

3 NF Example

Problem

- Let $R = \{A, B, C, D, E, F\}$
- Let the FD set be
 - $ABF \rightarrow C$
 - $CF \rightarrow B$
 - $CD \rightarrow A$
 - $BD \rightarrow AE$
 - $C \rightarrow F$
 - $B \rightarrow F$
- Create a set of 3NF tables from R and the FD set.

3NF Synthesis Algorithm

- Input: Set of attributes R and FDs F
- Step 1: Create a minimal cover for F called G
- Step 2. For each FD in G create a table. Call the tables T_1, T_2, \dots
- Step 3: If none of the T_i contain a super key for the universal table create a new table containing the attributes of a key for the universal table

Minimal Cover Step 1

Decompose RHS

- $ABF \rightarrow C$
- $CF \rightarrow B$
- $CD \rightarrow A$
- $BD \rightarrow AE$
- $C \rightarrow F$
- $B \rightarrow F$

- $ABF \rightarrow C$
- $CF \rightarrow B$
- $CD \rightarrow A$
- $BD \rightarrow A$
- $BD \rightarrow E$
- $C \rightarrow F$
- $B \rightarrow F$

Minimal Cover Step 2

Remove Redundant Attributes on LHS

- ~~ABF~~ → C
- ~~CF~~ → B
- CD → A
- BD → A
- BD → E
- C → F
- B → F

$$\begin{aligned}AB^+ &= ABFC \\ A^+ &= A \\ B^+ &= BF \\ C^+ &= CFB \\ F^+ &= F \\ D^+ &= D\end{aligned}$$

- ~~AB~~ → C
- ~~C~~ → B
- CD → A
- BD → A
- BD → E
- C → F
- B → F

Minimal Cover Step 3

Remove Redundant Dependencies

- $AB \rightarrow C$
- $C \rightarrow B$
- $CD \rightarrow A$
- $BD \rightarrow A$
- $BD \rightarrow E$
- $C \rightarrow F$
- $B \rightarrow F$

$CD^+=CDBA$
 $C^+=CBF$

- $AB \rightarrow C$
- $C \rightarrow B$
- $BD \rightarrow A$
- $BD \rightarrow E$
- $B \rightarrow F$

Minimal Cover Step 4

Combine Dependencies with common LHS

- $AB \rightarrow C$
- $C \rightarrow B$
- $BD \rightarrow A$
- $BD \rightarrow E$
- $B \rightarrow F$

- $AB \rightarrow C$
- $C \rightarrow B$
- $BD \rightarrow AE$
- $B \rightarrow F$

3NF Synthesis Step 2

Make a table for each Dependency

– $AB \rightarrow C$

– $C \rightarrow B$

– $BD \rightarrow AE$

– $B \rightarrow F$

$R1 = \{A, B, C\}$

$R2 = \{C, B\}$

$R3 = \{B, D, A, E\}$

$R4 = \{B, F\}$

3NF Synthesis Step 3

Does the attribute closure of the attributes of one of the tables include all attributes in the universal table?

In this case yes.

– $AB \rightarrow C$

– $C \rightarrow B$

– $BD \rightarrow AE$

– $B \rightarrow F$

$R1 = \{A, B, C\}$

$R2 = \{C, B\}$

$R3 = \{B, D, A, E\}$

$R4 = \{B, F\}$

$BDAE^+ = BDAECF$