

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”.

Account	Bank_Info
❖ 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 = 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 = 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 = Order_ID

$X^+ = \{\text{Order_ID , Order_time , Stop_Price , Status , User_ID , Stock_Symbol}\}$

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 theorem , 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

{User_ID , Stock_Symbol , Purchase_Time} \rightarrow Qty

Let $X = \{User_ID , Stock_Symbol , Purchase_Time\}$

$X^+ = \{User_ID , Stock_Symbol , Purchase_Time , Invested_Price , Qty\}$

Such that **Primary Key** = { User_ID , Stock_Symbol ,
Purchase_Time }

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

10. **Stocks** relation :-

❖ Attributes :-

Stocks {Stock_Symbol , Name , Type , Highest , Lowest ,
Exchange , CIN}

❖ Functional Dependencies :-

Stock_Symbol \rightarrow Name

Stock_Symbol \rightarrow Type

Stock_Symbol \rightarrow Highest

Stock_Symbol \rightarrow Lowest

Stock_Symbol \rightarrow Exchange

Stock_Symbol \rightarrow CIN

Let $X = Stock_Symbol$

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

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} \rightarrow Price

{Stock_Symbol, Time_Stamp} \rightarrow Open_Price

{Stock_Symbol, Time_Stamp} \rightarrow Previous Close

{Stock_Symbol, Time_Stamp} \rightarrow Inc/Dec

{Stock_Symbol, Time_Stamp} \rightarrow 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_symbol , Group_Name , Lowest , Highest , Price , Open Price , Close Price , Stock_Exchange}

❖ Functional Dependencies :-

Group_symbol \rightarrow Lowest
Group_symbol \rightarrow Highest
Group_symbol \rightarrow Price
Group_symbol \rightarrow Open Price
Group_symbol \rightarrow Close Price
Group_symbol \rightarrow Stock_Exchange

Let X = Group_symbol

$X^+ = \{ \text{Group_symbol , Group_Name , Lowest , Highest , Price , Open Price , Close Price , Stock_Exchange} \}$

Such that **Primary Key = Group_symbol**

The left side of all the FD's in the minimal set of FD's for the relation 'Stock_Group' is Group_symbol, 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_symbol, Time_Stamp , Inc/Dec , Open Price , Previous Close , Price}

❖ Functional Dependencies :-

{Group_symbol, Time_Stamp} \rightarrow Inc/Dec
{Group_symbol, Time_Stamp} \rightarrow Open Price
{Group_symbol, Time_Stamp} \rightarrow Previous Close
{Group_symbol, Time_Stamp} \rightarrow Price

Let X = {Group_symbol, Time_Stamp}

$X^+ = \{ \text{Group_symbol, Time_Stamp , Inc/Dec , Open Price , Previous Close , Price} \}$

Such that **Primary Key** = {Group_symbol, 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_symbol, 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 $X = CIN$

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

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 → CIN

IPO_Name → Open_Date

IPO_Name → Issue Price

IPO_Name → Close Date

IPO_Name → Lot Size

IPO_Name → Issue Price

IPO_Name → Minimum Invest

IPO_Name → Listing Date

Let X = IPO_Name

$X^+ = \{IPO_Name , Open_Date , CIN , Issue\ Price , Close\ Date , Lot\ Size , Issue\ Price , Minimum\ Invest , Listing\ Date\}$

Such that **Primary Key = IPO_Name**

The left side of all the FD's in the minimal set of FD's for the relation 'IPO' is IPO_Name ,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 $X = \{CIN , Title\}$

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

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.**