \rightarrow E, B \rightarrow F$
3.  $R3(A, D), D \rightarrow G, G \rightarrow H$
4.  $R4(D, C, H, G), A \rightarrow I, I \rightarrow A$
5.  $R5(A, I, C, E)$

6. Suppose you are given a relation R with four attributes ABCD. For each of the following sets of FDs, assuming those are the only dependencies that hold for R, do the following:

- (a) Identify the candidate key(s) for R.
- (b) Identify the best normal form that R satisfies (1NF, 2NF, 3NF, or BCNF).
- (c) If R is not in BCNF, decompose it into a set of BCNF relations that preserve the dependencies.

1.  $C \rightarrow D, C \rightarrow A, B \rightarrow C$
2.  $B \rightarrow C, D \rightarrow A$
3.  $ABC \rightarrow D, D \rightarrow A$
4.  $A \rightarrow B, BC \rightarrow D, A \rightarrow C$
5.  $AB \rightarrow C, AB \rightarrow D, C \rightarrow A, D \rightarrow B$

7. Consider the schema  $R=ABCD$ , subjected to FDs  $F= \{ A \rightarrow B, B \rightarrow C \}$ , and the Non-binary partition  $D1 = \{ACD, AB, BC\}$  and  $D2 = \{AB, BC, CD\}$ . Is D1 and D2 is a Lossless decomposition?

8. Consider the given table and check for 4NF.

Student	Major	Hobby
Sok	IT	Football
Sok	IT	Volleyball
Sao	IT	Football
Sao	Med	Football
Chan	IT	NULL
Puth	NULL	Football
Tith	NULL	NULL