



8.1

 $R_1 = \{A, B, C\}, R_2 = \{A, D, E\}, R_1 \cap R_2 = A$ 
 $A \rightarrow BC \Rightarrow A \rightarrow B, A \rightarrow C$ 
 $CD \rightarrow E \Rightarrow C \rightarrow E$ 
 $B \rightarrow D, C \rightarrow E, A \rightarrow BC \Rightarrow A \rightarrow D, A \rightarrow E$ 
 $A \rightarrow E, E \rightarrow A \Rightarrow A \rightarrow A$ 
 $\Rightarrow A$  is a candidate key

 $\Rightarrow R_1 \cap R_2 \rightarrow R_1$ 
 $\Rightarrow$  is a lossless-join decomposition

8.7

 $F_c = \{A \rightarrow BC, CD \rightarrow E, B \rightarrow D, E \rightarrow A\}$ 

8.13

 the restriction of  $F$  to  $(A, B, C)$  is  $F_1$ 
 $A \rightarrow ABC; A \rightarrow AB, AC, BC; A \rightarrow A, B, C, \text{ (same as } B, C \text{)};$ 
 $AB \rightarrow ABC; AB \rightarrow AB, AC, BC; AB \rightarrow A, B, C, \text{ (same as } AC, BC \text{)};$ 

 same as  $ABC$ 

 the restriction of  $F$  to  $(A, D, E)$  is  $F_2$ 
 $(F_1 \cup F_2)^+$  doesn't contain  $B \rightarrow D, B \rightarrow E, C \rightarrow D, C \rightarrow E$



8.19  
 $\{(A, B, C, E), (C, D)\}$

8.20  
 $\{(A, B, C), (C, D, E), (B \rightarrow D), (E \rightarrow A)\}$

8.21  
 books - 1 (accessionno, isbn)  
 books - 2 (isbn, title, publisher)  
 books - 3 (isbn, author)  
 users - 1 (userid, name, deptid)  
 users - 2 (deptid, deptname)

8.29  
 a.  $B \rightarrow D \Rightarrow B \rightarrow BD$   
 $D \rightarrow A \Rightarrow B \rightarrow ABD$   
 $A \rightarrow BCD \Rightarrow B \rightarrow ABCD$   
 $BC \rightarrow DE \Rightarrow B \rightarrow ABCDE$   
 $\therefore B^+ = ABCDE$



b.  $A \rightarrow BCD, BC \rightarrow DE$

$\Rightarrow A \rightarrow ABCDE$

$\Rightarrow AP \rightarrow ABCDEP$

c.  $A \rightarrow BCD, D \rightarrow A \Rightarrow A \rightarrow BC$

$BC \rightarrow DE, B \rightarrow D \Rightarrow BC \rightarrow E$

$B \rightarrow D, D \rightarrow A \Rightarrow \begin{cases} A \rightarrow BC \\ B \rightarrow DE \\ D \rightarrow A \end{cases}$

d.  $\{(A, B, C), (B, D, E), (C, D, A), (A, F)\}$

e.  $\{(A, B, C, D), (A, E), (A, F)\}$

f. No.