

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 $\{X\}^+$.

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-

$$A \rightarrow BC$$

$$BC \rightarrow DE$$

$$D \rightarrow F$$

$$CF \rightarrow G$$

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

Closure of attribute A-

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

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

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

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

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

Thus,

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

Closure of attribute D-

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

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

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}-

$$\{ B, C \}^+ = \{ B, C \}$$

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

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

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-

$$AB \rightarrow CD$$

$$AF \rightarrow D$$

$$DE \rightarrow F$$

$$C \rightarrow G$$

$$F \rightarrow E$$

$$G \rightarrow A$$

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):

$$\begin{aligned}\{CF\}^+ &= \{C, F\} \\ &= \{C, F, G\} \text{ (Using } C \rightarrow G \text{)} \\ &= \{C, E, F, G\} \text{ (Using } F \rightarrow E \text{)} \\ &= \{A, C, E, E, F\} \text{ (Using } G \rightarrow A \text{)} \\ &= \{A, C, D, E, F, G\} \text{ (Using } AF \rightarrow D \text{)}\end{aligned}$$

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

Option-(B):

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

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

Option-(C):

$$\begin{aligned}\{AF\}^+ &= \{A, F\} \\ &= \{A, D, F\} \text{ (Using } AF \rightarrow D \text{)} \\ &= \{A, D, E, F\} \text{ (Using } F \rightarrow E \text{)}\end{aligned}$$

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

$$\{AB\}^+ = \{A, B\}$$

$$= \{A, B, C, D, G\} \text{ (Using } C \rightarrow G \text{)}$$

Thus,

Next Article- [10 Different Kinds of Keys in DBMS](#)

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Summary



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.

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