

CS1555 Recitation 3

Objective: to practice normalization, canonical forms, decomposing relations into BCNF and checking for lossless decompositions.

Part 1: For each of the following relations R and sets of functional dependencies F, do the following:

- 1) Find the canonical cover (minimal cover) of F.
- 2) Using the canonical cover, find the keys of the R.

1. Consider the following set of functional dependencies F on a relation R (A, B, C, D, E):

F: 1. $A \rightarrow BC$
2. $A \rightarrow D$
3. $B \rightarrow C$
4. $C \rightarrow D$
5. $DE \rightarrow C$
6. $AC \rightarrow D$

① split everything to right
② remove lfc and still preserve
③ remove redundancy (duplicates transitive) remove the driven
④ can be removed (drop extra attributes)

2. Consider the following set of functional dependencies F on relation R (A, B, C, D, E, H):

$A \rightarrow C$
 $AC \rightarrow D$
 $E \rightarrow AD$
 $E \rightarrow H$
 $A \rightarrow CD$
 $E \rightarrow AH$

Part 2: Consider the following set of functional dependencies F on relation R (A, B, C, D, E, H):

$A \rightarrow C$
 $AC \rightarrow D$
 $E \rightarrow AD$
 $E \rightarrow H$
 $A \rightarrow CD$
 $E \rightarrow AH$

① left same, group it
② dependency relations.
 $A \rightarrow CD$
 $E \rightarrow AH$

$R_1(A, C, D)$

$R_2(E, A, H)$

$R_3(E, B)$ we can't summarise there get B

The key for R is EB and the following set of functional dependencies constitutes the canonical cover:

$A \rightarrow C, E \rightarrow A, E \rightarrow H, A \rightarrow D$

- 1) Using Synthesis Method, construct a set of 3NF relations. (merge)
- 2) Using Universal Method, decompose R into a set of BCNF relations. (decompose)

Part 3: Assume that R is decomposed into:

$R_1(A, B), F_1 = \{A \rightarrow B\}$, key (A)
 $R_2(B, C), F_2 = \{B \rightarrow C\}$, key (B)
 $R_3(C, D, E), F_3 = \{C \rightarrow D, DE \rightarrow C\}$, key (DE), (CE)

Is this decomposition a lossless-join decomposition? Use the table method.

	A	B	C	D	E
$R_1(A, B)$	a	a	a	a	a
$R_2(B, C)$	a	a	a	a	a
$R_3(C, D, E)$	a	a	a	a	a

no-full row \rightarrow can't retrieve
(lossy decomposition)

After can determine when
better in a relation

result

$A \rightarrow B$
 $B \rightarrow C$
 $C \rightarrow D$
 $DE \rightarrow C$

primkey

① find anything not on right (any)

As candidate
 AE^+ : $AE \rightarrow AEB$ ($\because A \rightarrow B$)
 $\hookrightarrow AEB$ ($B \rightarrow C$)
 $\hookrightarrow AEBD$ ($C \rightarrow D$)
can determine all relations.

top-down

U: $R(A, B, C, D, E, H)$ and CC & key.
(can't contain transitive form)

$R_1(A, B, D, E, H)$ [down]

$R_2(A, C)$ [top]

\hookrightarrow BCNF

$R_1'(A, B, E, H)$

$R_1''(A, D)$

$R_{11}'(B, E, H) \rightarrow E \rightarrow H$

$R_{12}'(E, A) \rightarrow$ BCNF

$R_{111}'(B, E) \rightarrow$ BCNF

$R_{112}'(E, H) \rightarrow$ BCNF

5 BCNFs

merge $R_1(A, C, D)$

$R_2(E, A, H)$

$R_3(B, E)$

Remove Transitive