TUTORIAL 7

1. Consider a relation schema R = (A, B, C, D, E, H) on which the following functional dependencies hold: {A–>B, BC–> D, E–>C, D–>A}. What are the candidate keys of R?

(a) AE, BE
(b) AE, BE, DE
(c) AEH, BEH, BCH
(d) AEH, BEH, DEH

Answer: (AE)+ = {ABECD} which is not set of all attributes. So AE is not a candidate key. Hence option A and B are wrong.
(AEH)+ = {ABCDEH}
(BEH)+ = {BEHCDA}
(BCH)+ = {BCHDA} which is not set of all attributes. So BCH is not a candidate key. Hence option C is wrong.
So correct answer is D.

2. Given R(A,B,C,D,E) with the set of FDs, F={AB->CD, ABC->E,C->A}.

i) Find any two candidate keys of R.

ii) What is the normal form of R? Justify your answer.

Answer :

In order to find the candidate keys from a given set of functional dependencies, first we will search for the attributes that are not present in the right hand side of FD's.

In this example, it is attribute B. So B will always there in the candidate key.

Then find the closure of B which is B+ =B

Now take the combination of B with any other attribute, say it as BA or AB

i) Consider the left hand side of the first FD, ie AB...take the closure of AB

AB+ =ABCDE.. So AB is a candidate key

Now take the combination of B with any other attribute, say it as BC

BC+ = BCAED…So BC is also a candidate Key

Thus the two candidate keys of R are {AB, BC}

ii) To find the normal form of R, consider each FD's one by one

FD1: AB->CD.

Since AB uniquely determines CD, it satisfies 1NF.

2NF states that every non prime attribute should be fully functionally dependent on the primary key/candidate key of R.

In this example D and E are non prime attributes.

IN FD1 D is a non prime attribute and it fully functionally dependent on the candidate key AB. Thus it satisfies 2NF.

3NF states that in a FD X->Y, either X is a superkey of R or Y is a prime attribute of R

In FD1 AB is a superkey of R...Thus FD1 holds 3NF

BCNF states that in a FD X->Y, X should be the superkey of R.

In FD1 AB is a superkey of R. Thus FD1 holds BCNF.

FD2: ABC->E

It satisfies 1NF.

E is a non prime attribute and it fully functionally dependent on the candidate key ABC. Thus it satisfies 2NF.

ABC is a superkey of R. So it satisfies 3NF and BCNF

FD3: C->A

It satisfies 1NF.

Since A and C are prime attributes. It satisfies 2NF.

C is not a superkey of R but A is a prime attribute. So it satisfies 3NF

Since C is not a superkey..It doesn't satisfy BCNF.

Thus by checking each FD's we can conclude that **Relation R is in 3NF**