CSE370

Theory ASSIGNMENT-4

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Section: 04

Ans. to the ques. No.-1

1. $A \rightarrow BD$

A	B	D
1	20	M
2	21	N
3	22	O
1	21	M
3	22	O

The dependency is not valid. Because

A	B	D
1	20	M
1	21	M

Values for '1' does not match. So, the dependency is not valid.

2. $A \rightarrow C$

A	C
1	M
2	N
3	O
1	M
3	O

Here in the column 'A', '1' and '3' has been repeated once. Both of the times, '1' and '3' has the exact same value from colum 'C'. So, the dependency is valid.

3. $AB \rightarrow D$

A	B	D
1	20	101
2	21	102
3	22	103
1	21	104
3	22	101

Here, From column, 'A' and 'B' when the values are '3' and '22', then the value from column 'D' is '103'. Also, for the same value '3' and '22' the value is '101'.

A	B	D
3	22	103
3	22	101

Hence, the dependency is not valid.

4. $D \rightarrow ABC$

D	A	B	C
101	1	20	M
102	2	21	N
103	3	22	O
104	1	21	M
101	3	22	O

Here,

For column 'D', the value '101' has been repeated once. It should have same values for column 'A', 'B', 'C'.

D	A	B	C
101	1	20	M
101	3	22	O

As, we can see, for column 'D', the value '101' has different set of values. So, we can say that, the dependency is not valid.

5. $BC \rightarrow A$

B	C	A
20	M	1
21	N	2
22	O	3
21	M	1
22	O	3

Here, the values from 'B' column 'B' and 'C' has no values from column 'A' which can lead to a invalid dependency. The tuple which is being made from column 'B' and 'C' has valid values from column 'A'. The tuple {22, O} has been repeated once and it has the value from column 'A', which is '3'. Other than that all tuples are unique.

Hence, the dependency is valid.

Ans. to the ques. No.-2

Given that,

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

Functional Dependencies:

$AB \rightarrow C,\ C \rightarrow E,\ B \rightarrow D.$

(1) Here, Attribute closure:

$(ABCDE)^+ = \{A, B, C, D, E\}$ (Super key)

Discarding 'C', because it can be reached by 'AB'

$(ABDE)^+ = \{A, B, C, D, E\}$ (Super key)

Discarding 'E', because, $AB \rightarrow C$ then $C \rightarrow E$

$(ABD)^+ = \{A, B, C, D, E\}$ (Super key)

Discarding 'D', because $B \rightarrow D$,

$(AB)^+ = \{A, B, C, D, E\}$ (Super key)

Now, Can not discard anymore.

'AB' will be a candidate key if and only if, all the proper subsets of 'AB' is not a super key.

Proper subsets of 'AB',

$A^+ = \{A\}$ (not a super key)

$B^+ = \{B, D\}$ (not a super key)

So, 'AB' is a candidate key.

Prime Attributes are: {A, B}

Candidate key: 'AB'.

So, the primary key will be the combination of column 'A' and column 'B'.

The relation satisfies First Normal Form (1NF).

Because,

The relation has no composite attributes. Even if there were composite attributes, it has been broken down to simple attributes.

The relation has no multivalued attributes.

And lastly,

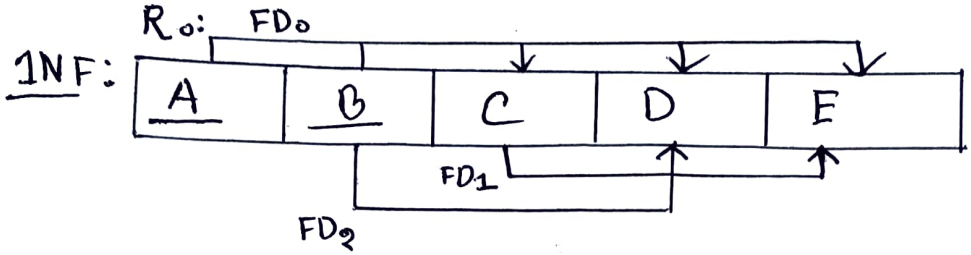
The relation has no nested relations. Nested relations are those whose attribute's values for an individual tuple are non-atomic.

In order to be in 1NF, a relation has to follow the above constraints. Given relation follows the constraints. So, the relation satisfy First Normal form.

(3)

Decomposing the relation until 3NF.

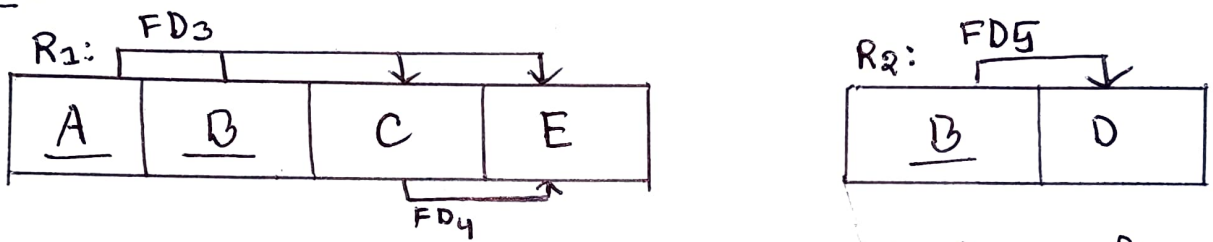
1NF:



Now,

In Order to be in 2NF form, the relation should not have any partial functional dependency.

2NF:

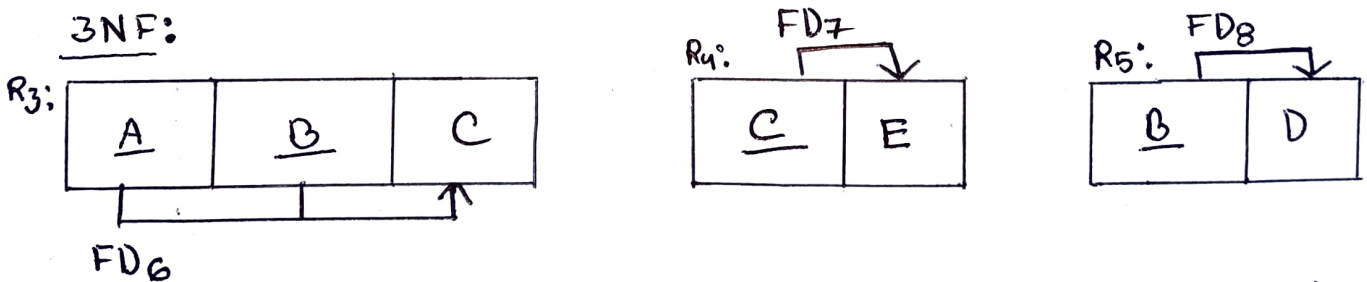


Here, D was partially dependent on B.

Now,

In Order to be in 3NF form, the relation should not have any transitive dependency.

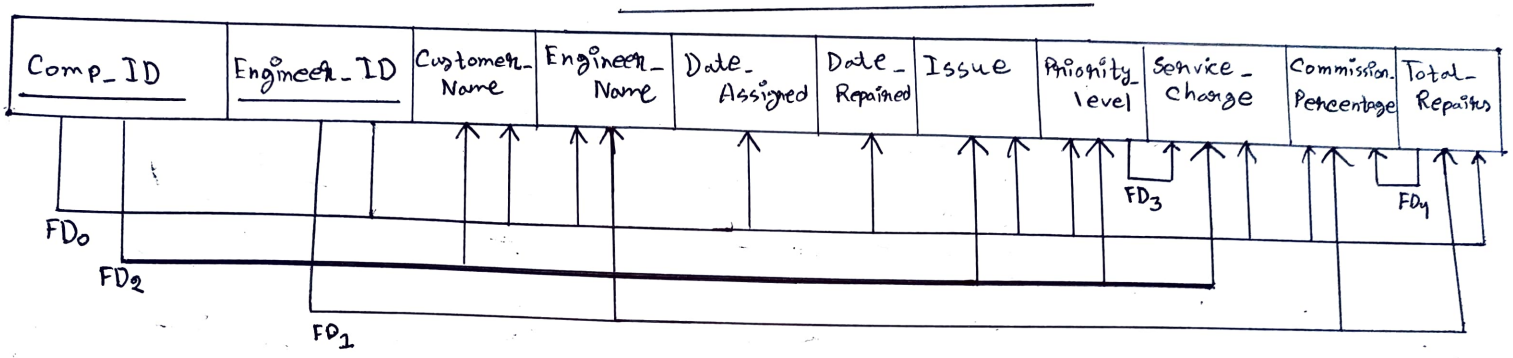
3NF:



Here, $AB \rightarrow C$, then, $C \rightarrow E$. It is a transitive dependency.

Now, the given relation is in 3NF.

Ans. to the ques. no.-3



(1)

In order to be in First Normal Form, a relation must not have,

(1) composite Attributes: All composite attributes have to be broken down to simple attributes.

(2) Multivalued Attributes: For multivalued attributes there should be a separate relation or table.

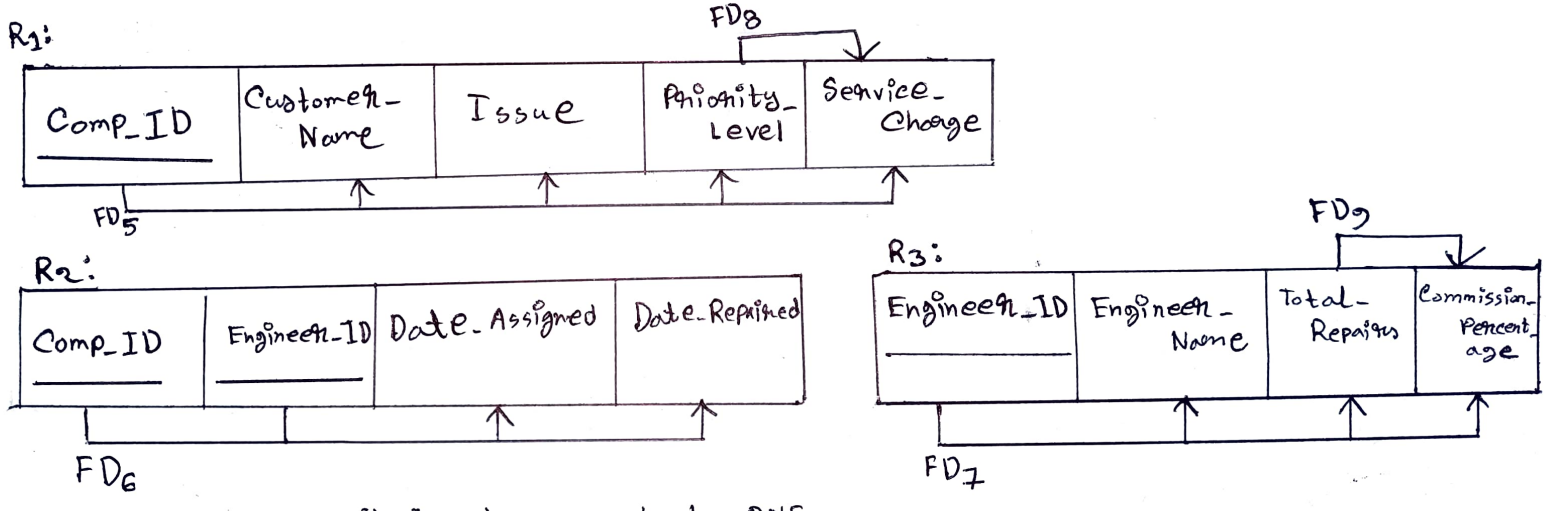
(3) The relation can not have any nested relations.

Given relation follows and obeys all the conditions. Hence we can say that the given relation is in 1NF.

(2)

The given relation is not in 2NF. Because it has partial dependency. FD_2 and FD_1 are partially dependent. It does not require both of the primary key to identify the values of certain columns. So, we can say that, the relation is partially dependent. Hence, the relation is not in 2NF.

2NF:

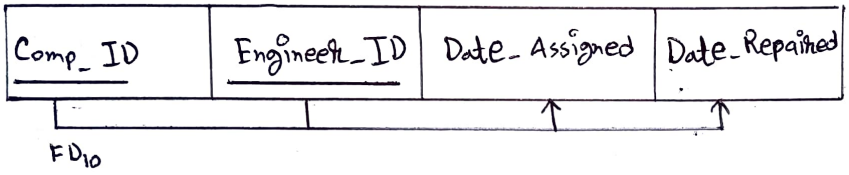


Now, it is decomposed to 2NF.

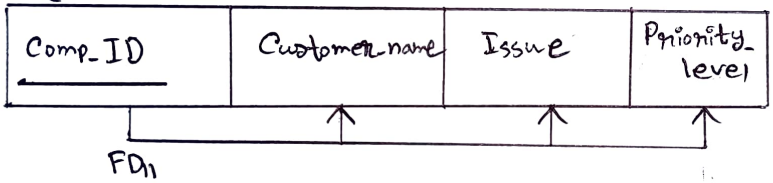
The given relation is not in 3NF. Because there is a transitive dependency between comp_ID and service_charge. Also, there is transitive dependency between Engineer_ID and Commission_Percentage.

3NF:

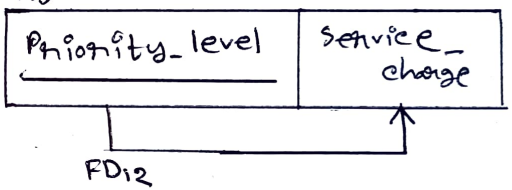
R_1:



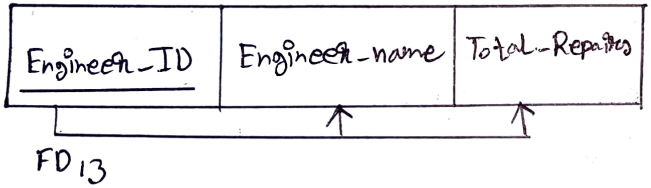
R_2:



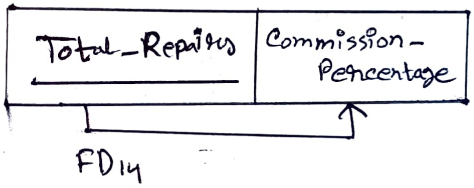
R_3:



R_4:



R_5:



Now, it is decomposed to 3NF.