

①

(i) Construct Pattern according to Query:  $\text{SELECT } z.D$   
FROM  $R_x, R_y, R_z$   
WHERE  $x.C = 0 \text{ AND } x.B = y.B$   
AND  $z.B = 5 \text{ AND } z.C = y.C$

\*Select z.D from R where conditions are met.

answer

R	A	B	C	D
x	-	Δ	-	-
y	-	Δ	0	-
z	-	5	0	□

answer	D
a	□

(ii) Minimize pattern in (i), satisfying FD's:  $A \rightarrow D$   
 $CD \rightarrow B$   
 $C \rightarrow A$

using  $C \rightarrow A$

R	A	B	C	D
x	-	Δ	-	-
y	a	Δ	0	-
z	a	5	0	□

$A \rightarrow D \Rightarrow$

R	A	B	C	D
x	-	Δ	-	-
y	a	Δ	0	□
z	a	5	0	□

$CD \rightarrow B \Rightarrow$

R	A	B	C	D
x	-	5	-	-
y	a	5	0	□
z	a	5	0	□

\*X.B changes to 5 as well due to the fact that  $x.B = y.B$

(iii) Query for minimized pattern.

$\text{SELECT } z.D$   
FROM  $R_z$   
Where  $z.B = 5 \text{ AND } z.C = 0$

Here we can minimize by ridding of  $y$ , due to duplicates

$\rightarrow$  row x can match z.

$\rightarrow$

R	A	B	C	D
x	a	5	0	□
z	a	5	0	□

$\Rightarrow$  can cancel due to duplicate.

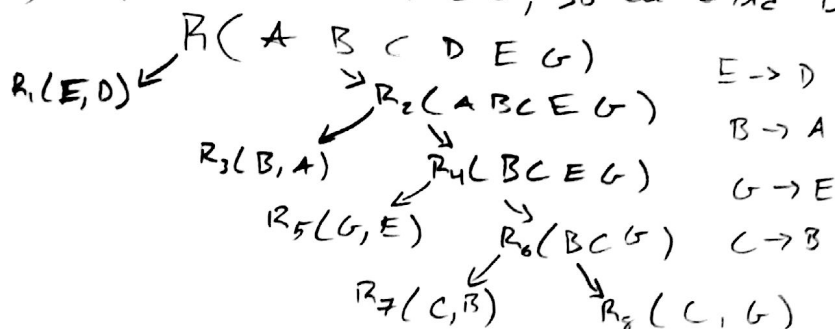
answer

answer	A	B	C	D
a	a	5	0	□

②  $R | A B C D E G$   $F = \{E \rightarrow D, C \rightarrow B, CBE \rightarrow AG, B \rightarrow A, G \rightarrow E\}$

(i) Find all keys in R, a key contains all attributes in R.  
 $\rightarrow$  Since C doesn't exist in RHS, it must appear in every key.  
if we do  $CE^+$  we get CBEAGD  
if we do  $CG^+$  we get CBEAGD as well.

(ii) Keys =  $CE + CG$ , so we find BCNF Decomp wrt F.



(iii) No, this decomposition is not dependency preserving as I decomposed the relation...

I never utilized FD:  $CBE \rightarrow AG$  in order to split. Therefore it is not preserved wrt F.

(iv) Find a 3NF decomp of R w/ lossless join & dependency preservation wrt F. Is it also in BCNF?

First step: must simplify FD's, must eliminate redundancies,  $\{E \rightarrow D, C \rightarrow B, CBE \rightarrow AG, B \rightarrow A, G \rightarrow E\}$

$\left. \begin{matrix} CBE \rightarrow A \\ CBE \rightarrow G \end{matrix} \right\} \rightarrow$  we can simplify by eliminating.   
  $\rightarrow$  Since  $B \rightarrow A$ , we see that  $C + E$  in  $CBE \rightarrow AG$  is redundant.

Then we are left with  $CBE \rightarrow G$

so F no redundancies =  $\{E \rightarrow D, C \rightarrow B, CBE \rightarrow G, B \rightarrow A, G \rightarrow E\}$

$R = ABCDEG$  keys =  $CE, CG \rightarrow$  add it to P  
\* except for  $CE$  since  $CBE$  already consists of  $CE$ .

A	B	C	D	E	G
			d	e	
a	b	c			
a	b	c	d	e	g
a	b				
			d	e	g
g	b	c	d	e	g

$P = \{ED, CB, CBE, BA, GE, CG\}$

must choose w/ F.

$\left. \begin{matrix} E \rightarrow D, \\ C \rightarrow B, \\ CBE \rightarrow G, \\ B \rightarrow A, \\ G \rightarrow E \end{matrix} \right\}$  in order

various of steps.

as you can see...

the end result

is the added key  $CG$  filled with each attribute.

$\rightarrow$  proves that preservation w/ 3NF holds.

The decomposition is not in BCNF since  $CBE$  violates BCNF.