COMPUTER SCIENCE



Database Management System

FD's & Normalization

Lecture_03







Attribute Closure

Finding Candidate keys





RDBMS Concept

FD Concept

Note

Note Trivial FD agre always Valid.

FD types

1 Trivial FD

2 Non Toivial FD

3 Semi Non Trivial FD



Trivial FD

X->y is Trival

X 2 y

AR-A

AR->B

AB - AB

Non Toivial FD

XMY = \$ & FD Debination Satisfy

A > B

AB >C



Consider the relation X(P, Q, R, S, T, U) with the following set of W functional dependencies [2015: 1 Marks]

$$F = \{$$

$$\{P, R\} \rightarrow \{S, T\}$$

$$\{P, S, U\} \rightarrow \{Q, R\}$$

$$\}$$

Which of the following is the trivial functional dependency in F+ is closure of F?



$$\{P, R\} \rightarrow \{S, T\}$$



$$\{P, R\} \rightarrow \{R, T\}$$



$$\{P, S\} \rightarrow \{S\}$$

$$\{P, S, U\} \rightarrow \{Q\}$$

X->y

@ PR -> ST XMY = \$ Non Trivial.

B PR-PRT Semi Non Toivial [AR-)BC]

X24 4 X14 + 0

@ PS-35 X27 Trivial FD. ~=14 X119 #9

(d) PSU >9 Non Trivial: X 14 = 6

Armstrong's Axioms/Inference Rules



- Axioms, or rules of inference, provide a simpler technique for reasoning about functional dependencies
- In the rules that follow, we use Greek letters $(\alpha, \beta, \gamma,...)$ for sets of attributes.
- We can use the following three rules to find logically implied functional dependencies.
- By applying these rules repeatedly, we can find all of F+, given F. This collection of rules called Armstrong's Axioms in honor of the person who first proposed it.
- Reflexivity Rule: If α is a set of attributes and $\beta \subseteq \alpha$, then $\alpha \to \beta$ holds.
- Augmentation rule: If $\alpha \to \beta$ holds and γ is a set of attributes, then $\gamma \alpha \to \gamma \beta$ holds.
- Transitivity Rule: If $\alpha \to \beta$ holds and $\beta \to \gamma$, then $\alpha \to \gamma$ holds.

- ① Replaxive

 α→β is Trivial (Replaxive) ibb α≥β
- (3) Toansitive

 If a > P & B > r then a > r

Additional Rules



- □ If $\alpha \rightarrow \beta$ holds and $\alpha \rightarrow \gamma$ holds, then $\alpha \rightarrow \beta \gamma$ holds (union)
- \square If $\alpha \rightarrow \beta \gamma$ holds, then $\alpha \rightarrow \beta$ holds and $\alpha \rightarrow \gamma$ holds (decomposition)
- □ If $\alpha \rightarrow \beta$ holds and $\gamma\beta \rightarrow \delta$ holds, then $\alpha\gamma \rightarrow \delta$ holds (Pseudo transitivity)

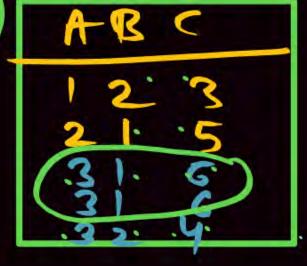
The above rules can be inferred from Armstrong's Axioms.

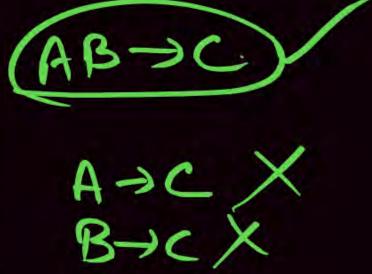
Union

If $\alpha \rightarrow \beta$, $\alpha \rightarrow \gamma$ then $\alpha \rightarrow \beta \gamma$ Decomposition

IB A-BY then A-B & A-JY

But AB-C (S)
AB-C X





Armstrong's Axioms/Inference Rules



Inference rules that can be used to infer new dependencies from a given set of dependencies

- □ IR1 (reflexive rule): If $X \supseteq Y$, then $X \to Y$. Trivial
- □ IR2 (augmentation rule)²: $\{X \rightarrow Y\} \mid =XZ \rightarrow YZ$.
- □ IR3 (transitive rule): $\{X \rightarrow Y, Y \rightarrow Z\} \mid = X \rightarrow Z$.
- □ IR4 (decomposition, or projective, rule): $\{X \rightarrow YZ\} = X \rightarrow Y$, $\{X \rightarrow YZ\} = X \rightarrow Y$, $\{X \rightarrow YZ\} = X \rightarrow Y$
- □ IR5 (union, or additive, rule): $\{X \rightarrow Y, X \rightarrow Z\} = X \rightarrow YZ$.
- □ IR6 (pseudotransitive rule): $\{X \rightarrow Y, WY \rightarrow Z \mid |=WX \rightarrow Z.\}$

Attribute closure [X]+



Let X be the Attribute Set of Relation R.

Set of All possible Attributes which are Logically bunctionally determine by X is Called Attribute

Closure of X. [X?]

Attribute closure [X]+



$$R(ABCDE)$$
 [A \rightarrow B, B \rightarrow C, C \rightarrow D, D \rightarrow E]
$$[A]^{+} = [ABCDE]$$

$$(D)^{+} = CDEJ$$

$$(E)^{\dagger} = (E)$$

Example



Let us consider a relation with attributes A, B, C, D, E, and F. Suppose that this relation has the FD's AB \rightarrow C, BC \rightarrow AD, D \rightarrow E, and CF \rightarrow B.

What is the closure of {A, B}, that is, {A, B}+?

```
Q.
```

$$F = \{Ssn \rightarrow Ename,$$



Pnumber → (Pname, Plocation),

(Ssn, Pnumber) \rightarrow Hours)

Find

```
{Ssn} + = [Ssn Ename]
```

{Pnumber} + = [Pnumber Phame Placation]

(Ssn, Pnumber) += [ssn Pumber Ename Phane Placation House]

BE B

R (ABCDEFG)



 $F: (AB \rightarrow C, BC \rightarrow AD, D \rightarrow E, E \rightarrow G, CE \rightarrow B)$

Find closure of ...

(i)
$$(A) = (A)$$

(V)
$$(F)^{\pm}$$
 (FG)



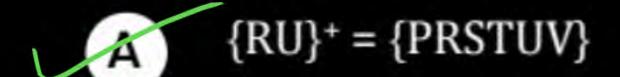
The following functional dependencies are given

$$\{PQ \rightarrow RS, PU \rightarrow S, ST \rightarrow U, R \rightarrow V, U \rightarrow T, V \rightarrow P\}$$

Which of the following option (s) is/are true?







$$B \qquad \{PU\}^+ = \{PRSTUV\}$$

$${QV}^+ = {PQRSV}$$

$$D (PQ)^+ = \{PQRSUV\}$$

Any (A&C).

[HOMEWORK]

The following functional dependencies are given:



 $AB \rightarrow CD$, $AF \rightarrow D$, $DE \rightarrow F$, $C \rightarrow G$, $F \rightarrow E$, $G \rightarrow A$.

Which one of the following options is false? [2006: 2 Marks]

PSU: 3 MONIG

$$\{CF\}^{+} = \{\underbrace{ACDEFG}^{+}\} (CF)^{+} = \{CFG EAD\} \Rightarrow \{ACDEFG\} (BG)^{+} = \{ABCDG\} (BG)^{+} = \{BGACD\}$$

$$\{BG\}^+ = \{ABCDG\} [BG]^- [BGACD]$$

SUPER-KEY: Let R be the Relation Schema R X be the Attribute Set of Relation?

If [X] [Closure of X] determines ALL ATTRIBUTES
of Relation R than X is Super key.

If ALL Attribute of Relation R is defermined by
the Attribute closure of X [X] them X is a suber key.

General Technical (DRMS)

(Cey = Super key)

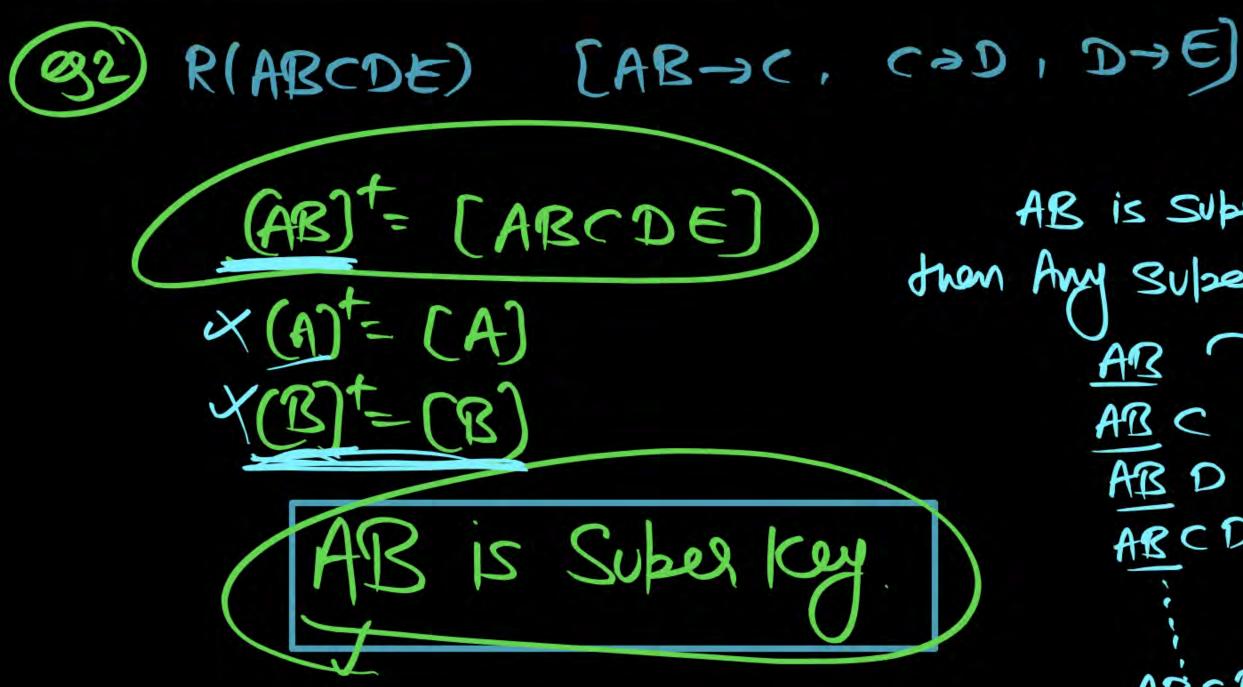
$$(c)^{\dagger} = (cDE)$$

$$(D)^{+} = (DE)$$

$$(E)^{\dagger}$$
 (E)

A is Suber key.

Any Suber Set ab suber kay (A) is also



AB is suber logg than Any Suber Set of Suber Key [AB] is also super AB ARCD

Note

Every key is super key.

(Note)

Any Suber Set of Suber key is also Suber key.

Super key Minimal > (andidate key(C.K) 1 select as Primary key Attavative Except Primaly

Any Doubt ?

