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Lecture Notes

Branch : .... Sem. : .... Subject : ....

Topic : .... Unit 3 .... Lecture No. ....

functional dependency (FD)

→ a functional dependency is a relationship b/w two attributes, typically b/w the primary key and othe non key attributes within a table.

syntax:

$$\boxed{X \rightarrow Y}$$

X ↓ determinant

Y ↘ determiner / dependent

example:

Student

S-id	S-Name	Age
E1	Ram	29
E2	shyam	31
E3	Anita	27
E4	sunil	23

$$\boxed{S\text{-id} \rightarrow S\text{-Name}}$$

here we can say that S-Name functionally dependent on S-id.

Types of functional dependency:

(i) Trivial Functional Dependency

(ii) Non-trivial functional dependency

(iii) Semi-Non trivial functional dependency

(i) Trivial functional dependency:

if x, y are some attribute of any relation, then in trivial functional dependency

$$\boxed{x \supseteq y}$$

Here x is superset of y or we can say that y is subset of x

Example 1 :

$$\boxed{S\text{-}id + S\text{-}Name \longrightarrow S\text{-}Name}$$

Here S-id + S-Name $\supseteq$ S-Name so it is in trivial functional dependency

example 2:

$$\boxed{S\text{-}id \longrightarrow S\text{-}Name}$$

Here S-id $\not\supseteq$ S-Name so it is not in trivial functional dependency.

example 3:

$$\boxed{S\text{-}id + S\text{-}Name \longrightarrow S\text{-}Name + age}$$

Here S-id + S-Name $\not\supseteq$ S-Name + age so it is not in trivial functional dependeny

Non-trivial functional dependency:

if x, y are two attribute of relation R

in Non-trivial functional dependency.

when $\boxed{x \cap y = \phi}$

example 1:

$$\underbrace{S\text{-id} + S\text{-Name}}_{x} \rightarrow \underbrace{Age}_{y}$$

$$x \cap y = \phi$$

Semi-Non trivial functional dependency:

It is a Combition of trivial and non-trivial functional dependency.

if x, y are two attribute of relation R

in Semi-Non trivial functional dependency

$$\boxed{x \not\supseteq y}$$

example:

$\boxed{\text{S-id} + \text{S-Name} \rightarrow \text{S-id} + \text{age}}$

↳ semi-Non trivial FD

$\left\{ \begin{array}{ll} \text{S-id} + \text{S-Name} \rightarrow \text{S-id} & \text{(Trivial FD)} \\ \text{S-id} + \text{S-Name} \rightarrow \text{age} & \text{(Non-Trivial FD)} \end{array} \right.$

Armstrong's Rule for FD:

(i) **Reflexivity Rule:**

$X \rightarrow X$ (always valid)

(ii) **Transitivity Rule:**

if $X \rightarrow Y$ and $Y \rightarrow Z$ then $X \rightarrow Z$

(iii) **Set argumentation Rule:**

if $X \rightarrow Y$

$\Rightarrow XZ \rightarrow YZ$

(iv) **Spilt Rule:**

if $X \rightarrow YZ$ then $X \rightarrow Z$ or $Y \rightarrow Z$

(v) **merge Rule:**

if $X \rightarrow Y$ or $X \rightarrow Z$ then $X \rightarrow YZ$

$[\, X \rightarrow YZ \iff X \rightarrow Y$ or $X \rightarrow Z \,]$

Attribute closure:

→ It is denoted by X^+.

→ Attribute closure is set of attribut determine by X recursively.

example:

R (A B C D)

FD [A → B, B → C, C → D]

here R is a relation (table) and A, B, C, D are attributes of relation R.

find closure of any attribute.

Sol:

$A^+ = ABCD$

$B^+ = BCD$

$C^+ = CD$

$D^+ = D$

here A is candidate key

example:

given R (A B C D E)

FD [$A \to B$, $B \to C$, $C \to D$, $D \to E$, $E \to A$]

Sol:

$A^+ = ABCDE$
$B^+ = BCDEA$
$C^+ = CDEAB$
$D^+ = DEABC$
$E^+ = EABCD$

Here A, B, C, D and E are candidate key or super key.

example:

given:

R (A B C D E F G)

FD [$A \to B$, $BC \to D$, $A \to E$, $E \to C$, $EF \to G$]

check A is candidate key or not

$A^+ = ABECD$

So A is not candidate key

Membership Test:

R(A B C D E F)

FD[AB → C, BC → D, E → F)

AB → F , F is member of AB or not ?

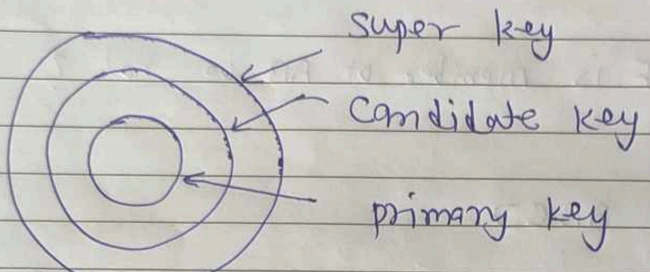
Sol:

$AB^+ = ABCD$

here F is not member of AB^+

Super key

→ It is a set of attribute.



R

X	
x_1	
x_2	
x_3	
.	
.	

X^+ = determine All Attribute of relation R.

example:

R (A B C D E)

FD [A → E, B → CD]

find AB is Super key or not.

sol:

AB^+ = ABECD , AB is super key.