Database Management Systems (BCSC – 0003)
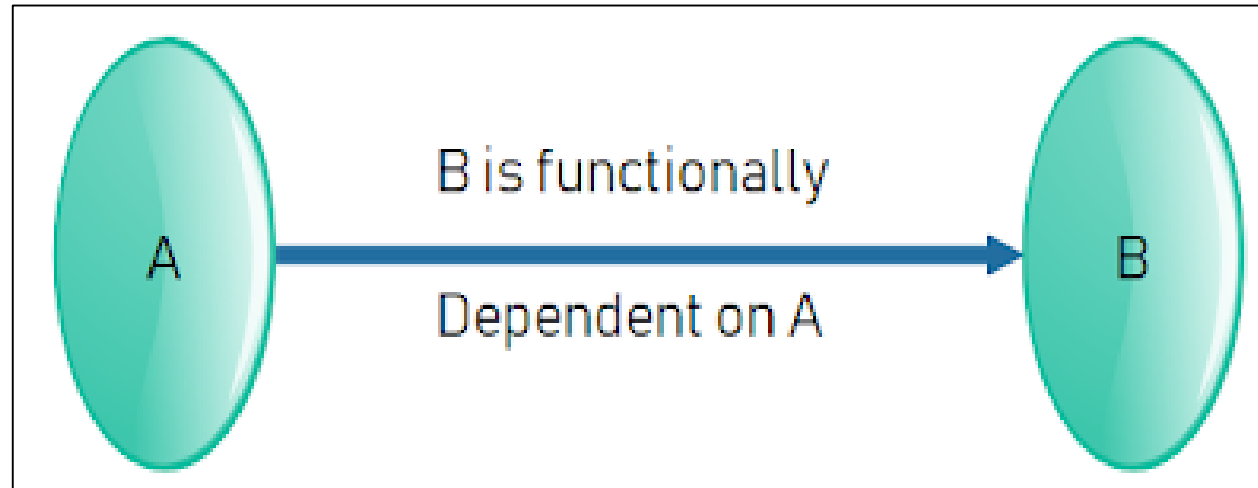
Topic: Functional Dependency

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Functional Dependency

- The functional dependency is a relationship that exists between two attributes.

- It typically exists between the primary key and non-key attribute within a table.

- It is usually denoted as: $X \rightarrow Y$

- The left side of arrow is known as a determinant, the right side of the arrow is known as a dependent.

Functional Dependency

Example:

Assume, we have an EMPLOYEE table with attributes: Emp_Id, Emp_Name, Emp_Address.

Here Emp_Id attribute can uniquely identify the Emp_Name attribute of employee table because if we know the Emp_Id, we can tell that employee name associated with it. Functional dependency can be written as:

$$Emp\_Id \rightarrow Emp\_Name$$

We can say that Emp_Name is functionally dependent on Emp_Id.

Functional Dependency

Types of Functional Dependencies:

1.   Trivial functional dependency

2.   Non-trivial functional dependency

3.   Multivalued dependency

4.   Transitive dependency

Functional Dependency

1. Trivial functional dependency

A → B has trivial functional dependency if B is a subset of A. The following dependencies are also trivial like: A → A, B → B

Example:

Consider a table with two columns Employee_Id and Employee_Name.

{Employee_id, Employee_Name} → Employee_Id is a trivial functional dependency as Employee_Id is a subset of {Employee_Id, Employee_Name}.

Also, Employee_Id → Employee_Id and

Employee_Name → Employee_Name are trivial dependencies too.

Functional Dependency

2. Non-trivial functional dependency

A → B has a non-trivial functional dependency if B is not a subset of A.

When A intersection B is NULL, then A → B is called as complete non-trivial.

Example:

ID → Name,

Name → DOB

Functional Dependency

3. Multivalued functional dependency

When existence of one or more rows in a table implies one or more other rows in the same table, then the Multi-valued dependencies occur.

If a table has attributes P, Q and R, then Q and R are multi-valued facts of P. It is represented by double arrow as $\rightarrow \rightarrow$

Example 1:

$P \rightarrow \rightarrow Q$

$P \rightarrow \rightarrow R$

In this case, Multivalued Dependency exists only if Q and R are independent attributes.

Functional Dependency

Example 2: Consider a Scooter manufacture company, which produces two colors (Grey and Red) in each variant every year.

MANUFACTURER

VARIENT_ID	YEAR	COLOR
M1001	2019	GREY
M1001	2019	RED
M2012	2020	GREY
M2012	2020	RED
M2222	2021	GREY
M2222	2021	RED

Here columns YEAR & COLOR are independent of each other and dependent on VARIENT_ID. In this case these two columns are said to be multivalued dependent on VARIENT_ID. These dependencies can be represented like this:

VARIENT_ID → → YEAR and

VARIENT_ID → → COLOR

Functional Dependency

4. Transitive functional dependency

A functional dependency is said to be transitive if it is indirectly formed by two functional dependencies.

Example:

X → Z is a transitive dependency if the following functional dependencies hold true:

- X → Y
- Y → Z

A transitive dependency can only occur in a relation of three of more attributes. This dependency helps us normalizing the database in 3NF (3rd Normal Form).

References

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Thank you