

DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

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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:

$AB \rightarrow C, C \rightarrow D, D \rightarrow A$

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



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

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:

$$A \rightarrow D, B \rightarrow A, BC \rightarrow D, AC \rightarrow BE$$

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.

1 Closure of AC

Start with: {A, C}

- $A \rightarrow D \Rightarrow$ add D
- $AC \rightarrow BE \Rightarrow$ add B, E
- $B \rightarrow A$ (already present)

So,

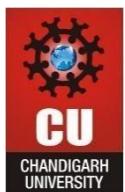
$$AC^+ = \{A, B, C, D, E\}$$

AC is a Candidate Key

2 Closure of BC

Start with: {B, C}

- $B \rightarrow A \Rightarrow$ add A
- $A \rightarrow D \Rightarrow$ add D
- $AC \rightarrow BE$ (A and C present) \Rightarrow add B, E



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So,

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

BC is a Candidate Key

③ Closure of AB

Start with: {A, B}

- $A \rightarrow D \Rightarrow$ add D
- $B \rightarrow A$ (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)



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- 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:

- $A \rightarrow BCD$
- $BC \rightarrow DE$
- $B \rightarrow D$
- $D \rightarrow A$

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:

- $CE \rightarrow D$
- $D \rightarrow B$
- $C \rightarrow A$

Find:

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



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From $CE^+ = \{C, E, D, B, A\}$, all attributes are obtained $\Rightarrow C, E$ are the candidate keys.

Prime attributes: C, E

Non-prime attributes: A, B, D

$C \rightarrow A$ and $D \rightarrow B$ are partial dependencies on the key CE

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

8.

Relation R(ABCDEF) having dependencies as:

- $AB \rightarrow C$
- $DC \rightarrow AE$
- $E \rightarrow F$

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 $E \rightarrow F$ is a transitive dependency on the key

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