## Experiment 4

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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.

Ans: Closure Property: - AB+
$$= \{A, B, C, D\}$$
$$BC+ = \{B, C, D, A\}$$
$$AC+ = \{A, C, D\}$$
$$BD+ = \{B, D, C, A\}$$
$$C+ = \{C, D, A\}$$
$$D+ = \{D, A\}$$

Thus, Candidate Keys = {AC, BC, BD}
Prime Attributes = {A, B, C, D}
Non-Prime Attributes = {Phi}

This is in 3NF form because every dependent (RHS) is a prime attribute, but not BCNF because attribute C, D are not SuperKey.

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.

Ans:  Closure  Property:  -
$$AC+ = \{A, C, B, E, D\}$$
$$AB+ = \{A, B, D\}$$
$$BC+ = \{B, C, D, A, E\}$$

A+ = {A, D}
B+ = {B, A}

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

This is a 1NF because the attribute non-multivalued. It's not a 2NF because the dependent D (non-prime) is determined by a prime.

3. 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.
Ans: Closure Property: - B+
= {B, A, C, E, D}
A+ = {A, C, B, E, D}

Thus, Candidate Keys = {A, B}
Prime Attributes = {A, B}
Non-Prime Attributes = {C, D, E}

This is a BCNF because the attributes A, B are single attribute Candidate Keys, thus any other attribute forming a key with them will become a SuperKey.

4. 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.
Ans: Closure Property: -
A+ = {A, B, C, D, E}
B+ = {B, C, D, E, A}
D+ = {D, A, B, C, E}

Thus, Candidate Keys = {A, B, D}
Prime Attributes = {A, B, D}
Non-Prime Attributes = {C, E}

This is a BCNF because the A, B, D are Candidate Keys, thus, any other attribute forming a key with them will eventually make the it a SuperKey.