Course Name: **A Level (1st Sem)** Subject : **Introduction to DBMS**

Topic: **DB Normalization – Dependency Preserving Decomposition (Part 13)** Date: **01-June-2020**

Database Normalization – Dependency Preserving Decomposition

Suppose R is a relational schema and F is the set of functional dependencies on R.

If R is decomposed into relations R1, R2, … … … Rn , each holding functional dependencies F1, F2, … … … Fn respectively.

We can say, F` = F1 U F2 U … … … U Fn

Now this decomposition will be considered as **dependency preserving decomposition** if and only if

Every dependency in F is logically implied by F` i.e. $F`^{+} = F^{+}$

It is obvious that $F1 \subseteq F^{+}$, $F2 \subseteq F^{+}$, and so on

If we verify that F` is satisfied in R, we have verified that decomposition is dependency preserving decomposition i.e. F1 U F2 = F

Suppose R (A B C D) and set of functional dependencies

F: $AB \rightarrow CD$

$D \rightarrow A$

If R is decomposed into following two relations

R1 (A D),

R2 (B C D)

Identify that this decomposition is dependency preserving or not?

Solution:

R (A B C D)

F: AB → CD

D → A

R1 (A D)

Since there are two attributes in R1 i.e. A, D

so find A^+, D^+

[Closure must be calculated using FD set in R**]**

A^+ = A [It concludes trivial FD A → A]

D^+ = AD [It concludes FD D → A]

The closure of attributes concludes, following FD exist in R1

F1 { D → A}

R2 (B C D)

Since there are three attributes in R2 i.e. B, C, D

so find B^+, C^+, D^+, BC^+, CD^+, BD^+

[Closure must be calculated using FD set in R**]**

B^+= B [trivial]

C^+= C [trivial]

D^+= DA [It concludes FD, D → A but it is invalid FD for R2 because A is not attribute in R2]

BC^+= BC [trivial]

CD^+= CDA [It concludes FD, CD → A but it is invalid FD for R2 because A is not attribute in R2]

BD^+= BDAC [It concludes FD, BD → C A is not included at right side of FD because A is not attribute in R2]

The closure of attributes concludes, following FD exist in R2

F2 { BD → C}

Now F\` = F1 U F2 = { **D → A, BD → C }**

and original F in R = {AB → CD, D → A}

It can be seen that while decomposing, the functional dependency AB → CD has been lost.

To understand, calculate AB^+ = AB [Using FD in F` ] while in F, AB can determine CD but this dependency is lost in F`.

Therefore, **this decomposition is not dependency preserving decomposition.**

Exercise:

Suppose R (A B C D) and set of functional dependencies

F: AB → C

C → D

D → A

If R is decomposed into following two relations

R1 (A B C),

R2 (C D)

Identify that this decomposition is dependency preserving or not?