Experiment 4

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Q1. Consider a relation R having attributes as R(ABCD), functional dependencies are given below:
AB->C, C->D, D->A Identifythesetofcandidatekeys possible in relation R. List all the set of prime and non prime attributes.

Given: R(A,B,C,D) with FDs
- AB→C
- C →D
- D →A

(AB)+ = ABCD
(BC)+=ABCD
(BD)+ = ABCD

So the CandidateKeysare:{ AB, BC, BD }

Prime attributes: {A,B,C,D }
Non-prime attributes: none→ ∅

Normal form :

BCNF: No

- Condition:For every FD X→Y ,X must be a superkey.
- C→D:Cisnot a superkey → violates.
- D→A:Disnot a superkey → violates.

3NF: Yes

- Condition:For every FD X→Y, either X is a superkey or every attribute in Y is prime.
- AB→C:ABis a key → OK.

- C→D: C not a superkey, but D is prime → OK.
- D→A not a superkey, but A is prime → OK.

NormalForm : 3NF

Q2. 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 non prime attributes.

Given: R(A,B,C,D,E) with
FDs • A → D • B → A • BC →
D • AC → BE

Closures:
• • (BC)+ =
So the Candidate Keys are: {A,B,C,D,E} (AC)+
= {A,B,C,D,E} { BC, AC }
Prime attributes: { A, B, C }
Non-prime attributes: { D,E }
Normal form:

BCNF: No
• • • Condition: For every FD X→Y, X must be a superkey.
3NF A→D: A not a superkey → violates.
No B→A: B not a superkey → violates.

• • • Condition: For every FD X→Y, either X is a superkey or every attribute in Y is prime.
2NF A→D: A is not a superkey, D is non-prime → violates → not in 3NF.
Form: 1NF

Q3. 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.

Given: R(A,B,C,D,E) with FDs

- B → A
- A → C
- BC → D
- AC → BE

Closures:

- (A)+ = {A, C, B, E, D} = {A,B,C,D,E}
- (B)+ = {B, A, C, E, D} = {A,B,C,D,E}
- (C)+ = {C}
- (D)+ = {D}
- (E)+ = {E}

Candidate Keys: { A, B }

Prime attributes: { A, B }
Non-prime attributes: { C, D, E }

BCNF: Yes

- B→A:Bisasuperkey → Ok
- A→C:Aisasuperkey → Ok

  So on..allLHSare superkeys

Normal Form:BCNF

Q4.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.

Given: R(A,B,C,D,E,F) with FDs

• A → B C D •

BC → D E • B

→ D • D → A

Closures:

- (A)+ = {A, B, C, D,
- E} (B)+ = {A, B, C,
- D, E} (D)+ = {A, B,
- C, D, E} (F)+ = {F}

• (AF)+ = {A,B,C,D,E,F} → key

• (BF)+ = {A,B,C,D,E,F} → key •

(DF)+ = {A,B,C,D,E,F} → key

Candidate Keys: { AF, BF, DF }

Prime attributes : { A, B, D, F }
Non-prime attributes: { C, E }

BCNF: No

- A→BCD: A is not a superkey → violates.

3NF: No

- A→C (part of A→BCD): A not a superkey and C is non-prime → violates.

2NF: No

• AF is a key, but A→C (C non-prime) is a partial dependency on part of key AF → violates.

1NF: Yes — attributes assumed atomic

Normal Form: 1NF

Q5. Designing a student database involves certain dependencies which are listed below:

X ->Y

WZ ->X

WZ ->Y

Y ->W Y -

>X Y ->Z

Given: attributes {W, X, Y, Z} with FDs

- X → Y
- WZ → X
- WZ → Y
- Y → W
- Y → X
- Y → Z

Closures:

- (Y)+ = {Y, W, X, Z} = all attributes → Y is a key.
- (X)+ = {X, Y, W, Z} = all attributes → X is a key.
- (WZ)+ = {W, Z, X, Y} = all attributes → WZ is a key.

Candidate Keys: { X, Y, WZ }
Prime attributes: { W, X, Y, Z }
Non-prime attributes: ∅

BCNF: Yes

- Every FD has LHS that is a superkey (X, Y, WZ) → satisfies BCNF.

Normal Form: BCNF

Q6. 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.

Given: R(A,B,C,D,E,F) with FDs

- A → B C
- D → E
- BC → D
- A → D

Closures:

- (A)+ = {A, B, C, D, E}
- (AF)+ = {A, B, C, D, E, F} → key
- (BC)+ = {B, C, D, E}
- (D)+ = {D, E}
- (F)+ = {F}

Candidate Keys: { AF }
Prime attributes: { A, F }
Non-prime attributes: { B, C, D, E }

BCNF: No

- A→BC / A→D: A not a superkey → violates.

3NF: No

- A→BC: A not a superkey and B,C are non-prime → violates.

2NF: No

- AF is a key, A→BC (BC non-prime) is a partial dependency on part of the key → violates.

1NF: Yes—attributes atomic.

Normal Form: 1NF