No. of I/ps : 3

No. of O/ps : 2

Cir	A	B	S	C
0	0	0	0	0
0	0	1	1	0
0	1	0	1	0
0	1	1	0	1
1	0	0	1	0
1	0	1	0	
1	1	0	0	
1	1	1	1	

4979
x17

x

Date: 6/12/2023 DBMS

Normalization: TO reduce Redundancy

{ Insertion, Deletion, Updation } — Anomaly

Given a Relation schema we need to decide whether it is a good design (or) whether we need to decompose it into smaller Relations, Such a decision must be guided by an understanding of what problems if any arise from the current schema. To product such guidance several normal forms have been proposed.

The Normal forms based on functional dependencies (F.D) are 1NF, 2NF, 3NF, BCNF (Boyce-codd NF), 4NF, 5NF

Every Relation in BCNF is also in 3NF.
Every Relation in 3NF is also in 2NF.
Every Relation in 2NF is also in 1NF.

⟹ 1st Normal Form:

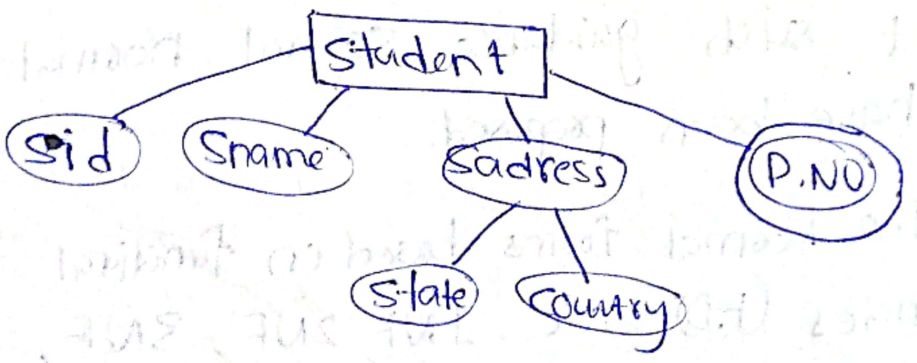
If Every field contains only atomic values (Single valued attributes here) then we say the relation is in 1NF.

Rules:

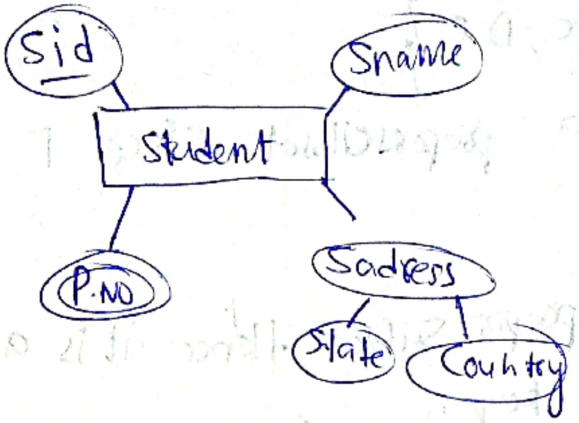
i) Each attribute should contain atomic values
ii) A column should contain value from same Domain
iii) Each column should have unique name
iv) No ordering to Rows and columns.

Ex:- Student

Sid	Sname	Saddress	P.NO
1	Ram	TS, IND	P_1
2	Sri	AP, IND	P_2 P_3
3	Sai	HR, IND	P_4, P_5
4	Shiva	MP, IND	P_6



Sid	Sname	Sadress St	Sadress country	P_{h1}	P_{h2}
1	Ram	TS	IND	P_1	NULL
2	Sri	AP	IND	P_2	P_3
3	Sai	HR	IND	P_4	P_5
4	Shiva	MP	IND	P_6	NULL



NOTE:

Sid	Sname	Sadd	PNO
1	Ram	TS, IND	P_1
2	Sri	AP, IND	P_2
2	Sri	AP, IND	P_3
3	Sai	HR IND	P_4
3	Sai	HR, IND	P_5
4	Shiva	MP, IND	P_6

$\Rightarrow$ 2nd Normal Form

$A \to BC$
$AB \to C$

Rules:

i) The relation must be in 1NF
ii) There would be no partial dependency in a relation
iii) proper subset of candidate key determine non-prime atribute

Ex:- R (A B C D E F)

{A→B, B→C, C→D, D→F}

Candidate key (A→F)

$ABCDEF^+ = \{A, B, C, D, E, F\}$

$\Rightarrow AF^+ = \{A, F, B, C, D, E\}$

* proper subset of a super key is candidate key

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

$\rightarrow A^+$ is not a proper subset since F missing

$F^+ = \{F\}$

then AF^+ is proper subset hence it is a candidate key

prime Attributes : $\{A, F\}$

Non prime Attribute : $\{B, C, D, E\}$

$A \rightarrow B$

determines

Decompose given Relation into..

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

$R_1 = \{A, B, C, D, E\}$ A is primary

$R_2 = \{A, F\}$ A is Forign key

Closures:

$\{A \rightarrow BCDE, B \rightarrow CDE, C \rightarrow DE, D \rightarrow E\}$

Decomposition Rule $\boxed{R = R_1 \cup R_2}$

Relation $R=\{A,B,C,D\}$

Functional dependencies : $\{A \to B, C \to D\}$

candidates $ABCD^+ = \{A,B,C,D\}$

$= \{AC\}$ is candidate key

As A and C both are prime attributes

Relation R does not obey 2NF.

$FD = \{A \to B, C \to D\}$

$A^+ = \{A,B\}$, $C^+ = \{C,D\}$

$Ac^+ = \{A,B,C,D\}$

prime attributes $= \{A,C\}$

Non prime " $= \{B,D\}$

∴ Given Relation not in 2NF

Closures:

$A^+\{A,B\}$ $C^+ = \{C,D\}$

$R_1 = \{A,B\}$, $R_2 = \{C,D\}$, $R_3 = \{A,C\}$

$FD_1 = \{A \to B\}$ $FD_2 = \{C \to D\}$ $FD_3 = \{A\}$

⟹ 3rd Normal Form

Rules:

1) It is in second normal form
2) No transtive dependency for non prime attributes.

A table is in 3NF if and only if for

each of its non trivial functional dependency At least one of the following conditions hold.

Conditions:

1) Left Hand side is Supper key
2) RHS is prime attribute

Example: R(A,B,C,D)

FD{A→B, B→C, C→D, A→D}

$ABCD^+ = \{A, B, C, D\}$

$ACD^+ = \{A, B, C, D\}$ // A→B

$AD^+ = \{A, B, C, D\}$ // A→B and B→C

$A^+ = \{A, B, C, D\}$ // A→B and B→C and C→D

Now A^+ is super key and candidate key

proper subset of super key is candidate key

A is candidate key

⟹ Only one attribute is involved hence 3NF

prime attributes = {A}

Non-prime attributes = {B, C, D}

$R_1(B, C, D)$

B→C

$B^+ = \{B, C, D\}$

FD: {B→CD, C→D}

$R_2(C, D)$

C→D

$C^+ = \{C, D\}$

FD: {C→D}

$R_3(A, B)$

FD: {A→B}

$A^+ = \{A, B\}$

R_1 (B, C, D)

FD: {B → C, C → D}

$B(D^+)$ = {B, C, D}

BD^+ = {B, C, D} // B → C

B^+ = {B, C, D} // B → C, C → D

↳ S.k and C.k

C^+ = {C, D}

prime attributes = {B}

Non " " = {C, D}

B^+ {B, C, D}

B → CD

R_{11} = (B, C, D)

FD: {B → CD}

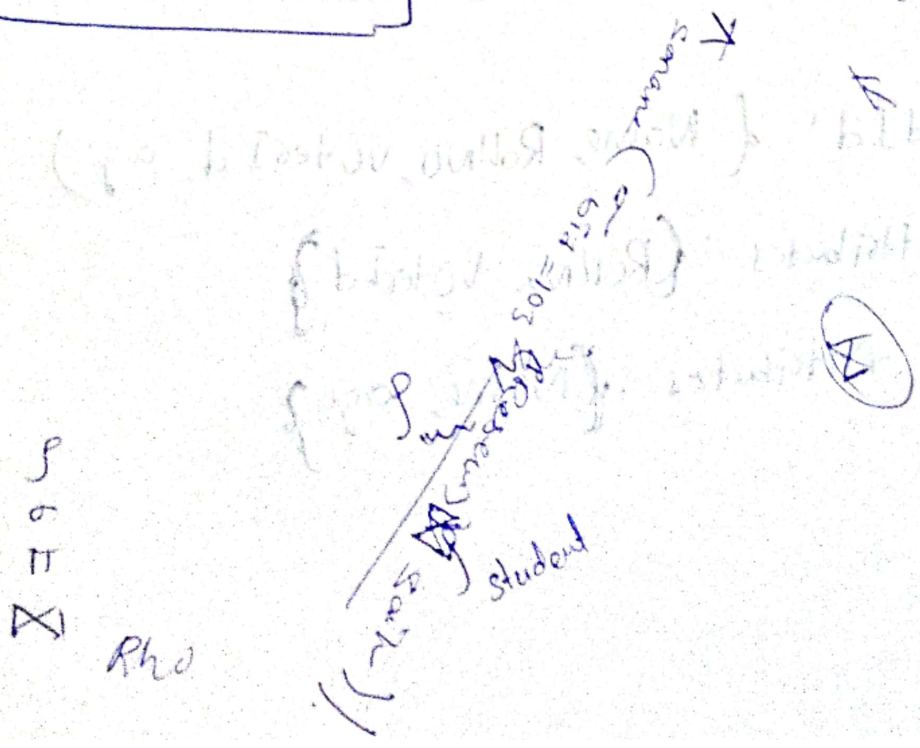
B → C B → D

C → D

R_{12} = {C, D}

FD: {C → D}

$R_1 = R_{11} \cup R_{12} \cup R_3$



BCNF

1) It should be in 3rd NF
2) LHS Must be candidate key or super key
3) Third Normal Form always ensures dependency preserving decomposition but not BCNF.
4) Both Third and BCNF ensures lossless decomposition.

Ex:- R (Roll.NO, Name, VoterId, age).

FD: { Roll.NO → Name, Roll.NO → VoterId, VoterId → age, VoterId → Roll.NO }

Roll.NO Name VoterId age $^+$ { Roll.NO, Name, VoterId, age)

Roll.NO VoterId age $^+$ { Roll.NO, Name, VoterId, age)

Roll.NO voterId $^+$ { Roll.NO, Name, VoterId, age)

Roll.NO$^+$ { — — — — } ⟹ SK, CK

Since Roll.NO and voterId are prime.

So, the relation is 3NF

VotedId$^+$ { Name, RollNO, voterId, age)

P Attributes : {RollNo, VoterId}

Non P Attributes : {Name, age}

4th Normal Form

Rules:

1) It should be in 3rd NF
2) NO multi valued dependency

Ex:-

Name	P.NO	Email
A	P_1	E_1
A	P_1	E_2
A	P_2	E_1
A	P_2	E_2
B	P	E

Name	P.NO
A	P_1
A	P_2
B	P

Name	Emai
A	E_1
A	E_2
B	E

5th Normal Form

Rules:

1) It should be in 4th NF
2) Ensures lossless decomposition

COALESCE()

This function is used to return the first non-NULL value in a list.

Syntax: COALESCE(a)

Ex:- COALESCE(P1, P2, P3)

Anamola

DUALTABLE: is a special table

One row one column table represented by default in database

The row name of dual table is 'sys'.

Dual can be accessed by every user.

Queries:

1) select 'Rajashekar' from dual;

Anomalies : A deviation from the norm, a glitch or error that doesn't fit with the rest of the pattern of database.

Inconsistencies: a situation where there are multiple tables with a database that deal with same data but may recieve it from diff. inputs.

Redundancy: the repetition of the same data in multiple places within a database.

Dependencies:

Functional dependencies

Relation $R(A, B, C, D)$ $R_1(ABC)$ $R_2(AD)$

FD $\{A \rightarrow BC\}$

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

FD: $\{AB \rightarrow C, C \rightarrow D, D \rightarrow E\}$

$\Rightarrow AB^{+}\{$ involved in candidate key

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

FD $\{C \rightarrow F, E \rightarrow A, EC \rightarrow D, A \rightarrow, B)$

$E \rightarrow A$
$E \rightarrow B$
$F \rightarrow D$
$E \rightarrow B$

$C \rightarrow F$
$C \rightarrow D$

$\Rightarrow Ec^{+}\{$ $\}$

Super key: 2^{n-1} in max case $= 16$

In min case A B

mandatory in candidate

$2 \times 2 \times 2 = 8$ super key.

2^{n-1} in max case $2^{6-1} = 2^5 = 32$

E C

$2 \times 2 \times 2 \times 2 = 2^4 = 16$ super keys.

---

3) R(E, F, G, H, I, J, K, L, M, N)

FD: { EF → G, F → IJ, EH → KL, K → M, L → N }

EFH^+

Super keys max: $2^{n-1} = 2^9 = 512$

min: E F H _ _ _ _ _ _ _ = 128

$2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2$

F → G

FD: { EF → G, F → IJ, EH → KL, K → M, L → N }

$EFGHIJKLMN^+ = (EFGHIJKLMN)$

~~EFH~~ EFIIJKLMN$^+$ = (")

EFH EFKLMN$^+$ = (")

EFH

---

4) R(A B C D E H)

FD: { A → B, BC → D, E → C, D → A }

AEH

BEH

DEH