



Experiment 4

Student Name: Punit Kumar

UID: 23BCS14148

Branch: CSE

Section/Group: 23BCS_KRG-1/A

Semester: 5

Date of Performance: 11/09/25

**Subject Name: Advanced Database
and Management System**

Subject Code: 23CSP-333

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 prime attributes and non-prime attributes.

Ans:

R (A, B, C, D)

Closure:

$A^+ \rightarrow A$

$B^+ \rightarrow B$

$C^+ \rightarrow C, D, A$

$AB^+ \rightarrow A, B, C, D$

$AC^+ \rightarrow A, C, D$

$AD^+ \rightarrow A, D$

$BC^+ \rightarrow B, D, A, C$

$CD^+ \rightarrow C, D, A$

Candidate keys: AB, BC, BD

Prime Attributes: A, B, C, D

Non-Prime Attributes:

Normal Form: 3NF

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 prime attributes and non-prime attributes.

Ans:

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

Closure:

$A^+ \rightarrow A, D$

$B^+ \rightarrow B, A, D$

$C^+ \rightarrow C$

$AB^+ \rightarrow A, B, D$

$AC^+ \rightarrow A, C, D, B, E$

$AD^+ \rightarrow A, D$

$BC^+ \rightarrow B, D, A, C, E$

Candidate keys: AC, BC

Prime Attributes: A, B, C

Non-Prime Attributes: D, E

Normal Form: 1NF

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

$B \rightarrow A$

$A \rightarrow C$

$BC \rightarrow D$

$AC \rightarrow BE$

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

Ans:

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

Closure:

$A^+ \rightarrow A, C, B, E, D$

$B^+ \rightarrow B, A, C, D, E$

$C^+ \rightarrow C$

$D^+ \rightarrow D$

$E^+ \rightarrow E$

Candidate keys: A, B

Prime Attributes: A, B

Non-Prime Attributes: C, D, E

Normal Form: BCNF

4. Consider a relation R having attributes as 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 prime attributes and non-prime attributes.

Ans:

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

Closure:

$A^+ \rightarrow A, B, C, D, E$

$B^+ \rightarrow B, D, A, C, E$

$C^+ \rightarrow C$

$D^+ \rightarrow D, A, B, C, E$

$E^+ \rightarrow E$

$F^+ \rightarrow E$

$AF^+ \rightarrow A, B, C, D, E, F$

$BF^+ \rightarrow B, F, D, A, C, E$

$CF^+ \rightarrow C, F$

$DF^+ \rightarrow D, F, A, B, C, E$

Candidate 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:

$X \rightarrow Y$

$WZ \rightarrow X$

$WX \rightarrow Y$

$Y \rightarrow W$

$Y \rightarrow X$

$Y \rightarrow Z$

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

Ans:

$R(W, X, Y, Z)$

Closure:

$X^+ \rightarrow X, Y, W, Z$

$Y^+ \rightarrow Y, X, W, Z$

$WZ^+ \rightarrow W, Z, X, Y$

Candidate keys: X, Y, WZ

Prime Attributes: X, Y, Z, W

Non-Prime Attributes:

Normal Form: BCNF

6. Debix Pvt. Limited needs to maintain database having dependent attributes ABCDEF.

These attributes are functionally dependent on each other for which functionally dependency set F given as:

$A \rightarrow BC$

$D \rightarrow E$

$BC \rightarrow D$

$A \rightarrow D$

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

Ans:

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

Closure:

$A^+ \rightarrow A, B, C, D, E$

$B^+ \rightarrow B$

$C^+ \rightarrow C$

$D^+ \rightarrow D, E$

$AF^+ \rightarrow A, B, C, D, E, F$

Candidate keys: AF

Prime Attributes: A, F

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

Normal Form: 1NF