COMPUTER SCIENCE



Database Management System

FD's & Normalization

Key Concepts & Finding Number of Candidate Keys Part-01





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Attribute Closure

Finding Candidate keys





ROBMS Concept

Ly Arity (Deposee)
Ly Cardinality
Ly Schema

Trytances

FD Concept

Type of FD

- 1) Trivial FD
- 2 Non Trivial FD
- 3 Semi Non Trival FD

Practice Question

X-y exists

It tix=tz.x then tiy=tz.y Must be same

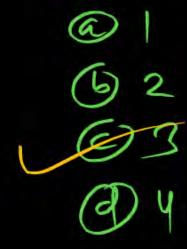
LI - SHYAM

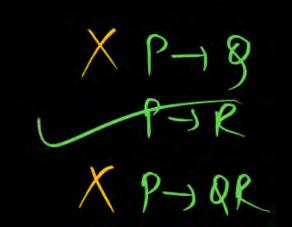
11 - SHYAM

56 - Vijay

58 - Vijay

Р	Q	R
6	6	
6	7	7
7	3	4
8	3	4





P->R 8-) R PROPR

A	В	С
7	5	6
7	7	6
7	5	7
7	7	7
9	5	6



$$X A \rightarrow B$$

Note

Trivial FD's one always Valid



I AB > A

II. AB >B

II. AB-AB

Always balid

Α	В	С
2	2	4
2	3	4
3	2	4
3	3	4
3	2	4



Q.

Given the following relation instance.



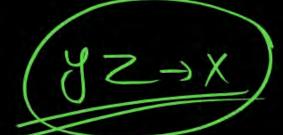
Х	Y	Z
4	4	4
4	7	4
7	4	7
7	4	9
4	9	9











The number of non trivial FD's are satisfied by the instance



Given the following relation instance.



Х	Y	Z
1	4	2
1	5	3
1	6	3
3	2	2

Which of the following functional dependencies are satisfied by the instance?



$$XY \rightarrow Z$$
 and $Z \rightarrow Y$



$$YZ \rightarrow X$$
 and $X \rightarrow Z$



$$YZ \rightarrow X$$
 and $Y \rightarrow Z$



$$XZ \rightarrow Y$$
 and $Y \rightarrow X$

Note

Rule out the FD, Based on the table.

Trivial FD'\$ are always Valid

AB > A, AB > B, AR > AB

Q.

From the following instance of a relation scheme R (A, B, C), we can conclude that:

[2002: 2 Marks]



(K.	7

A	В	C
1	1	1
1	(1 -	\rightarrow 0
2	3	2
2	3	2

A-B, B+C





A functionally determines B and B functionally determines C



A functionally determines B and B does not functionally determines C



B does not functionally determines C



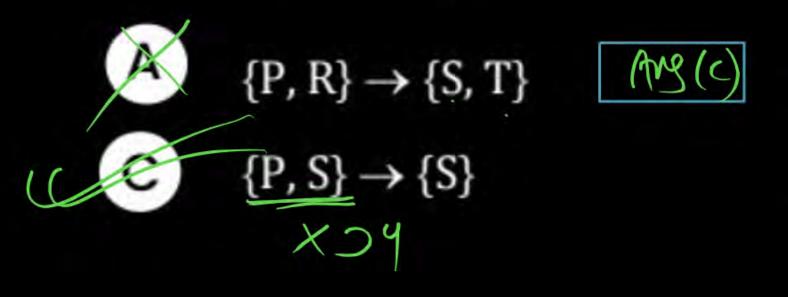
A does not functionally determines B and B does not functionally determines C

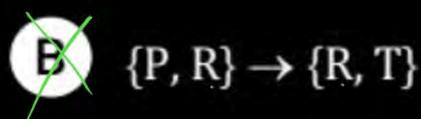
Q.

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

$$F = \{ \{P, R\} \rightarrow \{S, T\} \\ \{P, S, U\} \rightarrow \{Q, R\} \\ \} \\ X \supseteq Y \\ AB \rightarrow AB \\ AB \rightarrow AB$$

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





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

FD Concept & Type of FD's.

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 β ⊆ α, then α → β 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.

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)
- \square 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.

Armstrong's Axioms/Inference Rules



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

- \square IR1 (reflexive rule): If $X \supseteq Y$, then $X \to Y$.
- □ 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): $\{X \rightarrow YZ\} = X \rightarrow Y$.
- □ 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 one

Logically Bunctionally determined by Attribute X'

is called Attribute closure of X. [X]

Attribute closure [x)+

$$(A)^{\dagger} = [ABCDE]$$

$$(B)^{\dagger} = [BCDE]$$

$$(C)^{\dagger} = [CDE]$$

$$(D)^{\dagger} = [DE]$$

$$(CE)^{\dagger} = (CED)$$

$$(CE)^{\dagger} = (CED)$$

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}+?

$$R(ABCDEF)$$
 $EAB\rightarrow C$, $BC\rightarrow AD$, $D\rightarrow E$, $CF\rightarrow B$)

 $ABCDE$
 $EABCDE$
 $EABCDE$
 $EABCDE$

```
Q.
```

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



Pnumber → (Pname, Plocation),

$$(Ssn, Pnumber) \rightarrow Hours$$

Find

R (ABCDEFG)



$$F: (AB \to C, BC \to AD, D \to E, E \to G, CE \to B) (BEG)^{\dagger} = [BEG]$$

Find closure of ...

$$(B)^{\dagger} = [B]$$

$$(c)^{\dagger} = [c]$$

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

$$(AE)^{\dagger} = [AEG]$$



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?







$$\{RU\}^+ = \{PRSTUV\}$$



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



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



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

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



Pn DRMS Concepts:

- @ C with Enjuging
- B CC
- 0
- (2) Doubt



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]

(iii)
$$4(iv)$$

 $\begin{array}{c}
A & B & C \\
\hline
D & S & T
\end{array}$ $\begin{array}{c}
A & B & C \\
\hline
D & S & T
\end{array}$ $\begin{array}{c}
A & B & C \\
\hline
A & B & C
\end{array}$

Any Doubt ?

