Ques Find all the candidate keys of R given R and the Set F of functional dependencies (FPs) as follows :
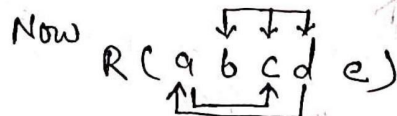
$R(a,b,c,d,e)$ and $f = \{ a \to c, c \to bd, d \to a \}$

Soln →

Given Relation : $R(a,b,c,d,e)$

$F : \{ a \to c, c \to bd, d \to a \}$

Now

R (a b c d e)

Here, only e is such a attribute who doesn't have any incoming edge.

⇒ e is an essential attribute

Now $(e)^+ = e$ ⇒ e is not a key

Now, using all combination of attribute with e,

$(ae)^+ = acbde = R$

$(be)^+ = be$ ⇒ Not a key

$(ce)^+ = cebda = R$

$(de)^+ = deacb = R$

Now, if we take any other combinations, it may be a super key but not a candidate key as it subset will be present as candidate key.

Hence,

Candidate keys for given relation : ae, ce, de

Ques 2. Given the following relation R and the set of functional dependencies F that hold on R, find all Candidate key for R
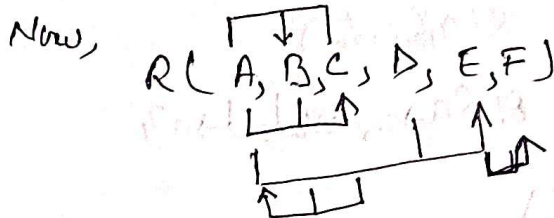
$R(A, B, C, D, E, F)$

$F = \{AB \to C, AC \to B, AD \to E, BC \to A, E \to F\}$

Solution → Given :

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

$F = \{AB \to C, AC \to B, AD \to E, BC \to A, E \to F\}$

Now,

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

Here, D is the essential attribute

Now, $(D)^+ = D \neq R \Rightarrow$ D is not a key.

Now trying on all Combination

$(AD)^+ = ADEF \neq R$

$(BD)^+ = BD \neq R$

$(CD)^+ = CD \neq R$ 　　　　　$(BDF)^+ = BDF \neq R$

$(DE)^+ = DEF \neq R$ 　　　　$(CDE)^+ = CDF \neq R$

$(DF)^+ = DF \neq R$ 　　　　　$(DEF)^+ = DEF \neq R$

$(ABD)^+ = ABCDEF = R$ 　　　　Now, all other Combination

$(ACD)^+ = ABCDEF = R$ 　　　　will either not be a key

$(ADE)^+ = AEFD \neq R$ 　　　　or a Supset of existed key.

$(ADF)^+ = ADFE \neq R$ 　　　　Hence,

$(BCD)^+ = ABCDEF = R$ 　　　　Req. Candidate keys =

　　　　　　　　　　　　　　　　ABD, ACD, BCD

Ques. Consider the Relation player with relational Schema PLAYER (Player-no, player-name, Team, Team-color, Coach-no, Coach-name, player-position, Teams Captain) and set of functional dependencies as follows:-

$F = \{$ player-no $\rightarrow$ player-name, Player-no $\rightarrow$ player-position, player-no $\rightarrow$ Team, Coach-no $\rightarrow$ Coach name, Team $\rightarrow$ Team-color, Team $\rightarrow$ Coach-no, Team $\rightarrow$ Team Captain $\}$

* Answer the question given below in detail:

(a) Is player is 2NF? If not convert into 2NF,

Soln $\rightarrow$ For a relation to be in 2NF, it must!

(i) be in 1NF

$\rightarrow$ Since, It is relational schema and there is no multivalued attribute

$\Rightarrow$ Player is in 1NF

(II) not have any partial dependency

$\rightarrow$ To find this, we first have to find the candidate key of the Relational Player.

Now Player(

player_no, player-name, Team, Team-Color, Coach-no, Coach-name, player-position, Team Captain)

Here, player-no is essential attribute

Now, (player-no)$^+$ = PLAYER

$\Rightarrow$ player-no is Candidate Key and there is no partial dependency in this relational Schema

$\Rightarrow$ player is in 2NF.

(b) IS PLAYER In 3NF? If not, convert into 3NF.

Soln- For a relation to be in 3NF

(1) It must be in 2 NF.

⟹ It has been shown in above that PLAYER
IS In 2NF

(II) There must not be any transitive dependency

⟹ But, in the given functional dependencies, we can
see that,

There are two transitive dependency —

(1) Coach_no → Coach_name

(II) Team → Team_color, Team_Captain,Coach_no.

So, PLAYER is not in 3NF

↳ To convert it into 3NF

we have to decompose PLAYER into more
tables based on the transitive dependencies.

PLAYER (Player_no, player_name, player_position, Team)

TEAM (Team, Team_color, Team_Captain, Coach_no, Coach
-name)

Here, PLAYER is in 3NF as it is in 2NF & there
is no transitive dependency, but TEAM is not
in 3NF as there is a transitive dependency.

Coach_no → Coach_name

So, again dividing the relation TEAM into more
tables based on transitive dependency:

TEAM (Team, Team_color, Team_Captain, Coach_no)

COACH (Coach_no, Coach_name)

Here,

Team and Coach both are in 3NF as both are in 2NF and there is no transitive dependency as well.

Hence,

Final set of decomposed tables that are in 3NF are:-

PLAYER (player_no, Player_name, player_position, Team)

TEAM (Team, Team_color, Team_Captain, Coach_no)

COACH (Coach_no, Coach_name)

Ques Consider the relational schema Membership for a library database as follows. :

Membership (MID, NAme, Address, PhoneNum, parentMID, ISBN, Title, Authors, Borrow Date, Returned date, Finedue, Fine Paid)

Here, ParentMID, may have the values Null, father -Name, Mother Name or both. The following is the set of functional dependencies that hold in Membership table,

$F = \{MID \rightarrow Name, Address, PhoneNum, ParentMID;$
$(MID, ISBN, Borrow date) \rightarrow Returned date,$
$Fine Paid, Fine Due;$
$ISBN \rightarrow Title, Authors \}$

Normalize the Membership schema to 3NF and

Show the Steps →

Sol^n →
Is the given table Membership in 1NF?

· For a table to be in 1NF, there must be atomic value

But Parent MID is multivalued attribute
⇒ Membership is not in 1NF.

To solve this, we will create a separate table with MID and parentMID attribute as follows.

Parent (MID, Parent MID)

Here, key is {MID, Parent MID} ⇒ Parent is 3NF

Now,
After this decomposition, we have the following Schemas.

* Schema 1: Parent (MID, Parent MID)

* Schema 2: Membership (MID, NAME, Address, PhoneNum, ISBN, Title, Authors, Borrow Date, Returned Date, fine Due, fine Paid)

Here, Membership is in 1NF.

Are Schemas 2, 3, and 4 are in 3NF?
↳ To be in 3NF ⇒

(1) One must be in 2NF
↳ from above, it can be seen that these three are in 2NF.

(11) There should not be any transitive dependency.

↳ And from the functional dependencies, It is seen that there are not any functional dependencies, It is seen that there are not any functional dependencies in any of 3 Schemas

⇒ All are in 3 NF.

Hence, list of 3 NF tables :-

1) Schema 1: Parent (MID, Parent MID)

ii) Schema 2: (MID, Name, Address, Phone num)

iii) Schema3: (ISBN, Title, Authors)

iv) Schema 4: (MID, ISBN, Borrow_Date, Return Date, fine due, fine paid)