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).

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.

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 ->Y
WZ ->X
WZ ->Y
Y ->W
Y ->X
Y ->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 -> BC, D -> E, BC -> D, A -> 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.

Learning Outcomes:

a) Learned to compute candidate keys using attribute closure.
b) Understood how to classify prime and non-prime attributes.
c) Identified partial dependencies and their effect on normalization.
d) Gained practical insight into reducing redundancy and anomalies in database design.