Multivalued dependency

- Let R be a relation schema and let X and Y be subsets of the attributes of R.The multivalued dependency *X ->->Y is said to hold over R if,in every legal instance r of R, each X value is associated with a set of Y values and this set is independent of the values in the other attributes.*

OR

For a dependency A → B, if for a single value of A, multiple values of B exists, then the relation will be a multi-valued dependency.

Multivalued Dependencies

Course	Teacher	Book
Physics101	Green	Electronics
Physics101	Green	Optics
Physics101	Brown	Mechanics
Maths301	Brown	Geometry
Maths301	Green	Vectors
Maths301	Green	Algebra

- Course ->-> Book
  Course ->-> Teacher

Fourth Normal Form (4NF)

- **4NF** is a direct generalisation of BCNF.
- A relation will be in 4NF if it is in Boyce Codd normal form and has no multi-valued dependency.
- Let R be a relation schema, *X and Y be non empty subsets of the attributes of R, and F' be a set* of dependencies that includes both FDs and MVDs.
- *R is said to be in fourth* normal form (4NF), if, for every MVD *X->->Y that holds over R, one of* the following statements is true:
  - *Y E X or XY=R or*
  - *X is a superkey.*

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).

Join Dependency

- Join decomposition is a further generalization of Multivalued dependencies.
- If the join of R1 and R2 over C is equal to relation R, then we can say that a join dependency (JD) exists. Where R1 and R2 are the decompositions R1(A, B, C) and R2(C, D) of a given relations R (A, B, C, D).
- Alternatively, R1 and R2 are a lossless decomposition of R.