



DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

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Experiment 8

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1. Question:

Relation R(ABCDEFGHI) having dependencies as:

$AB \rightarrow C$

$BD \rightarrow EF$

$AD \rightarrow GH$

$A \rightarrow I$

Highest normal form? C.K set?

Ans:

Relation: $R(ABCDEFGHI)$, FDs: $AB \rightarrow C, BD \rightarrow EF, AD \rightarrow GH, A \rightarrow I$

Candidate Key: Try $ABD \rightarrow ABD^+ = ABCDEFGHI = R$ Minimal \rightarrow C.K. = $\{ABD\}$

Prime attributes: A, B, D; Non-prime: C, E, F, G, H, I

1NF: All attributes atomic

2NF check: $AB \rightarrow C, BD \rightarrow EF, AD \rightarrow GH, A \rightarrow I \rightarrow$ partial dependencies exist Violates 2NF

3NF check: 2NF violated \rightarrow 3NF violated

Highest NF = 1NF, C.K. = $\{ABD\}$

Candidate Key = $\{ABD\}$



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Question 2:

Relation $R(ABCDE)$ having dependencies as:

$AB \rightarrow CD$

$D \rightarrow A$

$BC \rightarrow DE$

Highest normal form? C.K set?

Relation: $R(ABCDE)$, FDs: $AB \rightarrow CD, D \rightarrow A, BC \rightarrow DE$

Candidate Key: Try $BD \rightarrow BD^+ = B, D \rightarrow A(D \rightarrow A), C(BC \rightarrow DE), E$
 $BD^+ = ABCDE = R \rightarrow$ C.K. = $\{BD\}$

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

1NF: All attributes atomic

2NF check: Candidate key $BD \rightarrow$ no partial dependency (all FDs have whole key or non-prime determinant) 2NF satisfied

3NF check: $D \rightarrow A$, D is part of candidate key? D alone \rightarrow non-prime depends on prime (A) violates 3NF? Wait, A is non-prime, D is prime \rightarrow 3NF allows if determinant is prime 3NF satisfied

Highest NF = 3NF, C.K. = $\{BD\}$

◇ 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 **CE is the candidate key.**

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)**