"Normal form"

1NF
2NF
3NF
BCNF

} measure of goodness of

highest redundancy

least the redundancy
the Anomalies

Determine the Normal form

R(ABCDE)

F
AB → C
B → DE

(1) Compute Key
(2) Conditions to be checked

Key: determines all attrib. of relation

$A \rightarrow B$

every attribute of a relation

07. Consider relation R(A, B, C, D), and following FDs

$A \rightarrow BC$
$B \rightarrow C$
$A \rightarrow B$
$AB \rightarrow C$

Key : $A^+ = ABC$ — AD

BCNF : NO.. B → C FD (2) violates BCNF requirement

3NF : NO. FD (2) ∀ 3NF

2NF : NO.

(1) A → B.

~~A → C~~

(2) B → C.

~~A → B~~

~~AB → C~~ A → AB, AB → C, A → C

1NF

AD → B
AD → C
A → B
A → C

Prime (A) (B)

R(ABCD)

AB → CD

D → B

Key : AB

BCNF : NO

3NF : Yes.

3NF

every Non-prime attribute should be irreducibly depend on "Key"

$AB \rightarrow CDE$

$B \rightarrow DE$

R (PNO, PNAME, ESSN, HOURS)

- PNO → PNAME
- {ESSN, PNO} → HOURS

Key: ESSN, PNO

BCNF: NO

3NF : NO

Fo

MembID → {MembName, MembEmail, TeamID, ~~TeamPWD, MentorID, MentorName, MentorEmail, InstID, InstName~~}
~~MembID → {City, PIN, State}~~
TeamID → {TeamPWD, MentorID, ~~MentorName, MentorEmail, InstID, InstName, City, PIN, State~~}
MentorID → {MentorName, MentorEmail, InstID}
InstID → {InstName, ~~City,~~ PIN, ~~State~~}
PIN → {City, State}

BCNF?

fm

MembID → MembName
MembID → MembEmail
MembID → TeamID

R

Member(MembID, MembName, MembEmail, TeamID)

Key: MembId

BCNF: Yes | NO

irreducible

Team(TeamID, TeamPWD, MentorID)

TeamID → TeamPWD
TeamID → MentorID

Key: TeamId

BCNF: Yes

AB →

B → D

Mentor(MentorID, MentorName, MentorEmail, InstID)

MentorID → MentorName
MentorID → MentorEmail
MentorID → InstID

Key: MentorId

Yes it is in BCNF

Institute(InstID, InstName, City, PIN, State)

InstID → InstName
InstID → City
InstID → PIN
InstID → State
PIN → City
PIN → State

Key: InstId

BCNF: Not in BCNF

3NF: NO

2NF: Yes

MembID → {MembName, MembEmail, TeamID, TeamPWD, MentorID, MentorName, MentorEmail, InstID, InstName}
MembID → {City, PIN, State}
TeamID → {TeamPWD, MentorID, MentorName, MentorEmail, InstID, InstName, City, PIN, State}
MentorID → {MentorName, MentorEmail, InstID}
InstID → {InstName, City, PIN, State}
PIN → {City, State}

Member(MembID, MembName, MembEmail, TeamID)

MembID → MembName
MembID → MembEmail
MembID → TeamID

Team(TeamID, TeamPWD, MentorID, InstID)

TeamID → TeamPWD
TeamID → MentorID
MentorID → InstID

Key: TeamId

BCNF : Not in BCNF

3NF:

TeamId → InstId
Transitive

Mentor(MentorID, MentorName, MentorEmail, InstID)

MentorID → MentorName
MentorID → MentorEmail
MentorID → InstID

Institute(InstID, InstName, City, PIN, State)

InstID → InstName
InstID → City
InstID → PIN
InstID → State
PIN → City
PIN → State

MembID → {MembName, MembEmail, TeamID, TeamPWD, MentorID, MentorName, MentorEmail, InstID, InstName}
MembID → {City, PIN, State}
TeamID → {TeamPWD, MentorID, MentorName, MentorEmail, InstID, InstName, City, PIN, State}
MentorID → {MentorName, MentorEmail, InstID}
InstID → {InstName, City, PIN, State}
PIN → {City, State}

Member(MembID, MembName, MembEmail, TeamID)

MembID → MembName
MembID → MembEmail
MembID → TeamID

Team(TeamID, TeamPWD, MentorID, InstID)

TeamID → TeamPWD
TeamID → MentorID
TeamID → InstID ✓

Key : TeamId
BCNF : Yes

Team
MentorId → InstId

Mentor(MentorID, MentorName, MentorEmail, InstID)

MentorID → MentorName
MentorID → MentorEmail
MentorID → InstID

Institute(InstID, InstName, City, PIN, State)

InstID → InstName
InstID → City
InstID → PIN
InstID → State
PIN → City
PIN → State

MembID → {MembName, MembEmail, TeamID, TeamPWD, MentorID, MentorName, MentorEmail, InstID, InstName}
MembID → {City, PIN, State}
TeamID → {TeamPWD, MentorID, MentorName, MentorEmail, InstID, InstName, City, PIN, State}
MentorID → {MentorName, MentorEmail, InstID}
InstID → {InstName, City, PIN, State}
PIN → {City, State}

Member(MembID, MembName, MembEmail, TeamID)

MembID → MembName
MembID → MembEmail
MembID → TeamID

Team(TeamID, TeamPWD, MentorID, InstID)

TeamID → TeamPWD
TeamID → MentorID
TeamID → InstID ✓

Key : TeamId
BCNF : Yes

Team
MentorId → InstId

Mentor(MentorID, MentorName, MentorEmail, InstID)

MentorID → MentorName
MentorID → MentorEmail
MentorID → InstID

Institute(InstID, InstName, City, PIN, State)

InstID → InstName
InstID → City
InstID → PIN
InstID → State
PIN → City
PIN → State

MembID → {MembName, MembEmail, TeamID, TeamPWD, MentorID, MentorName, MentorEmail, InstID, InstName}
MembID → {City, PIN, State}
TeamID → {TeamPWD, MentorID, MentorName, MentorEmail, InstID, InstName, City, PIN, State}
MentorID → {MentorName, MentorEmail, InstID}
InstID → {InstName, City, PIN, State}
PIN → {City, State}

Member(MembID, MembName, MembEmail, TeamID)

MembID → MembName
MembID → MembEmail
MembID → TeamID

Team(TeamID, TeamPWD, MentorID, InstID)

TeamID → TeamPWD
TeamID → MentorID
TeamID → InstID ✓

Key : TeamId
BCNF : Yes

Team
MentorId → InstId

Mentor(MentorID, MentorName, MentorEmail, InstID)

MentorID → MentorName
MentorID → MentorEmail
MentorID → InstID

Institute(InstID, InstName, City, PIN, State)

InstID → InstName
InstID → City
InstID → PIN
InstID → State
PIN → City
PIN → State

Exercises #12: find out if following relations are in 3NF?

Given relation R(SSN, FName, PNO, PName, HOURS), and FD set-

{SSN, PNO} → HOURS

SSN → FNAME

PNO → PNAME

Compute key?

Is R in BCNF? NO.

Is R in 3NF? NO

SSN	FNAME	PNO	PNAME	HOURS
101	Sumit	1	P-1	38
101	Sumit	2	P-2	20
102	Vipul	1	P-1	64
103	Ajay	2	P-2	58

Key: {SSN, PNO}

Do all these depend on Key: Yes | NO YES

3NF: NO.

2NF: NO! FNAME, PNAME

{PNO, SSN} → FNAME

{PNO, SSN} → PNAME

$AE^+ = ABCDE$

R(ABCDE)

Input

$A \to B$
$A \to C$
$A \to D$

Key : AE

BCNF : ~~Yes~~. NO

3NF : NO

2NF : NO.

Normal form

BOOK (ISBN, Title, Price, PubId, Author)

ISBN → Title
ISBN → Price
ISBN → PubId

Key : {ISBN, Author}

BCNF :

3NF :

2NF :

Book (ISBN, Title, Price, Pubid, Author)

Key : {ISBN, Author}

BCNF :

3NF :

2NF :

ISBN → Title

ISBN → Price

ISBN → Pubid

Book (ISBN, Title, Price, Pubid)

Key : ISBN

BCNF : Yes

BookAuthor (ISBN, Author)

Key : ISBN, Author

BCNF : Yes.