

~~Notes~~ CS12132 Assignment 1 : Normalization.

1.  $F = \{$

$$A \rightarrow BC$$

$$B \rightarrow C$$

$$A \rightarrow B$$

$$AB \rightarrow C$$

}

$$F = \{$$

$$A \rightarrow BC$$

$$B \rightarrow C$$

~~$$A \rightarrow B$$~~

$$AB \rightarrow C$$

}

$$F = \{$$

~~AB → C~~

$$B \rightarrow C$$

$$A \rightarrow BC$$

{

$$\boxed{F = \{$$
  
$$A \rightarrow B$$
  
$$B \rightarrow C$$
  
{}}

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## 2a) Candidate Keys of R

~~every candidate key must have B in it.~~

$$\{B\} = \{\}$$

$$\{AB\} = \{ABCD\}$$

$$\{CB\} = \{ABCD\}$$

$$\{DB\} = \{ABCD\}$$

∴ Because  $\{B\}$  is empty,  
 $AB$ ,  $CB$ , and  $DB$  are candidate keys  
of R.

## b) 3NCF violations:

$$C \rightarrow D$$

$$D \rightarrow A$$

## c) 3NCF violations:

$$C \rightarrow D$$

$$D \rightarrow A$$



$$\{C\}^+ = \{C, D, A\}$$

Decompose R into  $R_1(C, D, A)$  and  $R_2(B, C)$

$\downarrow$   
 $R_1 \boxed{C}$  is ~~candidate~~ key,  
and  $D \rightarrow A$  is  
violation.

$$\{D\}^+ = \{D, A\}$$

Decompose  $R_1(C, D, A)$  into  $R_3(C, D)$  and  $R_4(D, A)$

∴ Final Answer =  $R_2, R_3, R_4$

=  $R_2(B, C)$ ,  $R_3(C, D)$ ,  $R_4(D, A)$ .

2d)

$$AB \rightarrow C$$

OR

$$D \rightarrow A$$

3a) Candidate Keys : A.

b) highest normal form = 2NF

Set F shows transitivity in  $A \rightarrow C$ ,  $C \rightarrow D$   
which is not allowed in 3NF.

c)  $R_1(A, B, C)$  where  $F = \{A \rightarrow B, A \rightarrow C\}$  3NF ✓  
 $R_2(C, D)$  where  $F = \{C \rightarrow D\}$  3NF ✓

d)  $F = \{A \rightarrow B, A \rightarrow C\}$   
 $F = \{C \rightarrow D\}$

e)  $R_1(A, B, C)$  candidate key = A  
 $R_2(C, D)$  candidate key = C

f) Decompositions:  $R_1(A, B, C)$  and  $R_2(C, D)$

Dependency preserving is maintained as all functional dependencies can be checked without  $R_1 \bowtie R_2$ .

lossless join is also present:

$$R_1 \bowtie R_2 = \{C\} \text{ and } C \rightarrow CD.$$