Normal Forms

Normalization:-

Normalization is the process of organizing the data in a database to reduce redundancy and to eliminate the undesirable characteristics like Insertion, Update and Deletion Anomalies.

Inf:-

A relation is in INF it follows below three rules,

i) Each table must contain primary key.

ii) Each ~~table~~ column must contain atomic value.

iii) ~~Each tab~~ There is no repeating group.

Ex:-

Before Inf:-

rollno - 198w1a12a1

name - Raju

subjectCode - 24IT201

Subject1 marks - 95

Subject2 Code - 24IT208

Subject2 marks - 100

Subject3 Code - 24IT283

Subject3 marks - 98

phone number - 91234 56789, 14324 95653 (not atomic)

After Inf:-

rollno	subjectcode	marks
198w1a12a1	24IT201	95
198w1a12a1	24IT208	100
198w1a12a1	24IT283	98

rollno	phone
198w1a12a1	91234 56789
198w1a12a1	14324 95653

rollno	name
198w1a12a1	Raju

2nf :-

A relation is in 2nf if it follows the rules given below,

i) It is in 1nf.

ii) Every non key attribute is fully dependent on key attribute.

Ex :-

Before 2nf :-

rollno	projectid	name	address	pname
1	10	a	vja	dbms
1	11	a	vja	java
2	10	b	vja	dbms

After 2nf :-

rollno	name	address
1	a	vja
2	b	vja

rollno	projectid
1	10
1	11
2	10

projectid	pname
10	dbms
11	java

3nf :-

A relation is in 3nf if,

i) It is in 2nf.

ii) There is no transitive dependency in a relation.

Before 3nf :-

empid	ename	pincode	district	state
128	Gowrish	520007	krishna	ap

Key attribute - empid

non key attribute - ename, pincode, district, state

empid → ename, pincode

pincode → district, state

After 3nf :-

empid ename pincode

key attribute - emp id

non key attribute - ename, pincode

i) pincode district state

key attribute - pincode

non key attribute - district, state

BCNF :-

BOYCC CODD Normal Form. It is not a normal form but it is a higher version of 3NF. BCNF is a 3.5 Normal Form (3.5NF). BCNF is stricter than 3NF.

Rules for BCNF,

i) It is in BCNF.

ii) For every functional dependency F: X → Y is a super key.

Before BCNF :-

Student - Course Registration.

Stuid	Course Name	Teacher
A7	DBMS	Ramesh
A8	DBMS	Suhasini
A7	Java	Sandeep
A9	Java	Sitha
B0	DBMS	Ramesh

Key attributes – Stuid, CourseName

Non key attributes – Teacher

Dependencies – (Stuid, CourseName) → Teacher

Teacher ⟶ CourseName

Teacher is not a super key

After BCNF:-

Stuid	Teacher
A7	Ramesh
A8	Suhasini
A7	Sandeep
A9	Sitha
B0	Ramesh

Teacher	Course Name
Ramesh	DBMS
Suhasini	DBMS
Sandeep	Java
Sitha	Java

4nf :-

Rules for 4nf,

i) It is in BCNF.

ii) No multivalued dependency.

Ex:-

Before 4nf :-

Bike_model	manuf_year	color
m2011	2008	white
m2001	2008	Black
m3001	2013	White
m3001	2013	Black
m4006	2017	white
m4006	2017	Black

Here, Bike_model →→ Manuf_year and Bike_model →→ color

After 4nf :-

Bike_model	manuf_year
m2011	2008
m2001	2008
m3001	2013
m4006	2017

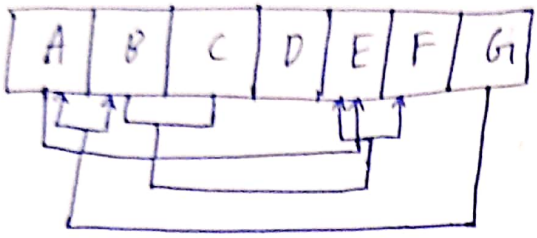
Bike_model	color
m2011	White
m2001	Black
m3001	White
m3001	Black
m4006	White
m4006	Black

Problems on Candidate Key

1) Let R be a relational schema with attribute set {A, B, C, D, E, F, G} with functional dependencies

$A \rightarrow E$
$BC \rightarrow EF$
$G \rightarrow AB$

Find the candidate key ? check whether R is in 2nf or 3nf or BCNF.



$(GCD)^+ = \{A, C, D, A, B, E, F\}$

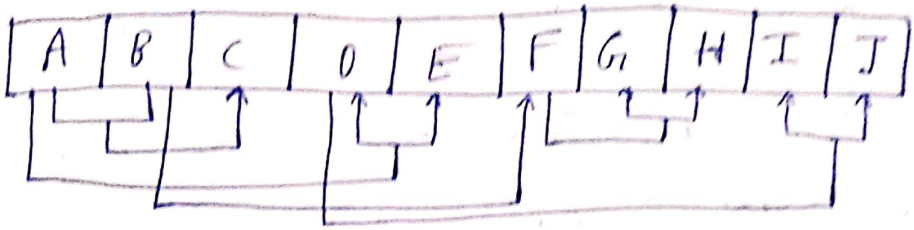
$\therefore (GCD)^+$ is a candidate key

$\therefore$ It is ~~not~~ in 2nf as non-key attributes are not partially dependent on key attribute. It is in 3nf. (no transitive dependency)

2) Consider the following schema $R = \{A, B, C, D, E, F, G, H, I, J\}$ and functional dependencies over R are,

$\{A, B\} \longrightarrow C$
$A \longrightarrow \{D, E\}$
$B \longrightarrow F$
$F \longrightarrow \{G, H\}$
$D \longrightarrow \{I, J\}$

i) Find the candidate keys in the Relational Schema R.



$(AB)^+ = \{A, B, C, D, E, F, G, H, I, J\}$

$\therefore$ $(AB)^+$ is a candidate key.

$\therefore$ R is not in 2nf D and E are dependent on A i.e, partially dependent on key AB.

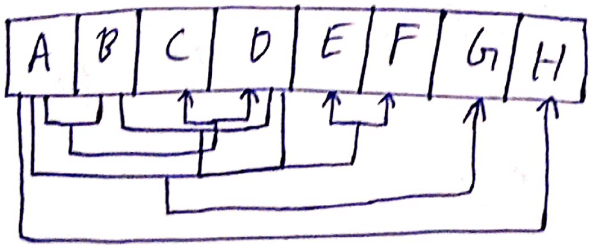
3) Let R be a relational schema with attribute set {A, B, C, D, E, F, G, H} with functional dependencies

$AB \rightarrow CD$

$BD \rightarrow EF$

$AD \rightarrow DEG$

$A \rightarrow H$



$(AB)^+ = \{A, B, CD, E, F, G, H\}$

$\therefore$ $(AB)^+$ is a candidate key.

∴ R is not in 2nf as H is partially dependent on the key attribute AB as $A \rightarrow H$.

4) Let R be a relational schema with attribute set {A, B, C, D, E} with functional dependencies,

$AB \rightarrow CD$

$D \rightarrow A$

$BC \rightarrow DE$

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

∴ $(AB)^+$ is a candidate key.

∴ R is in 2nf as there is no partial dependency.

∴ R is in 3nf as there are no transitive functional dependencies.

∴ R is not in BCNF as the non-key attribute D is not a super key.