Class-6

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Lec 6.1

NORMALIZATN / SCHEMA REFINEMENT

-> Goal of normalizat":
  i) Eliminate Redundancy
  ii) ensuring data dependencies make sense.

- Most 3NF relations are free of insertion, update and deletion anomalies.

① 1NF:

↳ domain should contain atomic value.

Sno	~
A	B, r
B	α

not in 1NF

1NF →

~	~
A	B
A	r
B	α

1NF ✓

② 2NF:

↳ R is in 1NF
↳ R contains no Partial dependency.
↳ every non-primary-key is fully dependent on primary key.

***NOTE: when a candidate key's subset determines the non-prime attributes, then we call it partial dependency

Partial dependency: let C.K = AB

AB → A → C

A ⊂ AB should not

Q. R(ABCDEF) ✗ { Not in 2NF

FD: { C → F , E → A , EC → D , A → B }

$CE^+ = CEFADB$

C.K = {EC} only on ck

prime-attribute = E, C

Non-prime attribute = A, B, D, F

- proper-subset of C.K(EC) = E or C.

E or C shoul not determine any non-prime attribute.

but E → A & C → F

E: proper subset of C.K.
A: Non-prime
F: non prime.

↓

partial dependency हो गया

Ex 6.2 Decompose the relation in 3NF:

R(ABCDE)

FD = {~~A → B~~, A → C, C → D, A → E}

FD = {A → C, B → DE, D → C}

Sol 1 identify Candidate key:

~~$A^+ = ABCDE$~~

$AB^+ = ABCD$

2. prime att = A, B

Non-prime : CD, E

non-prime attribute.

F.D {A → C , B → DE , D → C}

A → C : violates 3NF

B → DE : 3NF ~~&~~ violate

D → C : violate 3NF

→ R_1 (A → C)

→ R_2 (B → DE)

→ R_3 (D → C)

Q: R(ABCDE)

F.D = (A → B, A → C, C → D, A → E)

violate 3NF

decompose in 3NF

C.K = A^+ = ABCDE

prime att = (A)

→ R_1 (A → BCE)

→ R_2 (C → D)

Q: $R(ABCD)$:

$F = \{ A \to D,\ AB \to C,\ AD \to C,\ B \to C,\ D \to AB \}$

3NF 3NF violate 3NF 3NF

C.K: $A^+ = ADBC$, $D^+ = ABCD$

prime att: $\{A, D\}$

Non-prime (B, C)

BCNF DECOMPOSITION:

$R(ABCD)$

$F = \{ AB \to CD,\ C \to A,\ D \to B \}$

BCNF ✗ BCNF ✗

C.K = $\{ AB, AD, CB, CD \}$.

जो जो relat" BCNF को violate कर रहा है उसका एक अलग relat" बना दो।

$R_1(CA)$ — $C \to A$ ┐

$R_2(DB)$ — $D \to B$ ┘ → यहाँ Right side में AB आ गया।

अब CD बच गया

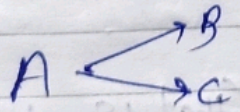
$R_3(CD)$ ← Joining relat"

3NF	BCNF
→ It concentrate on primary key.	→ it concentrate on C.K.
→ Redundancy is high as compare to BCNF	→ 0% Redundancy
→ it preserve all dependency	→ it may NOT preserve dependency.
→ X → Y either X – is C.K or Y is prime att.	→ X → Y X → is C.K

Ex 6.4

MVD : Multivalued dependency.

→ A MVD dependency A →→ B in R(ABC).
this mean for every value of A, there is corresponding set of values for B that doesn't depend on C.



there is no relat" b/w B & C

α →→ β

Condition to check MVD

→ take the alpha (α) value same, exchange the 'B' value. then we'll get a new row. if both new Row is present in Table. then MVD exist.

4NF :

conditions:
- → Table should have atleast 3 columns.
- → R should be already in BCNF.
- → the MVD $A \twoheadrightarrow B$ must be trivial or A should be part of C.K.

- MVD is trivial (means B is functionally determined by A) then it satisfy 4NF automatically.
- if not, A must be part of C.K.

How to check 4NF :-

$\alpha \twoheadrightarrow \beta$

1) left-side (α) is super key.

(or)

2) $\alpha \twoheadrightarrow \beta$ is trivial (that is $\beta \subseteq \alpha$ or $\alpha \cup \beta = R$)

MVD: Theory:

1) Complementation: if $X \twoheadrightarrow Y$, then $X \twoheadrightarrow (R-Y)$.

2) Augmentation: if $X \twoheadrightarrow Y$ and $W \supseteq Z$ then $WX \twoheadrightarrow YZ$

3) Transitivity: if $X \twoheadrightarrow Y$ and $Y \twoheadrightarrow Z$ then $X \twoheadrightarrow (Z-Y)$

4) Replication: ~~if $X \twoheadrightarrow Y$~~ if $X \rightarrow Y$, then $X \twoheadrightarrow Y$ but reverse is not true.

5) Coalescence: if $X \twoheadrightarrow Y$ and there is a W such that $W \cap Y$ is empty, $W \rightarrow Z$ and $Y \supseteq Z$, then $X \rightarrow Z$

A MVD $X \twoheadrightarrow Y$ in R is called a trivial MVD if:

- Y is subset of $X (X \supseteq Y)$ **OR**
- $X \cup Y = R$

TEMPORAL Database:

→ Temporal data have an associan time interval during which data is valid.

→ Snapshot is the value of data at a particular point of time.

two different aspects of time in temporal database!

i) Valid time: Time period during which fact is true.

ii) Transacd" Time: time period during which a fact is stored in the database.

- Uni-Temporal Relaf": Has one axis of time- either valid-time or Transacd" time.
- Bi-Temporal_Relaf": has both axis of time.

AQ6.4: Activity Questions 4 - Not Graded

Table 4: **Student**

Sname	*Course*	*Instructor*	*Inst_Room*
David	Python	MK Singh	503
David	JAVA	SN Joseph	505
David	Python	SN Joseph	505
David	JAVA	MK Singh	503

Which among the following is an MVD?

- ○ $Course \twoheadrightarrow \{Inst\_Room, Sname\}$
- ◉ $Sname \twoheadrightarrow Course$
- ○ $Sname \twoheadrightarrow \{Course, Instructor\}$
- ○ $Sname \twoheadrightarrow Instructor$