

## Proofs that relations are in BCNF

### 1. **USER** relation :-

#### ❖ Attributes :-

USER {User\_ID , Pan\_No. , Email\_ID , Name , Contact\_No. ,  
Hold\_Balance , Availabel\_Balance , Blocked\_Balance}

#### ❖ Functional Dependencies :-

User\_ID  $\rightarrow$  Pan\_No.

User\_ID  $\rightarrow$  Email\_ID

User\_ID  $\rightarrow$  Name

User\_ID  $\rightarrow$  Contact\_No.

User\_ID  $\rightarrow$  Hold\_Balance

User\_ID  $\rightarrow$  Availabel\_Balance

User\_ID  $\rightarrow$  Blocked\_Balance

Pan\_No.  $\rightarrow$  User\_ID

Email\_ID  $\rightarrow$  User\_ID

Let  $X = \{\text{User\_ID}, \text{Pan\_No.}, \text{Email\_ID}\}$

$X^+ = \{\text{User\_ID}, \text{Pan\_No.}, \text{Email\_ID}, \text{Name}, \text{Contact\_No.},$   
 $\text{Hold\_Balance}, \text{Availabel\_Balance}, \text{Blocked\_Balance}\}$

Such that **Primary Key** = {User\_ID , Pan\_No. , Email\_ID}

The left side of all the FD's in the minimal set of FD's for the relation 'USER' is {User\_ID , Pan\_No. , Email\_ID}, which is the primary Key of this relation. Such that **"USER" is in BCNF.**

### 2. **Account** relation :-

#### ❖ Attributes :-

Account {Account\_No , Bank\_Name , IFSC , User\_ID}

#### ❖ Functional Dependencies :-

Account\_No  $\rightarrow$  IFSC

Account\_No  $\rightarrow$  User\_ID

IFSC  $\rightarrow$  Bank\_Name

Let  $X = \text{Account\_No}$

$X^+ = \{\text{Account\_No}, \text{Bank\_Name}, \text{IFSC}, \text{User\_ID}\}$

Such that **Primary Key = Account\_No**

Here as we can see in last FD violates BCNF as determinant is not key. It also violates 3NF as last FD dependent is not prime attributes .

The above given relation is in 2NF it satisfies transitivity.

To convert this into BCNF we here do “LossLess Decomposition”.

<b>Account</b>	<b>Bank_Info</b>
❖ Attributes :- Account { Account_No , IFSC , User_ID }	❖ Attributes :- Account { IFSC ,Bank_Name }
❖ Functional Dependencies :- Account_No $\rightarrow$ IFSC Account_No $\rightarrow$ User_ID	❖ Functional Dependencies :- IFSC $\rightarrow$ Bank_Name

Above in both relation determinant is key , such that our relation becomes in BCNF.

### 3. **Transactions** relation :-

❖ Attributes :-  
Transactions { Transaction\_ID , Transaction\_Time , User\_ID }

❖ Functional Dependencies :-  
Transaction\_ID  $\rightarrow$  Transaction\_Time  
Transaction\_ID  $\rightarrow$  User\_ID

Let  $X = \text{Transaction\_ID}$

$X^+ = \{\text{Transaction\_ID}, \text{Transaction\_Time}, \text{User\_ID}\}$

Such that **Primary Key = Transaction\_ID**

The left side of all the FD's in the minimal set of FD's for the relation 'Transactions' is Transaction\_ID , which is the primary Key of this relation. Such that **“Transactions” is in BCNF.**

#### 4. **Bank\_Wallet** relation :-

❖ Attributes :-

Bank\_Wallet { Transaction\_ID , Bank\_Acc\_No , Amount , Transaction\_Type }

❖ Functional Dependencies :-

Transaction\_ID  $\rightarrow$  Bank\_Acc\_No

Transaction\_ID  $\rightarrow$  Amount

Transaction\_ID  $\rightarrow$  Transaction\_Type

Let X = Transaction\_ID

$X^+ = \{ \text{Transaction\_ID , Bank\_Acc\_No , Amount , Transaction\_Type} \}$

Such that **Primary Key = Transaction\_ID**

The left side of all the FD's in the minimal set of FD's for the relation 'Bank\_Wallet' is Transaction\_ID , which is the primary Key of this relation. Such that **“Bank\_Wallet” is in BCNF.**

#### 5. **Wallet\_Stock** relation :-

❖ Attributes :-

Wallet\_Stock { Transaction\_ID , Stock\_Symbol , Order\_Type , Qty , Price , Order\_ID }

❖ Functional Dependencies :-

Transaction\_ID  $\rightarrow$  Stock\_Symbol

Transaction\_ID  $\rightarrow$  Order\_Type

Transaction\_ID  $\rightarrow$  Qty

Transaction\_ID  $\rightarrow$  Price

Transaction\_ID  $\rightarrow$  Order\_ID

Let  $X = \text{Transaction\_ID}$

$X^+ = \{\text{Transaction\_ID}, \text{Stock\_Symbol}, \text{Order\_Type}, \text{Qty}, \text{Price}, \text{Order\_ID}\}$

Such that **Primary Key = Transaction\_ID**

The left side of all the FD's in the minimal set of FD's for the relation 'Wallet\_Stock' is Transaction\_ID, which is the primary Key of this relation. Such that **"Wallet\_Stock" is in BCNF.**

#### 6. **Holding Histroy** relation :-

❖ **Attributes :-**

Holding Histroy {User\_ID, Transaction\_ID, To Time\_Stamp, From Time\_Stamp, Sold Price, Baught Price, Profit/Loss, Amount}

❖ **Functional Dependencies :-**

Transaction\_ID  $\rightarrow$  To Time\_Stamp

Transaction\_ID  $\rightarrow$  From Time\_Stamp

Transaction\_ID  $\rightarrow$  Sold Price

Transaction\_ID  $\rightarrow$  Baught Price

Transaction\_ID  $\rightarrow$  Profit/Loss

Transaction\_ID  $\rightarrow$  Amount

Transaction\_ID  $\rightarrow$  User\_ID

Let  $X = \text{Transaction\_ID}$

$X^+ = \{\text{User\_ID}, \text{Transaction\_ID}, \text{To Time\_Stamp}, \text{From Time\_Stamp}, \text{Sold Price}, \text{Baught Price}, \text{Profit/Loss}, \text{Amount}\}$

Such that **Primary Key = Transaction\_ID**

The left side of all the FD's in the minimal set of FD's for the relation 'Holding History' is Transaction\_ID, which is the primary Key of this relation. Such that **"Holding History" is in BCNF.**

#### 7. **Order** relation :-

❖ Attributes :-

Order {Order\_ID , Order\_time , Stop\_Price , Status , User\_ID , Stock\_Symbol}

❖ Functional Dependencies :-

Order\_ID  $\rightarrow$  Order\_time

Order\_ID  $\rightarrow$  Stop\_Price

Order\_ID  $\rightarrow$  Status

Order\_ID  $\rightarrow$  User\_ID

Order\_ID  $\rightarrow$  Stock\_Symbol

Let  $X = \text{Order\_ID}$

$X^+ = \{\text{Order\_ID} , \text{Order\_time} , \text{Stop\_Price} , \text{Status} , \text{User\_ID} , \text{Stock\_Symbol}\}$

Such that **Primary Key** = Order\_ID

The left side of all the FD's in the minimal set of FD's for the relation 'Order' is Order\_ID , which is the primary Key of this relation. Such that **“Order” is in BCNF.**

8. **Watchlist** relation :-

❖ Attributes :-

Watchlist {User\_ID , Stock\_Symbol}

Here , Primary Key = {User\_ID , Stock\_Symbol }

According to thorem , All attributes of the relation are key such that **“Watchlist” is in BCNF.**

9. **Holding** relation :-

❖ Attributes :-

Holding {User\_ID , Stock\_Symbol , Purchase\_Time , Invested\_Price , Qty}

❖ Functional Dependencies :-

{User\_ID , Stock\_Symbol , Purchase\_Time}  $\rightarrow$  Invested\_Price

$\{\text{User\_ID}, \text{Stock\_Symbol}, \text{Purchase\_Time}\} \rightarrow \text{Qty}$

Let  $X = \{\text{User\_ID}, \text{Stock\_Symbol}, \text{Purchase\_Time}\}$

$X^+ = \{\text{User\_ID}, \text{Stock\_Symbol}, \text{Purchase\_Time}, \text{Invested\_Price}, \text{Qty}\}$

Such that **Primary Key** =  $\{\text{User\_ID}, \text{Stock\_Symbol}, \text{Purchase\_Time}\}$

The left side of all the FD's in the minimal set of FD's for the relation 'Holding' is  $\{\text{User\_ID}, \text{Stock\_Symbol}, \text{Purchase\_Time}\}$ , which is the primary Key of this relation. Such that **“Holding” is in BCNF.**

#### 10. Stocks relation :-

❖ Attributes :-

Stocks  $\{\text{Stock\_Symbol}, \text{Name}, \text{Type}, \text{Highest}, \text{Lowest}, \text{Exchange}, \text{CIN}\}$

❖ Functional Dependencies :-

$\text{Stock\_Symbol} \rightarrow \text{Name}$

$\text{Stock\_Symbol} \rightarrow \text{Type}$

$\text{Stock\_Symbol} \rightarrow \text{Highest}$

$\text{Stock\_Symbol} \rightarrow \text{Lowest}$

$\text{Stock\_Symbol} \rightarrow \text{Exchange}$

$\text{Stock\_Symbol} \rightarrow \text{CIN}$

Let  $X = \text{Stock\_Symbol}$

$X^+ = \{\text{Stock\_Symbol}, \text{Name}, \text{Type}, \text{Highest}, \text{Lowest}, \text{Exchange}, \text{CIN}\}$

Such that **Primary Key** = **Stock\_Symbol**

The left side of all the FD's in the minimal set of FD's for the relation 'Stocks' is **Stock\_Symbol**, which is the primary Key of this relation. Such that **“Stocks” is in BCNF.**

#### 11. Stock\_History relation :-

❖ Attributes :-

Stock\_History {Stock\_Symbol , Time\_Stamp , Price , Open\_Price , Previous Close , Inc/Dec , Volume}

❖ Functional Dependencies :-

{Stock\_Symbol , Time\_Stamp} → Price

{Stock\_Symbol , Time\_Stamp} → Open\_Price

{Stock\_Symbol , Time\_Stamp} → Previous Close

{Stock\_Symbol , Time\_Stamp} → Inc/Dec

{Stock\_Symbol , Time\_Stamp} → Volume

Let  $X = \{\text{Stock\_Symbol}, \text{Time\_Stamp}\}$

$X^+ = \{\text{Stock\_Symbol}, \text{Time\_Stamp}, \text{Price}, \text{Open\_Price}, \text{Previous Close}, \text{Inc/Dec}, \text{Volume}\}$

Such that **Primary Key** = {Stock\_Symbol , Time\_Stamp}

The left side of all the FD's in the minimal set of FD's for the relation 'Stock\_History' is {Stock\_Symbol , Time\_Stamp} , which is the primary Key of this relation. Such that **“Stock\_History” is in BCNF.**

12. **Stock\_Group** relation :-

❖ Attributes :-

Stock\_Group {Group\_Name , Lowest , Highest , Price , Open Price , Close Price , Stock\_Exchange}

❖ Functional Dependencies :-

Group\_Name → Lowest

Group\_Name → Highest

Group\_Name → Price

Group\_Name → Open Price

Group\_Name → Close Price

Group\_Name → Stock\_Exchange

Let  $X = \text{Group\_Name}$

$X^+ = \{ \text{Group\_Name} , \text{Lowest} , \text{Highest} , \text{Price} , \text{Open Price} , \text{Close Price} , \text{Stock\_Exchange} \}$

Such that **Primary Key = Group\_Name**

The left side of all the FD's in the minimal set of FD's for the relation 'Stock\_Group' is Group\_Name , which is the primary Key of this relation. Such that **"Stock\_Group" is in BCNF.**

### 13. Stock\_Group\_History relation :-

❖ Attributes :-

Stock\_Group\_History {Group\_Name , Time\_Stamp , Inc/Dec , Open Price , Previous Close , Price}

❖ Functional Dependencies :-

{Group\_Name , Time\_Stamp}  $\rightarrow$  Inc/Dec

{Group\_Name , Time\_Stamp}  $\rightarrow$  Open Price

{Group\_Name , Time\_Stamp}  $\rightarrow$  Previous Close

{Group\_Name , Time\_Stamp}  $\rightarrow$  Price

Let  $X = \{ \text{Group\_Name} , \text{Time\_Stamp} \}$

$X^+ = \{ \text{Group\_Name} , \text{Time\_Stamp} , \text{Inc/Dec} , \text{Open Price} , \text{Previous Close} , \text{Price} \}$

Such that **Primary Key = {Group\_Name , Time\_Stamp}**

The left side of all the FD's in the minimal set of FD's for the relation 'Stock\_Group\_History' is {Group\_Name , Time\_Stamp} , which is the primary Key of this relation. Such that **"Stock\_Group\_History" is in BCNF.**

### 14. MemberOf relation :-

❖ Attributes :-

MemberOf {Stock\_Symbol , Group\_Name}

Here , Primary Key = {Stock\_Symbol , Group\_Name}



According to theorem , All attributes of the relation are key such that **“MemberOf” is in BCNF.**

#### 15. **Company** relation :-

❖ Attributes :-

Company {CIN , Name , CEO , Market\_Capital , Revenue}

❖ Functional Dependencies :-

CIN  $\rightarrow$  Name

CIN  $\rightarrow$  CEO

CIN  $\rightarrow$  Market\_Capital

CIN  $\rightarrow$  Revenue

Let  $X = \text{CIN}$

$X^+ = \{\text{CIN , Name , CEO , Market_Capital , Revenue}\}$

Such that **Primary Key = CIN**

The left side of all the FD's in the minimal set of FD's for the relation 'Company' is CIN , which is the primary Key of this relation. Such that **“Company” is in BCNF.**

#### 16. **Sector** relation :-

❖ Attributes :-

Sector {Sector\_Name , CIN}

Here , Primary Key = {Sector\_Name , CIN}

According to theorem , All attributes of the relation are key such that **“Sector” is in BCNF.**

#### 17. **IPO** relation :-

❖ Attributes :-

IPO {IPO\_Name , Open\_Date , CIN , Issue Price , Close Date , Lot Size , Issue Price , Minimum Invest , Listing Date}

❖ Functional Dependencies :-

IPO\_Name  $\rightarrow$  CIN  
IPO\_Name  $\rightarrow$  Open\_Date  
IPO\_Name  $\rightarrow$  Issue Price  
IPO\_Name  $\rightarrow$  Close Date  
IPO\_Name  $\rightarrow$  Lot Size  
IPO\_Name  $\rightarrow$  Issue Price  
IPO\_Name  $\rightarrow$  Minimum Invest  
IPO\_Name  $\rightarrow$  Listing Date

Let  $X = \text{IPO\_Name}$

$X^+ = \{\text{IPO\_Name}, \text{Open\_Date}, \text{CIN}, \text{Issue Price}, \text{Close Date}, \text{Lot Size}, \text{Issue Price}, \text{Minimum Invest}, \text{Listing Date}\}$

Such that **Primary Key** = {IPO\_Name, Open\_Date}

The left side of all the FD's in the minimal set of FD's for the relation 'IPO' is { IPO\_Name , Open\_Date }, which is the primary Key of this relation. Such that **“IPO” is in BCNF.**

18. News relation :-

❖ Attributes :-

News {CIN , Title , Description}

❖ Functional Dependencies :-

{CIN , Title}  $\rightarrow$  Description

Let  $X = \{\text{CIN}, \text{Title}\}$

$X^+ = \{\text{CIN}, \text{Title}, \text{Link}, \text{Description}\}$

Such that **Primary Key** = {CIN , Title}

The left side of all the FD's in the minimal set of FD's for the relation 'News' is {CIN , Title}, which is the primary Key of this relation. Such that **“News” is in BCNF.**