University Institute of Engineering

Department of Computer Science & Engineering

EXPERIMENT: 4

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BRANCH: BE-CSE SECTION / GROUP: KRG_3B

SEMESTER: 5TH SUBJECT CODE: 23CSP-339

SUBJECT NAME: ADBMS

1. Consider a relation R having attributes as R(ABCD), functional dependencies are given below:

AB->C

C->D

D->A

Identify the set of candidate keys possible in relation R. List all the set of prime and non-prime attributes.

Ans:

Given:

R(A, B, C, D)

Functional Dependencies:

AB → C

C → D

D → A

Finding candidate keys by computing closures:

1. Closure of AB:

(AB)+ = {A, B, C, D}

Since closure contains all attributes, AB is a candidate key.

2. Closure of BC:

(BC)+ = {A, B, C, D}
Since closure contains all attributes, BC is a candidate key.

3. Closure of BD:
(BD)+ = {A, B, C, D}
Since closure contains all attributes, BD is a candidate key.

Candidate Keys:
{AB}, {BC}, {BD}
Prime and Non-prime Attributes:
Prime Attributes = A, B, C, D
Non-prime Attributes = None

2. Relation R(ABCDE) having functional dependencies as:
A->D
B->A
BC->D
AC->BE
Identify the set of candidate keys possible in relation R. List all the set of prime and nonprime attributes.
Ans:

Start with {B, C}
B → A ⇒ add A ⇒ {B, C, A}
A → D ⇒ add D ⇒ {B, C, A, D}
AC → BE ⇒ since A and C present, add B and E ⇒ {B, C, A, D, E}
All attributes covered ⇒ BC is a candidate key.

3. Consider a relation R having attributes as R(ABCDE), functional dependencies are given below:

   B->A

   A->C

   BC->D

   AC->BE

   Identify the set of candidate keys possible in relation R. List all the set of prime and non-prime attributes.

   Ans:

   Start with {B, C}

   B → A ⇒ add A ⇒ {B, C, A}

   A → C ⇒ already present

   BC → D ⇒ add D ⇒ {B, C, A, D}

   AC → BE ⇒ since A and C present, add B and E ⇒ {B, C, A, D, E}

   All attributes covered ⇒ BC is a candidate key.

   Conclusion:

   Candidate Key: {B, C}

   Prime Attributes: B, C

   Non-prime Attributes: A, D, E

4. Consider a relation R having attributes as R(ABCDEF), functional dependencies are given below: A->BCD

   BC->DE

   B->D

   D->A

   Identify the set of candidate keys possible in relation R. List all the set of prime and non-prime attributes.

   Ans:

   R (A, B, C, D, E, F)

   Closure:

   A+ □ A, B, C, D, E

   B+ □ B, D, A, C, E

   C+ □ C

   D+ □ D, A, B, C, E

   E+ □ E

F+ □ E

AF+ □ A, B, C, D, E, F

BF+ □ B, F, D, A, C, E

CF+ □ C, F

DF+ □ D, F, A, B, C, E

Candiate Keys: AF, BF, DF

Prime Attributes: A, B, D, F Non-prime Attributes: C, E

Normal Form: 1NF

5. Designing a student database involves certain dependencies which are listed below:

X ->Y

WZ ->X

WZ ->Y

Y ->W

Y ->X

Y ->Z

The task here is to remove all the redundant FDs for efficient working of the student database management system.

Ans:

1. WZ → Y is redundant because:

- Y can be derived from Y → X and X → Y

2. Y → X is redundant because:

- X can be derived from WZ → X and Y → W

After removing redundant dependencies, we have:

X → Y

WZ → X

Y → W

Y → Z

Conclusion:

The minimal set of functional dependencies is:

X → Y

WZ → X

Y → W

$Y \rightarrow Z$

6. Debix Pvt Ltd needs to maintain database having dependent attributes ABCDEF. These attributes are functionally dependent on each other for which functionally dependency set F given as:

   A -> BC

   D -> E

   BC -> D

   A -> D

   Consider a universal relation R1(A, B, C, D, E, F) with functional dependency set F, also all attributes are simple and take atomic values only. Find the highest normal form along with the candidate keys with prime and non-prime attribute.

   Ans:

   Closure of A and F ({A, F}):

   Start with {A, F}

   $A \rightarrow BC \Rightarrow$ add B, C $\Rightarrow$ {A, F, B, C}

   $BC \rightarrow D \Rightarrow$ add D $\Rightarrow$ {A, F, B, C, D}

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

   All attributes covered $\Rightarrow$ {A, F} is a candidate key.

   Checking minimality:

   Removing A or F from {A, F} will not cover all attributes, hence it's minimal.

   Determining normal form:

   No partial or transitive dependencies remain in {A, F}.

   Therefore, the highest normal form is 3NF (Third Normal Form).

   Conclusion:

   Candidate Key: {A, F}

   Prime Attributes: A, F

   Non-prime Attributes: B, C, D, E

   Highest Normal Form: 3NF