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Experiment 7

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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.

Given:

Relation:

$$R(A, B, C, D)$$

Functional Dependencies (FDs):

- $AB \rightarrow C$
- $C \rightarrow D$
- $D \rightarrow A$

Step 1: Find Closure of Attribute Sets

Check AB^+

Start with:

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

Using FDs:

- $AB \rightarrow C \Rightarrow$ add C
- $C \rightarrow D \Rightarrow$ add D
- $D \rightarrow A \Rightarrow$ A already present

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

Covers all attributes → AB is a superkey

Check minimality:

- A^+does not give all attributes
- B^+does not give all attributes

AB is a Candidate Key

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 non-prime attributes.

Step 1: Find Candidate Keys

We find attribute closures to see which sets can determine ABCDE.

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1 Closure of AC

Start with: {A, C}

- A → D ⇒ add D
- AC → BE ⇒ add B, E
- B → A (already present)

So,

AC^+ = {A, B, C, D, E}

☑ AC is a Candidate Key

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2 Closure of BC

Start with: {B, C}

- B → A ⇒ add A
- A → D ⇒ add D
- AC → BE (A and C present) ⇒ add B, E

So,

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

BC is a Candidate Key

3 Closure of AB

Start with: {A, B}

- A → D ⇒ add D
- B → A (already present)

E and C are missing, so not a key.

4 Single attributes

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

☑ Candidate Keys

Ans: AC,BC

Step 2: Prime and Non-Prime Attributes

◇ **Prime Attributes**

Attributes that are part of any candidate key.

Candidate keys: AC, BC

Prime attributes:

Ans: a,b,c

◇ **Non-Prime Attributes**

Attributes not part of any candidate key.

Ans: D,E

Final Answer (Exam-Ready)

- Candidate Keys: {AC, BC}
- Prime Attributes: A, B, C
- Non-Prime Attributes: D, E

Question 4

Consider a relation R having attributes
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.

Answer (In Short)

Candidate Keys:

- AF, DF

Prime Attributes:

- A, D, F

Non-Prime Attributes:

- B, C, E

5.

Relation **R(ABCDE)** having dependencies as:

- **CE → D**
- **D → B**
- **C → A**

Find:

- Highest Normal Form
- Candidate Key (C.K) set

From **CE^+ = {C,E,D,B,A}**, all attributes are obtained ⇒ **CE is the candidate key**.

Prime attributes: C, E

Non-prime attributes: A, B, D

C → A and **D → B** are partial dependencies on the key CE

Hence, relation is in **1NF only**

8.

Relation **R(ABCDEF)** having dependencies as:

- **AB → C**
- **DC → AE**
- **E → F**

Find:

- Highest Normal Form
- Candidate Key (C.K) set

From **BD^+ = {A, B, C, D, E, F}**, all attributes are obtained

Hence, **BD is the candidate key**

Prime attributes: B, D

Dependency **E → F** is a transitive dependency on the key

Therefore, the relation is in **2NF (not in 3NF)**