Database management System

Assignment - I

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(Q1) Consider the following Relational Schema R(ABCDEF) and functional dependency set : {AB → C, C → A, BC → D, ACD → B, BE → C, EC → AF, CF → BD, D → E}
The number of candidate keys for relation R are

Solution FDs are : AB → C BE → C
C → A EC → AF
BC → D CF → BD
ACD → B D → E

(a) All attributes are present in RHS of any of the FD ∴ we don't have any essential attribute for candidate key.

(b) All attribute are in LHS of any of the FD No such attribute in ~~these~~ that can't be in candidate. key.

(c) Hence, we have to check all possiblities.

Checking Candidate Key with 1 attribute :-

(a) Since A, B, E and F are not in any FD in LHS so they as a single attribute can't be candidate key

$C^+ = CA \neq R$

$D^+ = DE \neq R$

Checking candidate Key with 2 attribute :-

$AB^+ = ABCDEF = R$ ∴ AB is a candidate key

$AC^+ = AC \neq R$

$AD^+ = ADE \neq R$

$AE^+ = AE \neq R$

$AF^+ = AF \neq R$

$BC^+ = BCDAEF = R$ ∴ BC = candidate key

$BD^+ = BDECAF = R$ ∴ BD = Candidate key

$BE^+ = ABECFD = R$ ∴ BE = Candidate key

$BF^+ = DE \neq R$

$DF^+ = DFE \neq R$
$EF^+ = EF \neq R$

Checking Candidate Key with 3 attributes:-

(a) Now we take each failed combination to it such that it doesn't become represent of any candidate key.

(i) Lets take AC:-

ABC is not possible because AB is a candidate key. ACD, ACE, ACF are also not possible because CD, CE and CF are candidate key.

(ii) Lets take AD:

ADB, ADC, are not possible because AB and CD are candidate key ∴ we left with following option

$ADE^+ = ADE \neq R$
$ADF^+ = ADFE \neq R$

(iii) Lets take AE:

ABE, ACE, ADE are not possible

$AEF^+ = AEF \neq R$

(iv) Lets take AF

ABF, ACF, ADF, AEF are not possible

(v) Lets take BF now

ABF, CBF, BDF, BEF are not possible because AB, BC, BD and BF are already candidate key.

(vi) Lets take DF now

ADE, BDF, CDE not possible

$DEF^+ = DEF \neq R$

<vii> with DF : ADF , BDF , CDF , DEF all are not possible

Since we do not have any candidate key with 3 attribute we don't need to check further.

Hence, final candidate keys are :-
AB, BC, BE, CD, CE and BF 6 candidate key are there for relation R

Q2 Suppose relation R(ABC) has the tuples?

R

A	B	C
1	2	3
1	2	3
3	2	1

How many tuples ~~relation~~ resulted by given Relational Algebra expression?

$$\pi_{A,B}(R) \bowtie_{R.B < S.B} \rho_{S(A,B)}(\pi_{B,C}(R))$$

<u>Solution</u> Let $T_1 = \pi_{A,B}(R)$

A	B
1	2
3	2

Let $T_2 = \rho_{S(A,B)}(\pi_{B,C}(R))$

S

A	B
2	3
2	1

Now, we only have to take those tuples which have $R.B < S.B$ from cartesian product of $T_1 \times T_2$ $(T_1 \times T_2)$

Final table of the given relational algebra will look like:-

A	B	C	D
1	2	2	3
3	2	2	3

∴ 2 tuples will be there.

Q3 Consider the the relation r1 (P, Q, R) and r2 (R, S, T) with Primary Keys P and R ~~relat~~ respectively The relation r1 contain 2000 tuples and r2 contains 2500 tuples.

The maximum size of the join r1 ⋈ r2 · r1 ⋈ r2 is.

Solution r1 ⋈ r2 is a join operation done on the common attribute R since the value of common attribute should match ∴ at max, we can have 2000 tuples in the resultant table / relation.

Q4 Let R1 (A, B, C) and R2 (D, E) be two relation schemes, where the primary key are shown underlined, and let C be a foreign key in R1 referring to R2. Suppose there is no violation of the above ~~seff~~ referential integrity constraint in the corresponding relation instances r1 and r2. What relational algebra expressions would neccessarily produce an empty relation?

The following relational algebra expression would produce an empty relation.

$$\pi_C(R_1) - \pi_D(R_2)$$

Because in the foreign key in R_1 & it must be present in R_2 because ~~item~~ is the primary key of R_2.

Q6 Relation R has eight attributes ABCDEFGH. Fields of R contain only atomic value F= {CH → G, A → BC, B → CFH, E → A, F → EG} is a set of functional dependencies (FDs) so that F+ is exactly the set of FDs that hold for R. How many candidate keys does the relation R have?

FDs :- CH → G   E → A

A → BC   F → EG

B → CFH

R (ABCDEFGH)

(a) Since, D is not in RHS of any of the FD that means D must be a part of candidate key.

(b) Since, G is not in LHS it can't be a part of candidate key.

Checking candidate key haveing 1 attribute :-

<i> $D^+ = D \neq R$

we don't need to check any other attribute because D must be a part of candidate key

Checking candidate key haveing 2 attribute :-

1. AD^+ = ADBCFHEG = R ∴ AD is a candidate key.
2. BD^+ = BDCFHGEA = R ∴ BD is a candidate key
3. CD^+ = $CD \neq R$
4. ED^+ = EDABCFHG = R ∴ ED is a candidate key
5. FD^+ = FDEGABCH = R ∴ FD is a candidate key.

→ Now the only faild combination is CD and if we add any other attribute in it, it will surely become a superset of candidate key.

→ Relation R have ~~4~~ 4 candidate keys AD, BD, ED and FD.

Q8 Consider the following relational schema R(ABCDE) with:

Functional Dependency: $\{A \to B, C \to D, BD \to E, E \to C\}$

The number of given FD's violate 3NF ____.

Solution To check FD's for 3NF we first have to find keys.

→ A is not in RHS, it must be in key

$A^+ = AB \neq R$

$AB^+ = AB \neq R$

$AC^+ = ABCDE \neq R$

$AD^+ = ABCDE = R$

$AE^+ = ABCDE = R$

∴ Keys are AD, AC and AE

Prime Attribute :- A, C, D, E

Non-Prime attributes : B

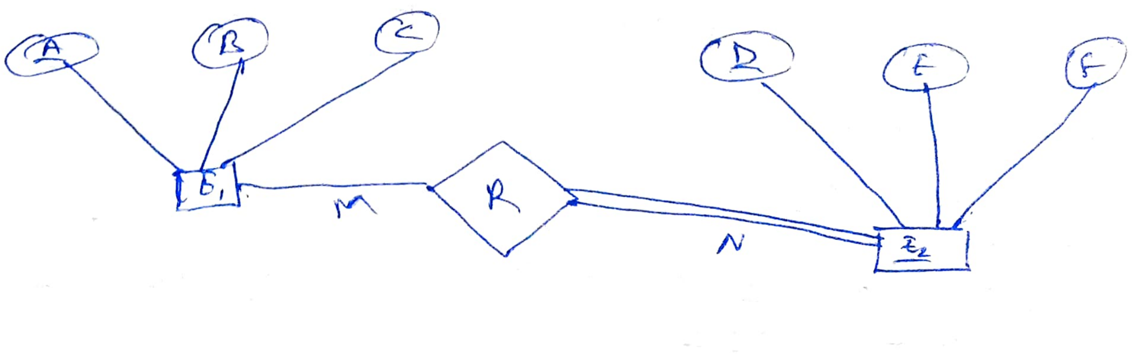
Now following FDs violating 2NF:

$A \to B$ (Partial Dependency)

$C \to D$, $BD \to E$ and $E \to C$ are in 3NF because D, E and C are prime attributes.

∴ The number of given FDs violate 3NF is 1

Q9 Consider the following ERD



The number of minimum relation which satisfy 1NF ______. (Partial participation between E, and R should not lost RDBMS design).

Solution The number of minimum relation which satisfy 1NF would be 2.

E_1 (A, B, C). $A \rightarrow BC$

Since, E_2 has total participation we merge the relationship on E_2 side.

E_2 (A, D, E, f)

$AD \rightarrow Ef$, $D \rightarrow Ef$