**Functional dependency**

A functional dependency (FD) is **a relationship between two attributes, typically between the PK and other non-key attributes within a table**.

if for every valid instance of X, **that value of X** **uniquely determines the value of Y** then

**X --> Y**

The left side of the above FD diagram is called the **determinant**, and the right side is the **dependent**

Say we have a relation R with columns A, B, C, D => R (A, B, C, D)

And A determines B => (A -> B)

**If, Ti [A] = Tj [A]**

**then**

**Ti [B] = Tj [B]**

Means if some columns Ti and Tj ‘s A column value is same then the B column value would be also same

**custid**  **custname**

1. johnny
2. jonardhon
3. john
4. johnny

Here row -1 and row 4’s customer id is same , so the customer name would be also same

**Armstrong Axioms**

The term Armstrong axioms refer to the sound and complete set of inference rules or axioms, that is used to test the logical implication of **functional dependencies**.

If F is a set of functional dependencies, then the closure of F, denoted as (F+), is the set of all functional dependencies logically implied by F. Armstrong’s Axioms are a set of rules, that when applied repeatedly, generates a closure of functional dependencies.

**Axiom of reflexivity (inference rule 1)**

If X is set of attributes and Y is a subset of X then X can determine Y

Ch-11-Axion-Reflexivity

X = {empid , addrs}

Y = addrs

Empid , addrs -> addrs

**Axiom of augmentation (inference rule 2)**

if X determines Y, then XZ determines YZ for any Z

Ch-11-Axiom-of-Augmentation-300x34

Empid -> name

Empid , sal -> name , sal

**Axiom of transitivity (inference rule 3)**

The axiom of transitivity says if X determines Y, and Y determines Z, then X must also determine Z (see Figure 11.3).

[Ch-11-Axiom-of-transitivity-300x30](http://opentextbc.ca/dbdesign01/wp-content/uploads/sites/11/2013/12/Ch-11-Axiom-of-transitivity-300x30.jpg)

**Union rule (inference rule 4)**

It states that if X determines Y and X determines Z then X must also determine Y and Z

Ch-11-Axiom-Union-300x23

**Decompose (inference rule 5)**

if X determines Y and Z, then X determines Y and X determines Z separately

Ch-11-Axiom-Decomposition-300x28

**Pseudo transitive (inference rule 6)**

if X determines Y and YZ determines W then XZ determines W

X -> Y

YZ -> W , XZ -> W

**Closure**

Closure of an attribute X is **the set of all attributes that are functional dependencies on X with respect to F**. It is denoted by X+ which means what X can determine.

say F = {A -> B , C -> D , B -> C}

A -> B

B -> C so A -> C

C -> D so A -> D

A+ = {A , B , C , D}

C+ = {C , D}

Etc…

If closure of a key can determine all the attributes then that key is a primary key