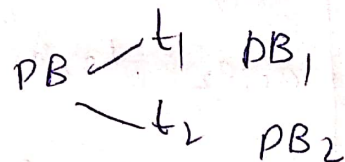


MVD & 4NF

classes (course, teacher, book)

$(c, t, b) \in \text{classes}$

course	teacher	book
DB	t_1	DB ₁
DB	t_1	DB ₂
DB	t_2	DB ₁
DB	t_2	DB ₂



key = courses, teacher, book
in a BCNF

Redundancy

Multivalued Dependency MVD_r

$\alpha, \beta \in R, \alpha \twoheadrightarrow \beta$ holds on R , if

for all $t_1, t_2 \in r \rightarrow t_1[\alpha] = t_2[\alpha]$

$\exists t_3, t_4 \in r$ such that

$$t_1[\alpha] = t_2[\alpha] \neq t_3[\alpha] = t_4[\alpha]$$

$$t_3[\beta] = t_1[\beta]$$

$$t_3[R-\beta] = t_2[R-\beta]$$

$$t_4[\beta] = t_2[\beta]$$

$$t_4[R-\beta] = t_1[R-\beta]$$

	α	β	$R - \alpha - \beta$
t_1	a_1, a_2	a_3, a_4	$a_5, a_6 \quad y_1 z_1$
t_2	a_1, a_2	b_3, b_4	$b_5, b_6 \quad y_2 z_2$
t_3	a_1, a_2	a_3, a_4	b_5, b_6
t_4	a_1, a_2	b_3, b_4	a_5, a_6

Suppose R partitioned into three subsets x, y, z

$$x \twoheadrightarrow y \text{ iff}$$

$$\forall (x_1, y_1, z_1) \& (x_1, y_2, z_2) \notin$$

$$\text{there is } \equiv (x_1, y_1, z_2)$$

$$(x_1, y_2, z_1)$$

UNF_r

R is a Relation

D - functional & MV dependencies

$$\forall \alpha \twoheadrightarrow \beta, \alpha, \beta \in R.$$

atleast one of the following holds

$$\alpha \twoheadrightarrow \beta \text{ is trivial } (\beta \subseteq \alpha \text{ or } \alpha \cup \beta = R)$$

$$\alpha \text{ is a superkey for } R.$$

$$R = \{A, B, C, G, H, I\}$$

$$D = \{A \twoheadrightarrow B, B \twoheadrightarrow HI, CG \twoheadrightarrow H\}$$

① $A \twoheadrightarrow B$: 4NF, Trivial
 A is not a key $\alpha \twoheadrightarrow \beta, \beta \subset \alpha$ or

$$\alpha \cup \beta = R$$

Decomposition r

$$R_1 = (A, B)$$

$$R_2 = R - \{B\} = \{A, C, G, H, I\}$$

$$R_1 = (A, B), D_1 \text{ line from } D^+ \text{ on } R_1$$

$$A \twoheadrightarrow B. \text{ Trivial, so in 4NF } [\because A \cup B = R]$$

Restriction of MVD r

$$\alpha \twoheadrightarrow (\beta \cap R_i)$$

where $\alpha \subseteq R_i$ and $\alpha \twoheadrightarrow \beta$ in D^+

$$R_2 = \{A, C, G, H, I\}$$

$$D_2 = \{CG \twoheadrightarrow H, \dots\}$$

Not trivial []

Not in 4NF

Decompose R_2

$$R_3 = (C, G, H)$$

$$D_3 = \{CG \twoheadrightarrow H\}. \text{ Trivial, 4NF}$$

$$R_4 = R - \{H\} = \{A, C, G, I\}. D_4 =$$

$$A \twoheadrightarrow HI \text{ in } D^+$$

$$A \twoheadrightarrow I \text{ in } D_4.$$

So, not in 4NF

Decompose r

Trivial,

$$R_5 = (A I), P_5 = \{ A \twoheadrightarrow I \}, \text{ In 4NF,}$$

$$R_6 = R_4 - \{ I \} = (A, C, G) \quad P_6 = \{ \}$$

4NF

Intro

DBMS r

Disk structure r