

## 0.7 Extraneous Attributes

you-said

This is the algorithm to find extraneous attributes in a set of functional dependencies  $F$ :  
 Given  $\alpha \rightarrow \beta$ :  
 •  $a$  is extraneous if  $(\alpha - a) \rightarrow \beta$  under  $F$   
 •  $a$  is extraneous if  $\alpha \rightarrow (\beta - a)$  under  $F'$   
 $F' = (F - \{\alpha \rightarrow \beta\}) \cup \{\alpha \rightarrow (\beta - a)\}$

ChatGPT said:

This algorithm is used to identify **extraneous attributes** in functional dependencies (FDs). An attribute is considered extraneous if removing it from the left-hand side ( $\alpha$ ) or the right-hand side ( $\beta$ ) of an FD does not change the closure of the functional dependencies (i.e., the set of FDs remains the same).

Here's a breakdown of the algorithm:

given-a-functional-dependency-left.- $\alpha \rightarrow \beta$ -right.  
 ux3b1ux3b2

**Given a functional dependency  $\alpha \rightarrow \beta$ :**  
**Given a functional dependency  $\alpha \rightarrow \beta$ :**  
 • **Left side:** Check if an attribute  $a \in \alpha$  is extraneous by removing it from  $\alpha$  and checking if  $\alpha - a \rightarrow \beta$  holds under  $F$ .  
 • **Right side:** Check if an attribute  $a \in \beta$  is extraneous by removing it from  $\beta$  and checking if  $\alpha \rightarrow \beta - a$  holds under  $F'$ , where  $F' = (F - \{\alpha \rightarrow \beta\}) \cup \{\alpha \rightarrow (\beta - a)\}$ .

1. To check if an attribute  $a \in \alpha$  (left-hand side) is extraneous:

- Remove  $a$  from  $\alpha$ , i.e., check  $\alpha - a$ .
- Calculate the closure of  $\alpha - a$  with respect to the set of FDs  $F$ .
- If the closure of  $\alpha - a$  contains  $\beta$  (i.e.,  $\beta \subseteq (\alpha - a)^+$  under  $F$ ), then  $a$  is extraneous in  $\alpha$ .

2. To check if an attribute  $a \in \beta$  (right-hand side) is extraneous:

- Create a modified set of FDs  $F'$ , where:
  - Remove the FD  $\alpha \rightarrow \beta$  from  $F$ .
  - Add the FD  $\alpha \rightarrow (\beta - a)$  to  $F'$ , i.e., replace  $\alpha \rightarrow \beta$  with  $\alpha \rightarrow (\beta - a)$ .
- Calculate the closure of  $\alpha$  with respect to  $F'$ .
- If  $a$  is in the closure of  $\alpha$  under  $F'$  (i.e.,  $a \in \alpha^+$  under  $F'$ ), then  $a$  is extraneous in  $\beta$ .

summary

**Summary:**

- **For an attribute  $aa$  in the left-hand side  $\alpha$ :** Check if the rest of  $\alpha$  still determines  $\beta$ . If it does,  $aa$  is extraneous in  $\alpha$ .
- **For an attribute  $aa$  in the right-hand side  $\beta$ :** Check if  $\alpha$  can still determine  $aa$  even when  $aa$  is removed from  $\beta$ . If it does,  $aa$  is extraneous in  $\beta$ .

Let me know if you'd like an example to clarify this!

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