Normalization Proofs

Players:

R (Player_ID, DOB, Name, Gender, Nationality, Bowling_Style, Batting_Style)

Minimal FD: Player_ID → DOB Player_ID → Name Player_ID → Gender Player_ID → Nationality Player_ID → Bowling_Style Player_ID → Batting_Style
Key Computation: $(Player\_ID)^+$ = (Player_ID, DOB, Name, Gender, Nationality, Bowling_Style, Batting_Style) Here closure of Player_ID contains all the attributes of the relation, hence Player_ID is the primary key. **Key: Player_ID**
BCNF Proof: For every minimal FD, attribute on the left side is a key, hence the relation is in BCNF.

Player_Stats:

R (Player_ID, Format, Batting_Current_Rank, Batting_Best_Rank, Batting_Innings, Batting_Best, Strike_Rate, Total_Runs, Bowling_Current_Rank, Bowling_Best_Rank, Bowling_Innings, Bowling_Best_Figures, Total_Runs_Conceded, Total_Wickets, All_Rounder_Current_Rank, All_Rounder_Best_Rank)

Minimal FD:

{Player_ID, Format} → Batting_Current_Rank
{Player_ID, Format} → Batting_Best_Rank
{Player_ID, Format} → Batting_Innings
{Player_ID, Format} → Batting_Best
{Player_ID, Format} → Strike_Rate
{Player_ID, Format} → Total_Runs
{Player_ID, Format} → Bowling_Current_Rank
{Player_ID, Format} → Bowling_Best_Rank
{Player_ID, Format} → Bowling_Innings
{Player_ID, Format} → Bowling_Best_Figures
{Player_ID, Format} → Total_Runs_Conceded
{Player_ID, Format} → Total_Wickets
{Player_ID, Format} → All_Rounder_Current_Rank
{Player_ID, Format} → All_Rounder_Best_Rank

Key Computation:

{Player_ID, Format}$^+$ = (Player_ID, Format, Batting_Current_Rank, Batting_Best_Rank, Batting_Innings, Batting_Best, Strike_Rate, Total_Runs, Bowling_Current_Rank, Bowling_Best_Rank, Bowling_Innings, Bowling_Best_Figures, Total_Runs_Conceded, Total_Wickets, All_Rounder_Current_Rank, All_Rounder_Best_Rank)

Here closure of {Player_ID, Format} contains all the attributes of relation, hence {Player_ID, Format} is the primary key.

Key: Player_ID, Format

BCNF Proof:

For every minimal FD, attribute on the left side is a key, hence the relation is in BCNF.

First_team_captain:

R (<u>Match_ID, Team_ID</u>, Captain_ID)

Minimal FD: {Match_ID, Team_ID} → Captain_ID
Key Computation: {Match_ID, Team_ID}$^+$ = (Match_ID, Team_ID, Captain_ID) Here closure of {Match_ID, Team_ID} contains all the attributes of relation, hence {Match_ID, Team_ID} is the primary key. **Key: Match_ID, Team_ID**
BCNF Proof: For every minimal FD, attribute on the left side is a key, hence the relation is in BCNF.

First_team_squad_scorecard:

R (<u>Match_ID, Team_ID, Player_ID</u>, Balls_Played, Runs_Scored, Runs_Conceded, Overs, Wickets_Taken)

Minimal FD: {Match_ID, Team_ID, Player_ID} → Ball_Played {Match_ID, Team_ID, Player_ID} → Runs_Scored {Match_ID, Team_ID, Player_ID} → Runs_Conceded {Match_ID, Team_ID, Player_ID} → Overs {Match_ID, Team_ID, Player_ID} → Wickets_Taken
Key Computation: {Match_ID, Team_ID, Player_ID}$^+$ = (Match_ID, Team_ID, Player_ID, Balls_Played, Runs_Scored, Runs_Conceded, Overs, Wickets_Taken) Here closure of {Match_ID, Team_ID, Player_ID} contains all the attributes of relation, hence {Match_ID, Team_ID, Player_ID} is the primary key. **Key: Match_ID, Team_ID, Player_ID**
BCNF Proof: For every minimal FD, attribute on the left side is a key, hence the relation is in BCNF.

Second_team_captain:

R (Match_ID, Team_ID, Captain_ID)

Minimal FD:

{Match_ID, Team_ID} → Captain_ID

Key Computation:

{Match_ID, Team_ID}$^{+}$ = (Match_ID, Team_ID, Captain_ID)

Here closure of {Match_ID, Team_ID} contains all the attributes of relation, hence {Match_ID, Team_ID} is the primary key.

Key: Match_ID, Team_ID

BCNF Proof:
For every minimal FD, attribute on the left side is a key, hence the relation is in BCNF.

Second_team_squad_scorecard:

R (Match_ID, Team_ID, Player_ID, Balls_Played, Runs_Scored, Runs_Conceded, Overs, Wickets_Taken)

Minimal FD:

{Match_ID, Team_ID, Player_ID} → Ball_Played
{Match_ID, Team_ID, Player_ID} → Runs_Scored
{Match_ID, Team_ID, Player_ID} → Runs_Conceded
{Match_ID, Team_ID, Player_ID} → Overs
{Match_ID, Team_ID, Player_ID} → Wickets_Taken

Key Computation:

{Match_ID, Team_ID, Player_ID}$^{+}$ = (Match_ID, Team_ID, Player_ID, Balls_Played, Runs_Scored, Runs_Conceded, Overs, Wickets_Taken)

Here closure of {Match_ID, Team_ID, Player_ID} contains all the attributes of relation, hence {Match_ID, Team_ID, Player_ID} is the primary key.
Key: Match_ID, Team_ID, Player_ID

BCNF Proof:
For every minimal FD, attribute on the left side is a key, hence the relation is in BCNF.

Matches:

R (Match_ID, Tournament_Name, Year, Date, First_Team_ID, Second_Team_ID, Format, Stadium_Name, Stadium_Location)

Minimal FD:

Match_ID → Tournament_Name
Match_ID → Year
Match_ID → Date
Match_ID → First_Team_ID
Match_ID → Second_Team_ID
Match_ID → Format
Match_ID → Stadium_Name
Match_ID → Stadium_Location

Key Computation:
(Match_ID)$^+$ = (Match_ID, Tournament_Name, Year, Date, First_Team_ID, Second_Team_ID, Format, Stadium_Name, Stadium_Location)

Here closure of Match_ID contains all the attributes of relation, hence Match_ID is the primary key.
Key: Match_ID

BCNF Proof:
For every minimal FD, attribute on the left side is a key, hence the relation is in BCNF.

Stadium:

R (Stadium_Name, Location, Capacity, Year_Established)

Minimal FD:

{Stadium_Name, Location} → Capacity
{Stadium_Name, Location} → Year_Established

Key Computation:
{Stadium_Name, Location}$^+$ = (Stadium_Name, Location, Capacity, Year_Established)
Here closure of {Stadium_Name, Location} contains all the attributes of relation, hence {Stadium_Name, Location} is the primary key.
Key: Stadium_Name, Location

BCNF Proof:
For every minimal FD, attribute on the left side is a key, hence the relation is in BCNF.

Match_Umpires:

R(<u>Match_ID, Umpire_ID</u>)

Minimal FD: {Match_ID,Umpire_ID} → Match_ID (Trivial FD) {Match_ID,Umpire_ID} → Umpire_ID (Trivial FD)
Key Computation: $\{Match\_ID,Umpire\_ID\}^{+}$ →(Match_ID,Umpire_ID) (Trivial) Here closure of {Match_ID,Umpire_ID} contains all the attributes of relation, hence {Match_ID,Umpire_ID} is the primary key. **Key: Match_ID, Umpire_ID**
BCNF Proof: Since both the attributes are keys, due to normal form theorem, the relation is in BCNF.

Recent_Matches:

R(<u>Match_ID</u>, Winning_Team)

Minimal FD: Match_ID → Winning_Team
Key Computation: $(Match\_ID)^{+}$ = (Match_ID,Winning_Team) Here closure of Match_ID contains all the attributes of relation, hence Match_ID is the primary key **Key: Match_ID**
BCNF Proof: For every minimal FD, attribute on the left side is a key, hence the relation is in BCNF.

Ongoing_Match_Live _Score:

R(Match_ID, Overs, Runs, Wickets)

Minimal FD: (Match_ID, Overs) → Runs (Match_ID, Overs) → Wicket
Key Computation: $\{Match\_ID, Overs\}^+$ = (Match_ID, Runs, Overs, Wickets) Here closure of Match_ID, Overs contains all the attributes of relation, hence {Match_ID, Overs} is the primary key. **Key: Match_ID, Overs**
BCNF Proof: For every minimal FD, attribute on the left side is a key, hence the relation is in BCNF.

Umpires:

R(Umpire_ID, Experience, Name, Nationality)

Minimal FD: Umpire_ID → Experience Umpire_ID → Name Umpire_ID → Nationality
Key Computation: $(Umpire\_ID)^+$ = (Umpire_ID, Experience, Name, Nationality) Here closure of Umpire_ID contains all the attributes of relation, hence Umpire_ID is the primary key. **Key: Umpire_ID**
BCNF Proof: For every minimal FD, attribute on the left side is a key, hence the relation is in BCNF.

Team_Stats:

R (Team_ID, Format, Matches_Played, Won, Lost)

Minimal FD:

{Team_ID,Format} → Matches_Played
{Team_ID,Format} → Won
{Team_ID,Format} → Lost

Key Computation:

{Team_ID,Format}$^+$ = (Team_ID, Format, Matches_Played,Won,Lost)

Here closure of Team_ID, Format contains all the attributes of relation, hence {Team_ID, Format} is the primary key.

Key: Team_ID, Format

BCNF Proof:
For every minimal FD, attribute on the left side is a key, hence the relation is in BCNF.

Bookings:

R (Match_ID, Stands, Available_Seats, Price, Booking_Site_Link)

Minimal FD:

{Match_ID,Stands} → Available_Seats
{Match_ID,Stands} → Price
{Match_ID,Stands} → Booking_Site_Link

Key Computation:

{Match_ID,Stands}$^+$ = (Match_ID, Stands, Available_Seats, Price,Booking_Site_Link)

Here closure of Match_ID, Stands contains all the attributes of relation, hence {Match_ID, Stands} is the primary key.

Key: Match_ID, Stands

BCNF Proof:
For every minimal FD, attribute on the left side is a key, hence the relation is in BCNF.

Tournament:

R (<u>Tournament_Name, Year</u>, Streaming_Partner)

Minimal FD: {Tournament_Name, Year} → Streaming_Partner
Key Computation: $\{Tournament\_Name, Year\}^+$ = (Tournament_Name, Year, Streaming_Partner) Here closure of Tournament_Name, Year contains all the attributes of relation, hence {Tournament_Name, Year} is the primary key. **Key: Tournament_Name, Year**
BCNF Proof: For every minimal FD, attribute on the left side is a key, hence the relation is in BCNF.

Team:

R (<u>Team_ID</u>, Team_Name, Head_Coach)

Minimal FD: Team_ID → Team_Name Team_ID → Head_Coach
Key Computation: $(Team\_ID)^+$ = (Team_ID, Team_Name, Head_Coach) Here closure of Team_ID contains all the attributes of relation, hence Team_ID is the primary key. **Key: Team_ID**
BCNF Proof: For every minimal FD, attribute on the left side is a key, hence the relation is in BCNF.