Vaishnavi · A · Patil
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Assignment - 3

Title : functional dependency & Normal Form

Problem statement :- Identify the functional dependencies in given relations.

1>

A	B	C	D
a_1	b_1	c_1	d_1
a_1	b_2	c_1	d_2
a_2	b_2	c_2	d_2
a_2	b_3	c_2	d_3
a_3	b_3	c_2	d_4

Ans :- On this instance →

$A \rightarrow C$ does hold
$B \rightarrow D$ does hold
$D \rightarrow B$ does hold
$AB \rightarrow C$ does hold

$A \rightarrow B$ doesn't hold
$A \rightarrow D$ doesn't hold
$C \rightarrow A$ doesn't hold

2>

A	B	C	D	E
a	b	z	w	p
e	b	r	w	a
a	d	z	w	t
e	d	r	w	q
a	f	z	s	t
e	f	r	s	t

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Ans :- On this instance,

$A \rightarrow C$ holds
$B \rightarrow D$ holds
$C \rightarrow A$ holds
$D \rightarrow B$ does not hold
$A \rightarrow B$ does not hold
$B \rightarrow C$ does not hold.

3>

A	B
1	4
1	4
2	4
3	7

A	C
a_1	c_1
a_1	c_1
a_2	c_2
a_2	c_2
a_3	c_2

Ans :- $A \rightarrow B$ holds
$B \rightarrow A$ does not holds

Ans :- $A \rightarrow C$ holds
$C \rightarrow A$ does not hold.

4>

Staff No	sName	position	Salary	Branch
SL21	John White	Manager	30000	B005
SG37	Ann Beech	Assistant	12000	B003
SG14	David Ford	Supervisor	18000	B003
SA9	Mary Howe	Assistant	9000	B007
SG5	Susan Brand	Manager	24000	B003
SL41	Julie Lee	Assistant	9000	B005

Ans :- StaffNO → StaffName
StaffNO → Position
StaffNO, SName → Branch no.
~~Sta~~Name → Staff No
StaffNO → Salary
StaffNO → Branch.

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A	B	C	D	E
a_1	b_1	c_1	d_1	e_1
a_2	b_1	c_2	d_2	e_1
a_3	b_2	c_{81}	d_1	e_1
a_4	b_2	c_2	d_2	e_1
a_5	b_3	c_3	d_1	e_1

On this instance,

$A \rightarrow B$ holds $B \rightarrow C$ does not hold.

$C \rightarrow D$ holds

$D \rightarrow E$ holds

$C \rightarrow E$ holds

$A \rightarrow D$ holds

6>

A	B	C
a_1	b_1	c_1
a_2	b_2	c_2
a_3	b_3	c_3

On this instance,

$A \rightarrow B$ holds $B \rightarrow A$ does not hold

$C \rightarrow B$ holds

$A \rightarrow C$ holds

$C \rightarrow A$ holds.

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Q3 Identify candidate keys in following relations

1) $R = ABCD$, $F = \{AB \rightarrow C, BC \rightarrow D, CD \rightarrow A\}$

→ $R = ABCD$ .... (given)

closure of set AB is,

$AB^+ = \{A, B\}$ As $A^+ = \{A\}$ and $B^+ = \{B\}$

$AB^+ = \{A, B, C\}$ $AB \rightarrow C$

$AB^+ = \{A, B, C, D\}$ $BC \rightarrow D$

$AB^+ = \{A, B, C, D, A\}$ $CD \rightarrow A$

$AB^+ = \{A, B, C, D\}$

The closure of AB^+ is entire relational schema

$BC^+ = \{B, C\}$

$BC^+ = \{B, C, D\}$ $BC \rightarrow D$

$BC^+ = \{B, C, D, A\}$ $CD \rightarrow A$

the closure of BC^+ also contains all attributes

$\{A, B, C, D\}$

$CD^+ = \{C, D\}$

$CD^+ = \{C, D, A\}$ $CD \rightarrow A$

Closure of CD is not a super key.

Thus AB^+ and BC^+ are having all attributes in relation so AB and BC are candidate

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keys while any of them can be primary key.

2] $R = ABCD \quad F = \{A \rightarrow BCD, \; C \rightarrow A\}$

$R = ABCD$

Closure of set A is,

$A^+ = \{A\}$

$A^+ = \{A, B, C, D\}$ $\quad A \rightarrow BCD$

Closure of A contains entire relation schema so A is super key.

Closure of set C is

$C^+ = \{C\}$

$C^+ = \{C, A\}$ $\quad C \rightarrow A$

$C^+ = \{C, A, B, D\}$ $\quad A \rightarrow BCD$

Closure of C also contains all relation schema attributes.

∴ A & C both are candidate keys any of them can be chosen primary keys.

3] $R = ABCDE$

$F = \{A \rightarrow BE, \; C \rightarrow BE, \; B \rightarrow D\}$

→ Given : $R = ABCDE$

Closure of set A is,

$A^+ = \{A\}$

$A^+ = \{A, B, E\}$ $A \rightarrow BE$ Closure of set C
$A^+ = \{A, B, E, D\}$ $B \rightarrow D$ $C^+ = \{C\}$
$A^+ = \{A, B, E, D\}$ ∴ Adding closure of $C \rightarrow A$
$AC^+ = \{A, B, C, D, E\}$
As all attributes are not present in closure of set A it is not a candidate key.
Therefore AC^+ is primary key.
Closure of set C is,

$C^+ = \{C\}$
$C^+ = \{C, B, E\}$ $C \rightarrow BE$
$C^+ = \{C, B, E, D\}$ $B \rightarrow D$
$C^+ = \{C, B, E, D\}$

Set C closure does not contain all attributes so, C is not candidate key.

$B \rightarrow D$
$B^+ = \{B\}$
$B^+ = \{B, D\}$

So B is not candidate key.

4] $R = ABCDEF$
$F = \{A \rightarrow B, B \rightarrow D, C \rightarrow D, E \rightarrow F\}$

→ Given : Closure set A is

$A^+ = \{A\}$
$A^+ = \{A, B\}$ $A \rightarrow B$
$A^+ = \{A, B, D\}$ $B \rightarrow D$

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$A^+ = \{A, B, D\}$

closure of set B is,

$B^+ = \{B\}$

$B^+ = \{D, B\}$ $B \rightarrow D$

closure of set C is,

$C^+ = \{C\}$

$C^+ = \{C, D\}$ $C \rightarrow D$

closure of set E is,

$E^+ = \{E\}$

$E^+ = \{E, F\}$ $E \rightarrow F$

As $A^+ = \{A, B, D\}$

we add closure of C^+ & E^+ in it,

we get,

$ACE^+ = \{A, B, D, E, F, C\}$

∴ we get entire relational schema in set ACE. so ACE is primary key & candidate key.

5] $R = ABCDE$

$F = \{ A \rightarrow C , E \rightarrow D , B \rightarrow C \}$

→ Closure of set A,

$A^+ = \{A\}$

$A^+ = \{A, C\}$ $A \rightarrow C$

Closure of set E,

$E^+ = \{E\}$

$E^+ = \{E, D\}$ $E \rightarrow D$

Closure of set B is,

$B^+ = \{B\}$

$B^+ = \{B, C\}$ $B \rightarrow C$

$B^+ = \{B, C\}$

Therefore, A^+, B^+, E^+ does not have all attributes so combining we take closure of A^+, B^+, E^+.

$\therefore ABE^+ = \{A, B, C, D, E\}$

$\therefore$ ABE is candidate as well as primary key.