



### Experiment - 4

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### PROBLEMS ON FUNCTIONAL DEPENDENCIES -

**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.**

**Sol.**

B is missing on the right-side of given functional dependencies , so it is sure that it will be the part of our candidate key so taking **Closures-**

B(+) - B (Not determines all the attributes so use it by combining with other attributes)

BA(+) - BACD

BC(+) - BCDA

BD(+) - BDAC

So the candidate keys are - (BA,BC,BD)

Prime attributes are - A,B,C,D

Non-prime attributes are - 0

So the normal form will be 3NF .

**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.**



**Sol.**

C is missing on right-side so it will be our candidate key or a part of it.

Closures-

A(+) - DA

C(+) - C

AC(+) - ACBED

BC(+) - DBCAE

DC(+) - DC

So the candidate keys are - (AC,BC)

Prime Attributes are - A,B,C

Non-prime Attributes are - D,E

The normal form will be 1NF.

**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.**

**Sol.**

Closures -

B(+) - BACDE

A(+) - ACBED

C(+) - C

D(+) - D

AC(+) - ACBED

BC(+) - BCDAE

So the candidate keys are (A,B)

The super keys are (AC,BC)

Prime attributes are - A,B

Non-prime attributes are - C,D,E

The normal form will be BCNF. (as AC and BC are super keys).



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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 the set of prime and non prime attributes.

**Sol.**

F is missing on the right-side of given functional dependencies. So , it is sure to be our candidate key or a part of it.

Closures-

$F(+) - F$

$AF(+) - AFBCDE$

$BF(+) - BFDACE$

$CF(+) - CF$

$DF(+) - DFABCE$

$EF(+) - EF$

So the candidate keys are (AF,BF,DF)

Prime attributes are - A,B,D,F

Non-prime attributes are - C,E

The normal form will be 1NF.

5. Designing a student database involves certain dependencies which are listed below:

$X \rightarrow Y$

$WZ \rightarrow X$

$WZ \rightarrow Y$

$Y \rightarrow W$

$Y \rightarrow X$

$Y \rightarrow Z$

Identify the set of candidate keys possible in student database. List all the set of prime and non prime attributes.

**Sol.**

Closures-

$X(+) - XYWZ$

$Y(+) - YXWZ$

$Z(+) - Z$

$WZ(+) - YXWZ$

So the candidate keys are (X,Y,WZ)

Prime attributes are X,Y,W,Z

Non-prime attributes are NOT ANY

So the normal form is BCNF.

**6. Debix Pvt Ltd 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  $R1(A, B, C, D, E, F)$  with functional dependency set F, also all attributes are simple and take atomic values only. Find the highest normal form along with the candidate keys with prime and non-prime attribute.**

**Sol.**

A and F are missing so they will be considered as a part of the candidate key.

$AF(+) - AFBCDE$

$BF(+) - BF$

$B(+) - B$

$A(+) - ABCDE$  (F is still missing)

So candidate key is (AF) only.

Prime attributes are A,F.

Non-prime attributes are B,C,D,E

So the highest possible normal form will be 1NF.