

## Assignment 6 (Chapter7, part1)

7.1 Suppose that we decompose the schema  $R = (A, B, C, D, E)$  into

$(A, B, C)$

$(A, D, E)$ .

Show that this decomposition is a lossless decomposition if the following set  $F$  of functional dependencies holds:

$A \rightarrow BC$

$CD \rightarrow E$

$B \rightarrow D$

$E \rightarrow A$

**Solution:**  $R_1 = (A, B, C)$ ,  $R_2 = (A, D, E)$ , so  $R_1 \cap R_2 = (A)$ .

**Because  $A \rightarrow BC$ , we have trivially  $A \rightarrow ABC$ .**

**Hence we have  $R_1 \cap R_2 \rightarrow R_1$ , thus we have shown that  $R$  decomposed into  $R_1$  and  $R_2$  is a lossless decomposition.**

7.2 List all nontrivial functional dependencies satisfied by the relation of Figure 7.18.

A	B	C
a1	b1	c1
a1	b1	c2
a2	b1	c1
a2	b1	c3

**Figure 7.18** Relation of Exercise 7.2.

**Solution:** Since there are only three attributes, we can check these function dependencies one by one.

**Single:**  $A \rightarrow B$ , yes.

**Aug:**  $A \rightarrow AB$ ,  $AC \rightarrow BC$ ,  $AC \rightarrow ABC$ ,

$A \rightarrow C$ , no.

$B \rightarrow A$ , no.

$B \rightarrow C$ , no.

$C \rightarrow A$ , no.

$C \rightarrow B$ , yes.

**Aug:**  $AC \rightarrow AB$ ,  $C \rightarrow BC$ ,  $AC \rightarrow ABC$ .

**Now we conclude here:**

**$F = \{A \rightarrow B, A \rightarrow AB, AC \rightarrow ABC, C \rightarrow BC, C \rightarrow B, AC \rightarrow AB, AC \rightarrow BC\}$**

7.13 Show that the decomposition in Exercise 7.1 is not a dependency-preserving decomposition.

Solution:  $R_1 \cap R_2 = (A)$ :

$A \rightarrow BC$  implies  $A \rightarrow B$  and  $A \rightarrow C$ , with  $B \rightarrow D$ , implies  $A \rightarrow D$

$A \rightarrow D$  and  $A \rightarrow BC$  implies  $A \rightarrow BCD$ , implies  $A \rightarrow CD$ , with  $CD \rightarrow E$  we have  $A \rightarrow E$ , and finally  $A \rightarrow BCDE$

But the last dependence of  $E \rightarrow A$  couldn't be checked unless computing  $R_1$  joins  $R_2$

So, it is not dependency preserving.