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

Topic: **DB Normalization – Lossless Join Decomposition (Part 12)** Date: **29-May-2020**

## Database Normalization – Lossless Join Decomposition

Suppose a relational schema R is decomposed into two relations R1 and R2, then this decomposition is considered as **lossless decomposition** if there is no loss of information after decomposition. This property is also knows as **lossless join decomposition**.

More technically, we can say that the result of natural join of R1 and R2 are same as R i.e. no extra or less tuple is generated in natural join of R1 and R2.

$$\pi_{Attributes}(R1) \bowtie \pi_{Attributes}(R2) = \pi_{Attributes}(R)$$

It is mandatory property and must always hold while decomposing of table.

The decomposition of R into R1 and R2 always will be lossless, if and only if, all the following three conditions holds true:

1. Attribute (R1) ∪ Attribute (R2) = Attribute (R)
2. Attribute (R1) ∩ Attribute (R2) ≠ ∅
3. The common attribute(s) between R1 and R2 must be candidate key either in R1 or in R2 i.e.

Attribute (R1) ∩ Attribute (R2) → Attribute (R)

Attribute (R1) ∩ Attribute (R2) → Attribute (R)

If the decomposition does not follow above three conditions then it is called **lossy decomposition** or **lossy-join decomposition**.

Consider a relation **R** (emp_id, emp_name, emp_dob, dept_id, dept_name, dept_location)

Now, it is divided into:

**R1** (emp_id, emp_name, emp_dob, dept_id)

**R2** (dept_id, dept_name, dept_locaion)

If it is lossless join decomposition then it has to follow all the above mentioned three conditions:

1- Union of attributes R1 and attributes R2 is equal to attributes of R
2- The intersection of attributes R1 and attributes R2 is not null. It is dept_id.
3- The common attribute between R1 and R2 (dept_id) is the candidate key in R2.

dept_id → dept_id, dept_name, dept_location

Therefore, **It concludes that above decomposition of R1(emp_id, emp_name, emp_dob, dept_id) and R2 ( dept_id, dept_name, dept_locaion) is lossless join decomposition.**

**Exercise:**

A. Suppose R (v w x y z) and set of FDs

F : { z → y,
y → z,
x → yv,
vw → x}

Which of the following decomposition is lossless, justify your answer:

1. R1(v w x), R2( x y z)
2. R1(v w), R2( y z)
3. R1(v w x), R2( y z)
4. R1(v w), R2( w x y z)

B. Suppose a relation R

| A | B | C | D | E |
|---|---|---|---|---|
| p | 111 | 6 | a | x |
| q | 134 | 5 | b | y |
| p | 338 | 6 | c | z |
| r | 463 | 4 | d | w |

Which of the following decomposition is lossless, justify your answer:

1. R1(A B), R2( C D)
2. R1(A B C), R2( D E)
3. R1(A B C), R2( C D E)
4. R1(A B C D), R2( A C D E)
5. R1(A B C D), R2( D E)
6. R1(A B C), R2( B C D), R3( D E)