

# **Normalization Exercise 9**

# Normalization Exercise 9 - Design Document

## Game (UNF)

### Exercise Description:

- Refine the design to conform to the 3<sup>rd</sup> normal form and meet the following business rules and design requirement.

### Business Rules:

- Track college football regular season games.
- There are 7 officials for each college football game.
- A player may play multiple positions. A team may have multiple players for a position.

### Design Requirements:

- Use Crow's Foot Notation

*GameID
DateTime
CollegeID
HostTeam
CollegeName
Stadium
State
City
CoachName
PlayerName
JerseyNumber
PositionID
PositionDescription
PlayerName
JerseyNumber
PositionID
PositionDescription
More players follow ...
CollegeID
VisitingTeam
CollegeName
CoachName
PlayerName
JerseyNumber
PositionID
PositionDescription
More players follow ...
OfficialID
OfficialName
More officials follow ...
Result
Notes

## UNF Game

*Is there a good primary key?*

<b>*GameID</b>
<b>DateTime</b>
<b>CollegeID</b>
<b>HostTeam</b>
<b>CollegeName</b>
<b>Stadium</b>
<b>State</b>
<b>City</b>
<b>CoachName</b>
<b>PlayerName</b>
<b>JerseyNumber</b>
<b>PositionID</b>
<b>PositionDescription</b>
<b>PlayerName</b>
<b>JerseyNumber</b>
<b>PositionID</b>
<b>PositionDescription</b>
<b>More players follow ...</b>
<b>CollegeID</b>
<b>VisitingTeam</b>
<b>CollegeName</b>
<b>CoachName</b>
<b>PlayerName</b>
<b>JerseyNumber</b>
<b>PositionID</b>
<b>PositionDescription</b>
<b>More players follow ...</b>
<b>OfficialID</b>
<b>OfficialName</b>
<b>More officials follow ...</b>
<b>Result</b>
<b>Notes</b>

# Unnormalized Form (UNF)

## Take to 1<sup>st</sup> NF

*Composite Attribute?*  
*Multi-value Attribute?*  
*Repeating Groups?*  
*Many-to-many relationship?*

UNF  
Game

*GameID
DateTime
CollegeID
HostTeam
CollegeName
Stadium
State
City
CoachName
PlayerName
JerseyNumber
PositionID
PositionDescription
PlayerName
JerseyNumber
PositionID
PositionDescription
More players follow ...
CollegeID
VisitingTeam
CollegeName
CoachName
PlayerName
JerseyNumber
PositionID
PositionDescription
More players follow ...
OfficialID
OfficialName
More officials follow ...
Result
Notes

# Unnormalized Form (UNF)

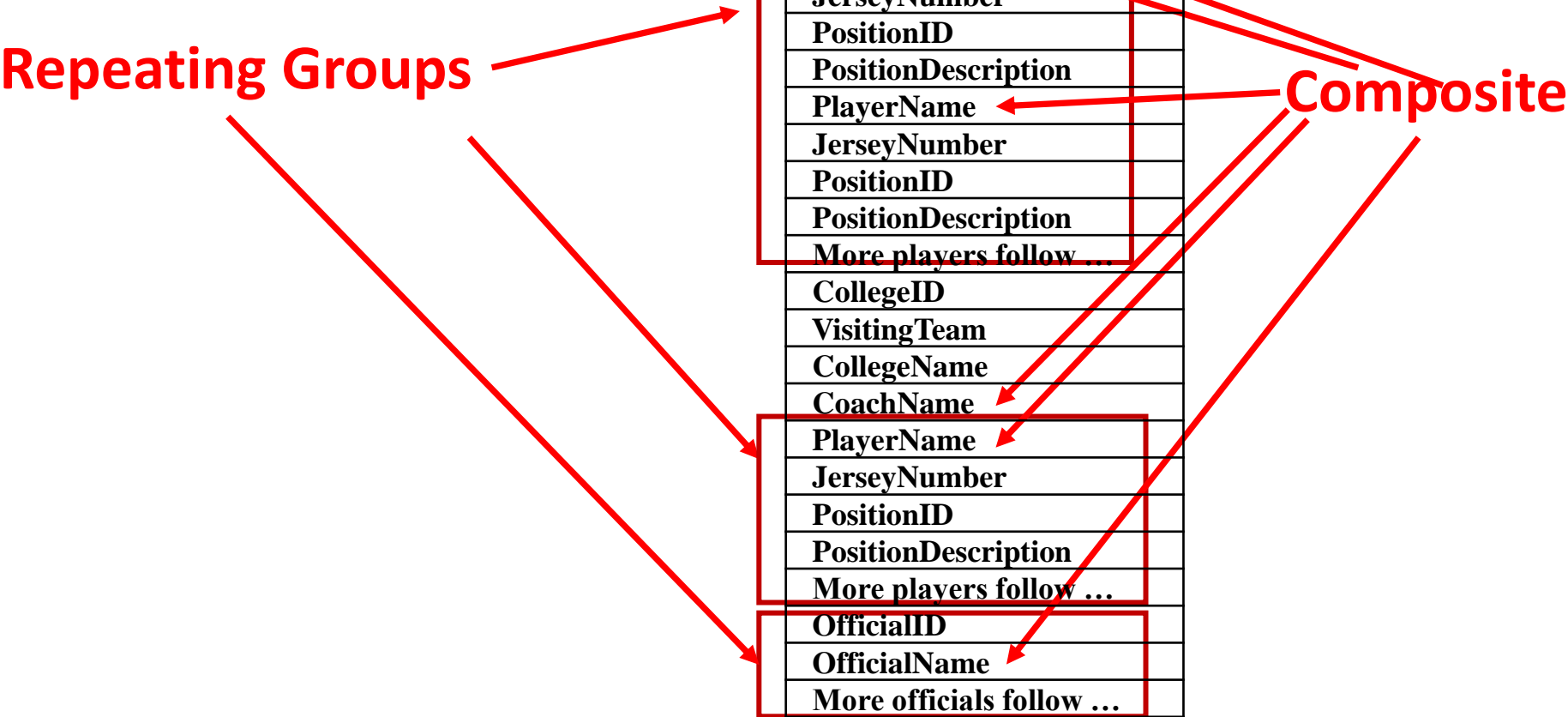
## Take to 1<sup>st</sup> NF

*GameID
DateTime
CollegeID
HostTeam
CollegeName
Stadium
State
City
CoachName
PlayerName
JerseyNumber
PositionID
PositionDescription
PlayerName
JerseyNumber
PositionID
PositionDescription
More players follow ...
CollegeID
VisitingTeam
CollegeName
CoachName
PlayerName
JerseyNumber
PositionID
PositionDescription
More players follow ...
OfficialID
OfficialName
More officials follow ...
Result
Notes

UNF  
Game

Repeating Groups

Composite



# Corrected Composite Attributes and Repeating Groups

**Game**

<b>*GameID</b>
<b>DateTime</b>
<b>CollegeID</b>
<b>HostTeam</b>
<b>CollegeName</b>
<b>Stadium</b>
<b>State</b>
<b>City</b>
<b>CoachLName</b>
<b>CoachFName</b>
<b>CollegeID</b>
<b>VisitingTeam</b>
<b>CollegeName</b>
<b>CoachLName</b>
<b>CoachFName</b>
<b>Result</b>
<b>Notes</b>

**Official**

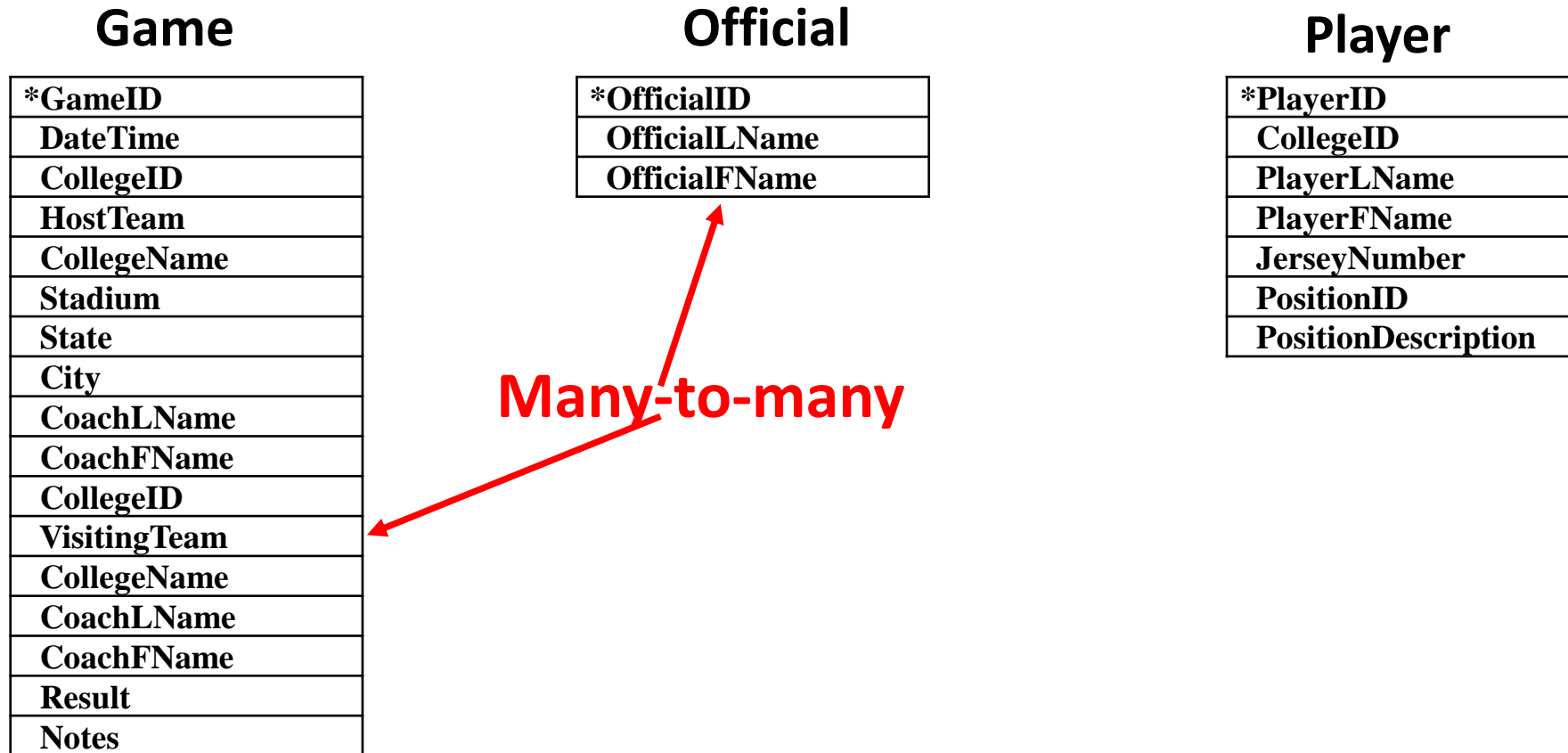
<b>*OfficialID</b>
<b>OfficialLName</b>
<b>OfficialFName</b>

**Player**

<b>*PlayerID</b>
<b>CollegeID</b>
<b>PlayerLName</b>
<b>PlayerFName</b>
<b>JerseyNumber</b>
<b>PositionID</b>
<b>PositionDescription</b>

**Created two new entities and  
decompose composite attributes**

# Go Back to Beginning of Normalization Process



# Corrected Many-to-Many Relationship

## Conform to 1<sup>st</sup> NF

**Game**

<b>*GameID</b>
<b>DateTime</b>
<b>CollegeID</b>
<b>HostTeam</b>
<b>CollegeName</b>
<b>Stadium</b>
<b>State</b>
<b>City</b>
<b>CoachLName</b>
<b>CoachFName</b>
<b>CollegeID</b>
<b>VisitingTeam</b>
<b>CollegeName</b>
<b>CoachLName</b>
<b>CoachFName</b>
<b>Result</b>
<b>Notes</b>

**GameOfficial**

<b>*GameID</b>
<b>*OfficialID</b>

**Official**

<b>*OfficialID</b>
<b>OfficialLName</b>
<b>OfficialFName</b>

**Player**

<b>*PlayerID</b>
<b>CollegeID</b>
<b>PlayerLName</b>
<b>PlayerFName</b>
<b>JerseyNumber</b>
<b>PositionID</b>
<b>PositionDescription</b>

**Created an Associative Entity to correct  
Many-to-Many Relationship**



# First Normal Form (1<sup>st</sup> NF)

## Take to 2<sup>nd</sup> NF Next

**Game**

<b>*GameID</b>
<b>DateTime</b>
<b>CollegeID</b>
<b>HostTeam</b>
<b>CollegeName</b>
<b>Stadium</b>
<b>State</b>
<b>City</b>
<b>CoachLName</b>
<b>CoachFName</b>
<b>CollegeID</b>
<b>VisitingTeam</b>
<b>CollegeName</b>
<b>CoachLName</b>
<b>CoachFName</b>
<b>Result</b>
<b>Notes</b>

**GameOfficial**

<b>*GameID</b>
<b>*OfficialID</b>

**Official**

<b>*OfficialID</b>
<b>OfficialLName</b>
<b>OfficialFName</b>

**Player**

<b>*PlayerID</b>
<b>CollegeID</b>
<b>PlayerLName</b>
<b>PlayerFName</b>
<b>JerseyNumber</b>
<b>PositionID</b>
<b>PositionDescription</b>



*Partial Dependency?*

# Second Normal Form (2nd NF)

## Take to 3rd NF Next

**Game**

<b>*GameID</b>
<b>DateTime</b>
<b>CollegeID</b>
<b>HostTeam</b>
<b>CollegeName</b>
<b>Stadium</b>
<b>State</b>
<b>City</b>
<b>CoachLName</b>
<b>CoachFName</b>
<b>CollegeID</b>
<b>VisitingTeam</b>
<b>CollegeName</b>
<b>CoachLName</b>
<b>CoachFName</b>
<b>Result</b>
<b>Notes</b>

**GameOfficial**

<b>*GameID</b>
<b>*OfficialID</b>

**Official**

<b>*OfficialID</b>
<b>OfficialLName</b>
<b>OfficialFName</b>

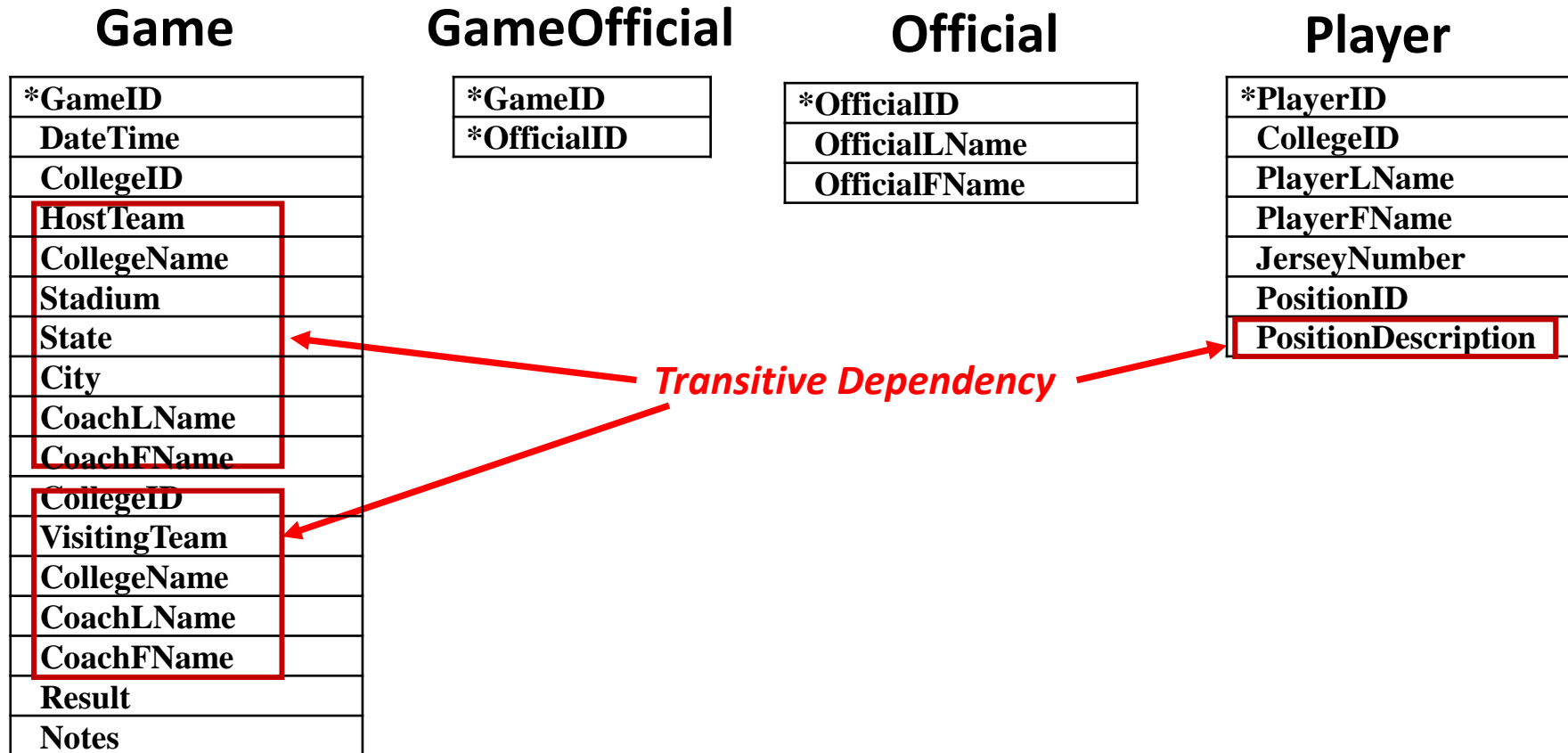
**Player**

<b>*PlayerID</b>
<b>CollegeID</b>
<b>PlayerLName</b>
<b>PlayerFName</b>
<b>JerseyNumber</b>
<b>PositionID</b>
<b>PositionDescription</b>

***Transitive Dependency?***

# Second Normal Form (2nd NF)

## Take to 3rd NF Next



# Corrected Transitive Dependency

## College

<b>*CollegeID</b>
Team
CollegeName
Stadium
State
City
CoachLName
CoachFName

## Game

<b>*GameID</b>
DateTime
HostCollegeID
VisitingCollegeID
Result
Notes

## GameOfficial

<b>*GameID</b>
<b>*OfficialID</b>

## Official

<b>*OfficialID</b>
OfficialLName
OfficialFName

## Player

<b>*PlayerID</b>
CollegeID
PlayerLName
PlayerFName
JerseyNumber

## Position

<b>*PositionID</b>
PositionDescription

**Created two new entities and  
corrected Transitive Dependency**

# Go Back to Beginning of Normalization Process

**College**

<b>*CollegeID</b>
Team
CollegeName
Stadium
State
City
CoachLName
CoachFName

**Game**

<b>*GameID</b>
DateTime
HostCollegeID
VisitingCollegeID
Result
Notes

**GameOfficial**

<b>*GameID</b>
<b>*OfficialID</b>

**Official**

<b>*OfficialID</b>
OfficialLName
OfficialFName

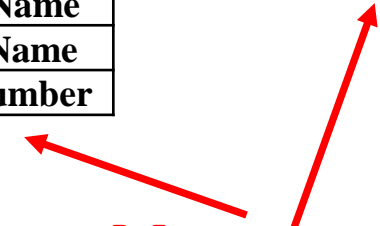
**Player**

<b>*PlayerID</b>
CollegeID
PlayerLName
PlayerFName
JerseyNumber

**Position**

<b>*PositionID</b>
PositionDescription

**Many-to-many**



# Corrected Many-to-Many Conform to 3rd NF

## College

<b>*CollegeID</b>
Team
CollegeName
Stadium
State
City
CoachLName
CoachFName

## Game

<b>*GameID</b>
DateTime
HostCollegeID
VisitingCollegeID
Result
Notes

## GameOfficial

<b>*GameID</b>
<b>*OfficialID</b>

## Official

<b>*OfficialID</b>
OfficialLName
OfficialFName

## Player

<b>*PlayerID</b>
CollegeID
PlayerLName
PlayerFName
JerseyNumber

## Position

<b>*PositionID</b>
PositionDescription

## PlayerPosition

<b>*PlayerID</b>
<b>*PositionID</b>

**Created an Associative Entity to correct  
Many-to-Many Relationship**

# Done with Normalization

## College

<b>*CollegeID</b>
Team
CollegeName
Stadium
State
City
CoachLName
CoachFName

## Game

<b>*GameID</b>
DateTime
HostCollegeID
VisitingCollegeID
Result
Notes

## Official

<b>*OfficialID</b>
OfficialLName
OfficialFName

## Player

<b>*PlayerID</b>
CollegeID
PlayerLName
PlayerFName
JerseyNumber

## Position

<b>*PositionID</b>
PositionDescription

## GameOfficial

<b>*GameID</b>
<b>*OfficialID</b>

## PlayerPosition

<b>*PlayerID</b>
<b>*PositionID</b>

# What To Do Next?

- Create entities in Design Tool
- Don't add any additional entity or attribute
- Establish relationships between entities
- Pay attention to Multiplicity
- Pay attention to type of relationship
  - Identifying vs Non-Identifying
- Avoid unnecessary relationships
- Label PKs and FKs