# Normalization Form

**UNF**

Racer Entity

(

Racer\_ID (PK), Team\_ID (FK), Car\_ID (FK), Championship\_ID (FK), Name, Address, Phone\_Number, Racer\_Nationality, Family

)

Circuit Entity

(

Circuit\_ID (PK), Address, Circuit\_Temperature, Circuit\_Track\_Layout, Circuit\_Construction\_Date

)

Pit\_Stop Entity

(

PS\_ID (PK), *Team\_ID (FK)*, Tire\_Change\_Time, PS\_Fueling\_Time, Racer\_Change\_Time, Repair\_Time,Total\_Time

)

Team Entity

(

Team\_ID (PK), Team\_Name, Owner\_Name, Team\_No\_Of\_Drivers

)

Sponsor Entity

(

Sponsor\_ID (PK), *Team\_Id (FK)*, Name, Sponsor\_Contract\_Duration, Amount, Basic\_Terms

)

Coach Entity

(

Coach\_ID (PK), *Team\_ID (FK)*, Coach\_Name, Address, Phone\_Number, Coach\_Expertise

)

Race Entity

(

Race\_ID (PK), *Circuit\_ID (FK)*, *Championship\_ID (FK)*, Race\_Date, Winner\_F\_Name, Runner\_F\_Name, Temperature, Laps

)

Championship Entity

(

Championship\_ID (PK), Season\_ID, Season\_Name, Winner\_Name, Runner\_Name

)

Car Entity

(

Car\_ID (PK), *Team\_ID* (FK), Car\_Chassis\_Number, Car\_Engine\_Type, Car\_Wheel\_Specifications, Car\_Body\_Modifications, Car\_Performance\_Data, *part\_type (FK)*

)

Engine Entity

(

*Car\_ID* (PK,*FK*), Engine\_Part\_ID (PK), Part\_Name, Count

)

Wheel Entity

(

*Car\_ID* (PK,*FK*), Wheel\_Part\_ID (PK), Part\_Name, Count

)

Body Entity

(

*Car\_ID* (PK,*FK*), Body\_Part\_ID (PK), Part\_Name, Count

)

Racer\_Coach Entity

(

*Racer\_ID* (PK,FK), *Coach\_ID* (PK,FK)

)

Champ\_Team Entity

(

*Championship\_ID* (PK,FK), *Team\_ID* (PK,FK)

)

Circuit\_Team Entity

(

*Circuit\_ID* (PK,FK), *Team\_ID* (PK,FK)

)

Parts Entity

(

Part\_Type (PK), Classification

)

**1NF – 1st Normalization Form**

* Make sure that all the entities have unique primary keys.
* There are some composite attributes identified and changes as follows
  + In Racer entity
    - Name as Racer\_F\_Name and Racer\_L\_Name
    - Address as Address\_1, Address\_2, City, State, Zip\_Code
  + In Circuit entity
    - Address as Address\_1, Address\_2, City, State, Zip\_Code
  + In Team entity
    - Owner\_Name as Team\_Owner\_F\_Name and Team\_Owner\_L\_Name
  + In Sponsor entity
    - Name as Sponsor\_F\_Name and Sponsor\_L\_Name
  + In Coach entity
    - Name as Coach\_F\_Name and Coach\_L\_Name
    - Address as Address\_1, Address\_2, City, State , Zip\_Code
  + In Championship entity
    - Winner\_Name as Winner\_F\_Name and Winner\_L\_Name
    - There are some multi-valued attributes identifies and changed as follows
  + In Racer entity, Family is multi-valued attribute, so a new entity Family is created with appropriate attributes
  + In Race entity, Laps is multi-valued attribute, so a new entity Laps is created with appropriate attributes
  + In Team entity, Technical Staff is multi-valued attribute, so a new entity Technical Staff is created with appropriate attributes

Racer Entity

(

Racer\_ID (PK), *Team\_ID (FK)*, *Car\_ID (FK)*, *Championship\_ID (FK)*, Racer\_F\_Name, Racer\_L\_Name, Address\_1, Address\_2, City, State, Zip\_Code, Phone\_Area\_Code, Phone\_Number, Racer\_Nationality

)

Circuit Entity

(

Circuit\_ID (PK), Address\_1, Address\_2, City, State, Zip\_Code, Circuit\_Temperature, Circuit\_Track\_Layout, Circuit\_Construction\_Date

)

Pit\_Stop Entity

(

PS\_ID (PK), *Team\_ID (FK)*, Tire\_Change\_Time, PS\_Fueling\_Time, Racer\_Change\_Time, Repair\_Time,Total\_Time

)

Team Entity

(

Team\_ID (PK), Team\_Name, Team\_Owner\_F\_Name, Team\_Owner\_L\_Name, Team\_No\_Of\_Drivers

)

Sponsor Entity

(

Sponsor\_ID (PK), *Team\_Id (FK)*, Sponsor\_F\_Name, Sponsor\_L\_Name, Sponsor\_Contract\_Duration, Amount, Basic\_Terms

)

Coach Entity

(

Coach\_ID (PK), *Team\_ID (FK)*, Coach\_F\_Name, Coach\_L\_Name, Address\_1, Address\_2, City, State, Zip\_Code, Phone\_Area\_Code, Phone\_Number, Coach\_Expertise

)

Race Entity

(

Race\_ID (PK), *Circuit\_ID (FK)*, *Championship\_ID (FK)*, Race\_Date, Winner\_F\_Name, Runner\_F\_Name, Temperature

)

Championship Entity

(

Championship\_ID (PK), Season\_ID, Season\_Name, Winner\_F\_Name, Winner\_L\_Name, Runner\_F\_Name, Runner\_L\_Name

)

Car Entity

(

Car\_ID (PK), *Team\_ID* (FK), Car\_Chassis\_Number, Car\_Engine\_Type, Car\_Wheel\_Specifications, Car\_Body\_Modifications, Car\_Performance\_Data

)

Family Entity

(

Family\_ID (PK), *Racer\_ID* (PK,*FK*), First\_Name, Last\_Name, Address\_1, Address\_2, City, State, Zip\_Code, Phone\_Area\_Code, Phone\_Number

)

Laps Entity

(

Lap\_Number (PK), *Race\_ID* (PK,*FK*), Winning\_Team, Winning\_Lap\_Time

)

Technical\_Staff Entity

(

Staff\_ID (PK), *Team\_ID* (PK,*FK*), Domain, First\_Name, Last\_Name

)

Engine Entity

(

*Car\_ID* (PK,*FK*), Engine\_Part\_ID, Part\_Name, Count

)

Wheel Entity

(

*Car\_ID* (PK,*FK*), Wheel\_Part\_ID, Part\_Name, Count

)

Body Entity

(

*Car\_ID* (PK,*FK*), Body\_Part\_ID, Part\_Name, Count

)

**2NF – 2nd Normalization Form**

* All relations must be in 1st Normalization form.
* Partial dependency exists when there is a presence of composite primary key.
* There are no partial dependencies for any entities.
* Carry a copy of the original table key in the isolated part to maintain the link.

Racer Entity

(

Racer\_ID (PK), *Team\_ID (FK)*, *Car\_ID (FK)*, *Championship\_ID (FK)*, Racer\_F\_Name, Racer\_L\_Name, Address\_1, Address\_2, City, State, Zip\_Code, Phone\_Area\_Code, Phone\_Number, Racer\_Nationality

)

Circuit Entity

(

Circuit\_ID (PK), Address\_1, Address\_2, City, State, Zip\_Code, Circuit\_Temperature, Circuit\_Track\_Layout, Circuit\_Construction\_Date

)

Pit\_Stop Entity

(

PS\_ID (PK), *Team\_ID (FK)*, Tire\_Change\_Time, PS\_Fueling\_Time, Racer\_Change\_Time, Repair\_Time,Total\_Time

)

Team Entity

(

Team\_ID (PK), Team\_Name, Team\_Owner\_F\_Name, Team\_Owner\_L\_Name, Team\_No\_Of\_Drivers

)

Sponsor Entity

(

Sponsor\_ID (PK), *Team\_Id (FK)*, Sponsor\_F\_Name, Sponsor\_L\_Name, Sponsor\_Contract\_Duration, Amount, Basic\_Terms

)

Coach Entity

(

Coach\_ID (PK), *Team\_ID (FK)*, Coach\_F\_Name, Coach\_L\_Name, Address\_1, Address\_2, City, State, Zip\_Code, Phone\_Area\_Code, Phone\_Number, Coach\_Expertise

)

Race Entity

(

Race\_ID (PK), *Circuit\_ID (FK)*, *Championship\_ID (FK)*, Race\_Date, Winner\_F\_Name, Runner\_F\_Name, Temperature

)

Championship Entity

(

Championship\_ID (PK), Season\_ID, Season\_Name, Winner\_F\_Name, Winner\_L\_Name, Runner\_F\_Name, Runner\_L\_Name

)

Car Entity

(

Car\_ID (PK), *Team\_ID* (FK), Car\_Chassis\_Number, Car\_Engine\_Type, Car\_Wheel\_Specifications, Car\_Body\_Modifications, Car\_Performance\_Data

)

Family Entity

(

Family\_ID (PK), *Racer\_ID* (PK,*FK*), First\_Name, Last\_Name, Address\_1, Address\_2, City, State, Zip\_Code, Phone\_Area\_Code, Phone\_Number

)

Laps Entity

(

Lap\_Number (PK), *Race\_ID* (PK,*FK*), Winning\_Team, Winning\_Lap\_Time

)

Technical\_Staff Entity

(

Staff\_ID (PK), *Team\_ID* (PK,*FK*), Domain, First\_Name, Last\_Name

)

Engine Entity

(

*Car\_ID* (PK,*FK*), Engine\_Part\_ID, Part\_Name, Count

)

Wheel Entity

(

*Car\_ID* (PK,*FK*), Wheel\_Part\_ID, Part\_Name, Count

)

Body Entity

(

*Car\_ID* (PK,*FK*), Body\_Part\_ID, Part\_Name, Count

)

Racer\_Coach Entity

(

*Racer\_ID* (PK,FK), *Coach\_ID* (PK,FK)

)

Champ\_Team Entity

(

*Championship\_ID* (PK,FK), *Team\_ID* (PK,FK)

)

Circuit\_Team Entity

(

*Circuit\_ID* (PK,FK), *Team\_ID* (PK,FK)

)

Racer\_Coach Entity

(

*Racer\_ID* (PK,FK), *Coach\_ID* (PK,FK)

)

Champ\_Team Entity

(

*Championship\_ID* (PK,FK), *Team\_ID* (PK,FK)

)

Circuit\_Team Entity

(

*Circuit\_ID* (PK,FK), *Team\_ID* (PK,FK)

)

Parts Entity

(

Part\_Type (PK), Classification

)

**3NF – 3rd Normalization Form**

* All relationships must be in 2nd Normalization Form
* When a relation has more than one non-primary attribute, check for transitive dependency.
* All the entities except Racer\_Coach, Champ\_Team, Circuit\_Team, Parts have more than one non-primary attribute, so check for transitive dependency in all entities except Racer\_Coach, Champ\_Team, Circuit\_Team, Parts.
* There aren’t any transitive dependencies in any entity.
* It’s important that the determinant remains on the original table.

Racer Entity

(Racer\_ID (PK), *Team\_ID (FK)*, *Car\_ID (FK)*, *Championship\_ID (FK)*, Racer\_F\_Name, Racer\_L\_Name, Address\_1, Address\_2, City, State, Zip\_Code, Phone\_Area\_Code, Phone\_Number, Racer\_Nationality)

Circuit Entity

(Circuit\_ID (PK), Address\_1, Address\_2, City, State, Zip\_Code, Circuit\_Temperature, Circuit\_Track\_Layout, Circuit\_Construction\_Date)

Pit\_Stop Entity

(PS\_ID (PK), *Team\_ID (FK)*, Tire\_Change\_Time, PS\_Fueling\_Time, Racer\_Change\_Time, Repair\_Time,Total\_Time)

Team Entity

(Team\_ID (PK), Team\_Name, Team\_Owner\_F\_Name, Team\_Owner\_L\_Name, Team\_No\_Of\_Drivers )

Sponsor Entity

(Sponsor\_ID (PK), *Team\_Id (FK)*, Sponsor\_F\_Name, Sponsor\_L\_Name, Sponsor\_Contract\_Duration, Amount, Basic\_Terms)

Coach Entity

(Coach\_ID (PK), *Team\_ID (FK)*, Coach\_F\_Name, Coach\_L\_Name, Address\_1, Address\_2, City, State, Zip\_Code, Phone\_Area\_Code, Phone\_Number, Coach\_Expertise)

Race Entity

(Race\_ID (PK), *Circuit\_ID (FK)*, *Championship\_ID (FK)*, Race\_Date, Winner\_F\_Name, Runner\_F\_Name, Temperature)

Championship Entity

(Championship\_ID (PK), Season\_ID, Season\_Name, Winner\_F\_Name, Winner\_L\_Name, Runner\_F\_Name, Runner\_L\_Name)

Car Entity

(Car\_ID (PK), *Team\_ID* (FK), Car\_Chassis\_Number, Car\_Engine\_Type, Car\_Wheel\_Specifications, Car\_Body\_Modifications, Car\_Performance\_Data)

Family Entity

(Family\_ID (PK), *Racer\_ID* (PK,*FK*), First\_Name, Last\_Name, Address\_1, Address\_2, City, State, Zip\_Code, Phone\_Area\_Code, Phone\_Number)

Laps Entity

(Lap\_Number (PK), *Race\_ID* (PK,*FK*), Winning\_Team, Winning\_Lap\_Time)

Technical\_Staff Entity

(Staff\_ID (PK), *Team\_ID* (PK,*FK*), Domain, First\_Name, Last\_Name)

Engine Entity

(*Car\_ID* (PK,*FK*), Engine\_Part\_ID, Part\_Name, Count)

Wheel Entity

(*Car\_ID* (PK,*FK*), Wheel\_Part\_ID, Part\_Name, Count)

Body Entity

(*Car\_ID* (PK,*FK*), Body\_Part\_ID, Part\_Name, Count)

Racer\_Coach Entity

(*Racer\_ID* (PK,FK), *Coach\_ID* (PK,FK))

Champ\_Team Entity

(*Championship\_ID* (PK,FK), *Team\_ID* (PK,FK))

Circuit\_Team Entity

(*Circuit\_ID* (PK,FK), *Team\_ID* (PK,FK))

Parts Entity

(Part\_Type (PK), Classification)