

# Stadium Management System

## Normalization Phase

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## Entity #1:

**Stadiums** (Stadium entity has information regarding stadium type, seats capacity etc)

- a. Stadium ID
- b. Stadium Name
- c. Stadium Type (Football, Cricket, Hockey turf, etc)
- d. Address
- e. Postal Code
- f. Stadium Capacity (seats)
- g. City

### Functional Dependencies:

Stadium ID  $\Rightarrow$  (Stadium Name, Stadium Type, Address, Postal Code, Stadium Capacity)

Stadium Name  $\Rightarrow$  (Stadium Type, Address, Postal Code, Stadium Capacity)

Address  $\Rightarrow$  (Postal Code, City)

{Stadium ID, Stadium Name}  $\Rightarrow$  (Stadium Type, Address, Postal Code, Stadium Capacity)

{Stadium ID, Address}  $\Rightarrow$  (Stadium Name, Postal Code, Stadium Capacity, City)

### Assumptions:

1. Each stadium is of only one type i.e. if, for example, a stadium is of type Cricket, then it can not be of any other type.

### Candidate Keys:

1. Stadium ID
2. Stadium Name
3. Address

### Normal Forms:

Already in 2NF

### 3NF:

Address  $\Rightarrow$  (Postal Code, City) violates 3NF

After Normalization:

*Location* (Address[PK], Postal Code, City)

*Stadium* (Stadium ID[PK], Stadium Name, Stadium Type, Address, Stadium Capacity)

### BCNF:

Already in BCNF

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## Entity #2:

**Teams** (Teams will provide their details before reserving a stadium)

Team ID [PK]

Team Name

No. of Team Members

Team Owner [FK]

### Functional Dependencies:

Team ID  $\Rightarrow$  (Team Name, No. of members, Team owner)

Team Name  $\Rightarrow$  (Team ID, no. of members, Team owner)

Team ID, Team Owner  $\Rightarrow$  (Team Name, No. of Team Members, Team)

### Assumptions:

1. Names of all the teams should be unique

### Candidate Keys:

1. Team ID
2. Team Name

### Normal Forms:

Already in BCNF.

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### Entity #3:

**Team Members** (This entity contains member's details and the team they belongs to)

Member ID (CNIC) [PK]

Team ID (Member belongs to which team) [FK]

Member F\_Name

Member L\_Name

Age

Phone Number

Sex

Role

### Functional Dependencies:

Member ID  $\Rightarrow$  (Team ID, Member F\_Name, Member L\_Name, Age, Phone No., Sex, Role)

Phone Number  $\Rightarrow$  (Member ID)

{Member ID, Team ID}  $\Rightarrow$  (Member F\_Name, Member L\_Name, Age, Phone No., Sex, Role)

### Assumptions:

1. Each member will have only one phone number

### Candidate Keys:

1. Member ID
2. Phone Number

## Normal Forms:

Already in BCNF.

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### **Entity #4:**

**Team Reservation** (Total summary of the reservation of teams i.e. starting and ending time of reservation, team information and the stadium they chose. Furthermore, It will contain the total cost of reservation as well)

- a. Date
- b. Start Time
- c. End Time
- d. Team ID
- e. Stadium ID
- f. Rate/hr
- g. Reservation Hours
- h. Total Cost
- i. Invoice Number

### Functional Dependencies:

{Rate/hr, Reservation hours}  $\Rightarrow$  Total Cost

{Date, Start Time}  $\Rightarrow$  (Team ID, Stadium ID, Invoice Number)

Invoice Number  $\Rightarrow$  (Rate/her, Reservation Hours, total cost)

### Candidate Keys:

1. Date, Start time, End time

## Normal Forms:

### 2NF:

After Normalization:

*(Start Time, End Time, Reservation Hours)*

*(Date, Start Time, End Time, Invoice Number, Team ID, Stadium ID, Rate/hr, Total Cost)*

*(Date, Start Time, End Time)*

**3NF:**

**After Normalization:**

***Billing (Invoice Number[PK], Rate/hr, Total cost)***

***Reservation (Date, StartTime[PK], Invoice Number[FK], TeamID[FK], StadiumID[FK])***

***Duration (Date, StartTime[FK], EndTime, Reservation Hours) [Weak Entity]***

**BCNF:**

**Already in BCNF.**

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## **Entity #5:**

**Tickets** (Ticket entity contains information regarding stadium, and time of the match and ticket price. It will not contain the details of spectators. Ticket price could vary according to types of seats)

- a. Ticket ID
- b. Date
- c. Start Time
- d. Stadium ID
- e. Seat Type (Standard, Economy, First Class)
- f. Ticket Price (according to Seat Type)

### **Functional Dependencies:**

**Ticket ID ⇒ Date, Start Time, Seat Type, Ticket Price**

**Seat Type ⇒ Ticket Price**

### Candidate Keys:

1. Ticket ID

### Normal Forms:

#### 2NF:

Already in 2NF

#### 3NF:

After Normalization:

*Seat* (*Seat Type*[PK], *Ticket Price*)

*Ticket* (*Ticket ID*[PK], *Date*, *Start Time*, *Stadium ID*, *SeatType*[FK])

#### BCNF:

Already in BCNF.

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### **Entity #6:**

**Stadium Staff** (It will contain the information about staff working in the stadium, types of staff and their salary as well)

- a. Staff ID
- b. First Name
- c. Last Name
- d. Job ID (Manager, Supervisor, Gardener, Electrician)
- e. Phone Number
- f. Salary
- g. Hire Date

### Functional Dependencies:

Staff ID ⇒ First Name, Last Name, Role, Phone Number, Salary, Hire Date

Job ID ⇒ Salary

### Candidate Keys:

## 1. Staff ID

### Normal Forms:

#### 2NF:

After Normalization:

*(Staff ID, First Name, Last Name, Role, Phone Number, Salary, Hire Date)*

#### 3NF:

After Normalization:

*Jobs (Role [PK], Salary)*

*Staff (Staff ID [PK], First Name, Last Name, Role [FK], Phone Number, Hire Date)*

#### BCNF:

Already in BCNF.

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### Entities *Before* Normalization:

#### 1. Stadiums

- a. Stadium ID
- b. Stadium Name
- c. Stadium Type (Football, Cricket, Hockey turf, etc)
- d. Address
- e. Postal Code
- f. Stadium Capacity (seats)

#### 2. Teams

- a. Team ID
- b. Team Name
- c. No. of Team Members
- d. Team Owner



### **3. Team Members**

- a. Member ID (CNIC)
- b. Team ID (Member belongs to which team)
- c. Member First Name
- d. Member Last Name
- e. Phone Number
- f. Sex
- g. Position

### **4. Billing**

- a. Invoice Number
- b. Team ID
- c. Rate (per hour)
- d. Reservation Hours
- e. Total Cost

### **5. Team Reservation**

- a. Date
- b. Start Time
- c. End Time
- d. Team ID
- e. Stadium ID
- f. Invoice Number

### **6. Tickets**

- a. Ticket ID
- b. Date
- c. Time
- d. Stadium ID
- e. Seat Type (Lower, Economy, First Class)
- f. Ticket Price (according to Seat Type)

### **7. Stadium Staff**

- a. Staff ID
- b. First Name
- c. Last Name
- d. Role (Manager, Supervisor, Gardener, Electrician)
- e. Phone Number
- f. Salary
- g. Hire Date

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## **Entities After Normalization:**

### **1. Stadium**

- a. Stadium ID [PK]
- b. Stadium Name
- c. Stadium Type
- d. Address [FK]
- e. Stadium Capacity

### **2. Location**

- a. Address [PK]
- b. Postal Code
- c. City

### **3. Teams**

- a. Team ID [PK]
- b. Team Name
- c. No. of Team Members
- d. Team Owner [FK]

### **4. Team Members**

- a. Member ID (CNIC) [PK]
- b. Team ID [FK]
- c. Member F\_Name
- d. Member L\_Name
- e. Age
- f. Phone Number
- g. Sex
- h. Role

### **5. Reservation**

- a. Date, Start Time
- b. Invoice Number
- c. Team ID
- d. Stadium ID

### **6. Billing**

- a. Invoice Number [PK]
- b. Rate/Hr

- c. Total Cost
- 7. Duration (Weak Entity)
  - a. (Date, StartTime) [FK]
  - b. End Time
  - c. Reservation Hours
  - d.
- 8. Seat
  - a. Seat Type [PK]
  - b. Ticket Price
- 9. Ticket
  - a. Ticket ID [PK]
  - b. Date
  - c. Start Time
  - d. Stadium ID
  - e. Seat Type [FK]
- 10. Staff
  - a. Staff ID [PK]
  - b. First Name
  - c. Last Name
  - d. Role [FK]
  - e. Phone Number
  - f. Hire Date
- 11. Jobs
  - a. Role [PK]
  - b. Salary