## Closure in DBMS | Steps to Find Closure

► Database Management System

## **Closure of an Attribute Set-**

- The set of all those attributes which can be functionally determined from an attribute set is called as a closure of that attribute set.
- Closure of attribute set {X} is denoted as {X}<sup>+</sup>.

## **Steps to Find Closure of an Attribute Set-**

Following steps are followed to find the closure of an attribute set-

#### **Step-01:**

Add the attributes contained in the attribute set for which closure is being calculated to the result set.

#### Step-02:

Recursively add the attributes to the result set which can be functionally determined from the attributes already contained in the result set.

## **Example-**

Consider a relation R ( A , B , C , D , E , F , G ) with the functional dependencies-

 $A \rightarrow BC$ 

 $BC \rightarrow DE$ 

$$D \,\to\, F$$

Now, let us find the closure of some attributes and attribute sets-

#### **Closure of attribute A-**

$$A^{+} = \{A\}$$

$$= \{A, B, C\} (Using A \rightarrow BC)$$

$$= \{A, B, C, D, E\} (Using BC \rightarrow DE)$$

$$= \{A, B, C, D, E, F\} (Using D \rightarrow F)$$

$$= \{A, B, C, D, E, F, G\} (Using CF \rightarrow G)$$

Thus,

$$A^{+} = \{ A, B, C, D, E, F, G \}$$

#### **Closure of attribute D-**

$$D^{+} = \{ D \}$$

$$= \{ D, F \} ( Using D \rightarrow F )$$

We can not determine any other attribute using attributes D and F contained in the result set.

Thus,

$$D^+ = \{ D, F \}$$

### Closure of attribute set {B, C}-

$${B,C}^+={B,C}$$
  
=  ${B,C,D,E}$  (Using BC  $\rightarrow$  DE)

$$= \{B, C, D, E, F\} (Using D \rightarrow F)$$
$$= \{B, C, D, E, F, G\} (Using CF \rightarrow G)$$

Thus,

$${B,C}^{+} = {B,C,D,E,F,G}$$

## Finding the Keys Using Closure-

## **Super Key-**

- If the closure result of an attribute set contains all the attributes of the relation, then that attribute set is called as a super key of that relation.
- Thus, we can say-

"The closure of a super key is the entire relation schema."

#### **Example-**

In the above example,

- The closure of attribute A is the entire relation schema.
- Thus, attribute A is a super key for that relation.

## **Candidate Key-**

 If there exists no subset of an attribute set whose closure contains all the attributes of the relation, then that attribute set is called as a candidate key of that relation.

#### **Example-**

In the above example,

- No subset of attribute A contains all the attributes of the relation.
- Thus, attribute A is also a candidate key for that relation.

Also Read- How To Find Candidate Keys?

# PRACTICE PROBLEM BASED ON FINDING CLOSURE OF AN ATTRIBUTE SET-

#### **Problem-**

Consider the given functional dependencies-

$$AB \ \to \ CD$$

 $AF \rightarrow D$ 

DE → F

 $C \rightarrow G$ 

 $F \rightarrow E$ 

 $G \ \to \ A$ 

Which of the following options is false?

$$(A) \{ CF \}^+ = \{ A, C, D, E, F, G \}$$

(B) 
$$\{ BG \}^+ = \{ A, B, C, D, G \}$$

$$(C) \{ AF \}^+ = \{ A , C , D , E , F , G \}$$

(D) 
$$\{AB\}^+ = \{A, C, D, F, G\}$$

## **Solution-**

Let us check each option one by one-

## Option-(A):

$$\{CF\}^+ = \{C, F\}$$

$$= \{C, F, G\} (Using C \rightarrow G)$$

$$= \{C, E, F, G\} (Using F \rightarrow E)$$

$$= \{A, C, E, E, F\} (Using G \rightarrow A)$$

$$= \{A, C, D, E, F, G\} (Using AF \rightarrow D)$$

Since, our obtained result set is same as the given result set, so, it means it is correctly given.

#### Option-(B):

$$\{BG\}^+ = \{B, G\}$$
  
=  $\{A, B, G\}$  (Using  $G \rightarrow A$ )  
=  $\{A, B, C, D, G\}$  (Using  $AB \rightarrow CD$ )

Since, our obtained result set is same as the given result set, so, it means it is correctly given.

## Option-(C):

$$\{AF\}^+ = \{A, F\}$$

$$= \{A, D, F\} (Using AF \rightarrow D)$$

$$= \{A, D, E, F\} (Using F \rightarrow E)$$

Since, our obtained result set is different from the given result set, so, it means it is not correctly given.

#### Option-(D):

$${AB}^{+} = {A, B}$$
  
=  ${A, B, C, D} (Using AB \rightarrow CD)$   
=  ${A, B, C, D, G} (Using C \rightarrow G)$ 

Since, our obtained result set is different from the given result set, so, it means it is not correctly given.

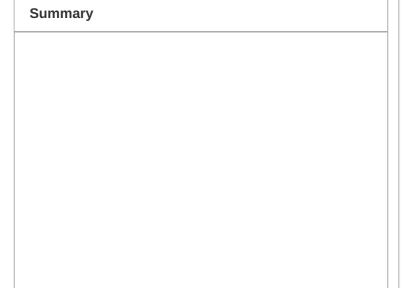
Thus,

Option (C) and Option (D) are correct.

**Next Article- 10 Different Kinds of Keys in DBMS** 

Get more notes and other study material of **Database Management System (DBMS)**.

Watch video lectures by visiting our YouTube channel **LearnVidFun**.





Article Name Closure in DBMS | Steps to Find

Closure

**Description** Closure in DBMS is a set of

attributes that can be functionally determined from an attribute set. How to find closure in DBMS- The given steps are followed to find the

closure of an attribute set.

Author Akshay Singhal

Publisher Name Gate Vidyalay

**Publisher Logo** 

