

**JOIN DEPENDENCIES AND FIFTH NORMAL FORM****Join Dependency**

A relation is said to have join dependency if it can be recreated by joining multiple sub relations and each of these sub relations has a subset of the attributes of the original relation.

**Condition for join dependency:**

If the join of  $R_1$  and  $R_2$  over  $Q$  is equal to relation  $R$  then we can say that a join dependency exists, where  $R_1$  and  $R_2$  are the decomposition  $R_1 (P, Q)$  and  $R_2 (Q, S)$  of a given relation  $R (P, Q, S)$ .  $R_1$  and  $R_2$  are a lossless decomposition of  $R$ .

**Example:** Consider the relation  $R$  below having the schema  $R(\text{supplier}, \text{product}, \text{consumer})$ . The primary key is a combination of all three attributes of the relation.

**Table 1**

supplier	product	consumer
S1	P1	C1
S1	P2	C1
S2	P1	C1
S3	P3	C3

**Table 2**

supplier	product
S1	P1
S1	P2
S2	P1
S3	P3

**Table 3**

consumer	product
C1	P1
C1	P2
C3	P3

Table 4

supplier	consumer
S1	C1
S2	C1
S3	C3

#### Explanation:

Table 2, Table 3 and Table 4 when joined yield the original table (Table 1). Hence join dependency exists in Table 1, therefore Table 1 is not in 5NF or PJNF.

#### FIFTH NORMAL FORM (5NF)

- A relation is in 5NF if it is in 4NF and not contains any join dependency and joining should be lossless.
- 5NF is satisfied when all the tables are broken into as many tables as possible in order to avoid redundancy.
- 5NF is also known as Project-join normal form (PJ/NF).

#### Example

SUBJECT	LECTURER	SEMESTER
Computer	Anshika	Semester 1

Computer	John	Semester 1
Math	John	Semester 1
Math	Akash	Semester 2
Chemistry	Praveen	Semester 1

In the above table, John takes both Computer and Math class for Semester 1 but he doesn't take Math class for Semester 2. In this case, combination of all these fields required to identify a valid data.

Suppose we add a new Semester as Semester 3 but do not know about the subject and who will be taking that subject so we leave Lecturer and Subject as NULL. But all three columns together acts as a primary key, so we can't leave other two columns blank.

So to make the above table into 5NF, we can decompose it into three relations P1, P2 & P3:

#### P1

SEMESTER	SUBJECT
Semester 1	Computer
Semester 1	Math
Semester 1	Chemistry
Semester 2	Math

#### P2

SUBJECT	LECTURER
Computer	Anshika

Computer	John
Math	John
Math	Akash
Chemistry	Praveen

**P3**

SEMSTER	LECTURER
Semester 1	Anshika
Semester 1	John
Semester 1	John
Semester 2	Akash
Semester 1	Praveen

