Project: Investigate a Soccer Database

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Introduction

> **What is Soccer Database?**
> The ultimate Soccer Database is a collection of tables that contain information regarding players, teams, matches, and more.
> I shall first introduce you to the structure of the Tables :

`Country`

Attribute	Type	Describtion
id	integer	table identifier
name	text	country name

`League`

Attribute	Type	Describtion
id	integer	table identifier
country_id	integer	foreign key for country table
name	text	name of league

`Match`

Attribute	Type	Describtion
id	integer	table identifier
country_id	integer	foreign key for country table
league_id	integer	foreign key for the league
season	text	season eg.2018/2019
stage	integer	stage number
date	text	the date of the match
home_team_api_id	integer	the foreign key for the team represents the team who plays in his stadium
away_team_api_id	integer	the foreign key for the team represents the team who doesn't play in his stadium
home_team_goal	integer	number of goals home team has scored in the match
away_team_goal	integer	number of goals away team has scored in the match
home_player_x1	integer	position of the home player x axis
.....	.....	.....
away_player_x1	integer	position of the away player x axis
.....	.....	.....
home_player_y1	integer	position of the home player y axis
.....	.....	.....
away_player_y1	integer	position of the away player y axis
.....	.....	.....
home_player_1	integer	the foreign key for the player table represents the first player of the home team
.....	.....	.....
away_player_1	integer	the foreign key for the player table represents the first player of the away team

shoton	text	XML text to represent the id of each player who made a shot on the target
shotoff	text	XML text to represent the id of each player who made a shot off the target
goal	text	XML text to represent the ids of the players who scored goals and how many
foulcommit	text	XML text to represent the ids of the players who commit fouls
card	text	XML text to represent the ids of the players who took a [yellow-red] card
corner	text	XML text to represent the ids of the players who played corners
possession	text	XML text to represent home and away possession
B365H	numeric	Bookmaker or betting site odds in decimal format
B365D	numeric	Bookmaker or betting site odds in decimal format

Player

Attribute	Type	Describtion
id	integer	table identifier
player_api_id	integer	unique id
palyer_fifa_api_id	integer	unique id
palyer_name	text	name of the player
birthday	text	palyer birthday
weight	integer	weight of the player
height	integer	height of the player

Player_Attributes

Attribute	Type	Describtion
id	integer	table identifier
player_api_id	integer	foreign key for player table
palyer_fifa_api_id	integer	foreign key for player table
date	text	date of the update
overall_rating	integer	fifa rating
potential	integer	fifa rating
preferred_foot	text	fifa rating

Team

Attribute	Type	Describtion
id	integer	table identifier
team_api_id	integer	unique id
team_fifa_api_id	integer	unique id
team_long_name	text	team long name
team_short_name	text	team short name

Team_Attributes

Attribute	Type	Describtion
id	integer	table identifier
team_api_id	integer	foreign key for player table
team_fifa_api_id	integer	foreign key for player table
date	text	date of season

builduppplayspeed	integer	rank from 1 to 100
builduppplayspeedclass	text	classification for build up speed
builduppplaydribbiling	integer	rank from 1 to 100
builduppplaydribbilingclass	text	classification for build up dribbiling
.....	.....	.....

Notes

- the dots ..... in the tables above mean that the next attributes will have the same sequence and i did't mention them to save time
- there isn't a key between team table and player table
- I have used tablesgenerator web (https://www.tablesgenerator.com/markdown_tables#) site to write these tables in the markdown cell
- I have found a lot of information about betting websites her (http://www.football-data.co.uk/notes.txt)

Questions
1) which team has improved through all seasons in Spain LIGA BBVA?
2) How is the player's physical power related to weight and height?
3) How did the number of red cards change from 2008 to 2016?

In [1]:

```
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import seaborn as sns
import os
from sqlalchemy import create_engine
from sqlalchemy.types import Integer
from bs4 import BeautifulSoup
%matplotlib inline
```

Data Wrangling

Sections:

Loading Data

Loading Data is one of the most easiest thing with **sql** ,but reading multiple tables each time we want to answer a question lead to code redundency so in the next cell i will make a two functions to do the following:

- Build a connection to our database
- Load the data into a dataframe
- Convert all the columns names to lowercase and replace spaces with "_"
- the second function will load a dataframe into our database

In [3]:

```
def make_Query(query):
    """This function to make query from database.db
    inputs :
    query ----------> string --------> the query to be done
    outputs:
    df    ----------> dataframe-------> dataframe contains the query result
    """
    # the path of my database
    path = r"C:\Users\Eslam\Desktop\Eslam\Summer\Data analysis Udacity\Professional\Introduction to data analysis
\Project 2\database.sqlite"
    #bulding a connection with create_engine object
    engine = create_engine('sqlite:///'+path)
    df = pd.read_sql(query, engine)
    df.rename(columns = lambda name:name.lower().replace(' ','_'),inplace = True)
    #   types and look for instances of missing or possibly errant data.
    return df
```

In [4]:

```
def load_table( df, name, index = False, datatypes=None):
    """
    this function ask the user for dataframe to load it to our database
    inputs :
    df--------> DataFrame --------> dataframe to be converted into a table in database
    name------> string -----------> name of the table
    index-----> Boolean ----------> specify if the table will come with index or not
    datatypes-----> dictionary -----> specify datatype for each column such that column name is the key
    outputs :
    None
    """
    # the path of my database
    path = r"C:\Users\Eslam\Desktop\Eslam\Summer\Data analysis Udacity\Professional\Introduction to data analysis
\Project 2\database.sqlite"
    #bulding a connection with create_engine object
    engine = create_engine('sqlite:///'+path)
    df.to_sql( name, engine, index = index, dtype = datatypes)
```

In [5]:

```
# first of all let's get the team information
query = """
select ta.* ,t.team_short_name,t.team_long_name from Team_Attributes  ta
JOIN Team t on(ta.team_api_id = t.team_api_id AND ta.team_fifa_api_id = t.team_fifa_api_id) ;
"""
df_teams_info = make_Query(query)
```

In [6]:

```
# let's get all the players information
query = """
select  p.player_name ,p.birthday,p.height,p.weight,pa.*  from Player_Attributes  pa
JOIN Player p on(pa.player_api_id = p.player_api_id AND pa.player_fifa_api_id = p.player_fifa_api_id ) ;
"""
df_players_info = make_Query(query)
```

In [7]:

```
query = """
SELECT  t1.team_short_name as home_team_short_name,t1.team_long_name as home_team_long_name,
t2.team_short_name as away_team_short_name,t2.team_long_name as away_team_long_name,
l.name as league_name,
m.*
FROM   Team t1
JOIN Match m on (t1.team_api_id = m.home_team_api_id)
JOIN Team t2 on (t2.team_api_id = m.away_team_api_id)
JOIN League l on(m.league_id = l.id) ;
"""
df_mathces_info = make_Query(query)
```

General Properties

let's explore our data `shape` , `columns names` , `datatypes` , `null values` , `duplicates and unique values`

In [8]:

```
def explore_dataset(df):
    """
    this function to print the main properties of any data set
    inputs:
    df-----> dataframe ---------> dataframe object
    outputs:
    None
    """
    num_rows = df.shape[0]
    num_columns = df.shape[1]
    column_nulls = df.isnull().sum()
    total_nulls = df.isnull().sum().sum()
    num_duplicates = df.duplicated().sum()
    print("we have {} rows and {} columns ".format(num_rows,num_columns))
    print("\n","_"*50)
    for column in df.columns :
        print("column name :  ",column,"\n")
        print("column datatype :  ",type(df[column][0]),"\n")
        print(" unique values : \n{}\nwith total {}".format(df[column].unique(),df[column].nunique()))
        print("\n","_"*20)
    print("\n","_"*50)
    print("columns with null values count :\n {} \n with total {}".format(column_nulls,total_nulls))
    print("\n","_"*50)
    print("columns with duplicates count :\n{}".format(num_duplicates))
    print("\n","_"*50)
```

Teams Dataset

In [9]:

```
# first 5 rows of data
df_teams_info.head()
```

Out[9]:

	id	team_fifa_api_id	team_api_id	date	buildupplayspeed	buildupplayspeedclass	buildupplaydribbling	buildupplaydribblingclass
0	1	434	9930	2010-02-22 00:00:00	60	Balanced	NaN	Little
1	2	434	9930	2014-09-19 00:00:00	52	Balanced	48.0	Normal
2	3	434	9930	2015-09-10 00:00:00	47	Balanced	41.0	Normal
3	4	77	8485	2010-02-22 00:00:00	70	Fast	NaN	Little
4	5	77	8485	2011-02-22 00:00:00	47	Balanced	NaN	Little

5 rows × 27 columns

In [10]:

```
# teams information dataset
explore_dataset(df_teams_info)
```

```
we have 1458 rows and 27 columns


 __________________________________________________
column name :   id

column datatype :   <class 'numpy.int64'>

 unique values :
[   1    2    3 ... 1456 1457 1458]
with total 1458


 ____________________
column name :   team_fifa_api_id

column datatype :   <class 'numpy.int64'>

 unique values :
[   434     77    614     47   1901    650    245   1861    229   1530
```

```
 111082 111989    159 112513      1      2     39    448    240 100409
     57   1906    241   1848    896     32     21    675   1897   1889
   1714    234     88      3   1926   1898    160    189      4     59
     22     23 111376   1943   1896    190    378   1796    210   1842
    647   1961 112409 110364    450     78   1750 110915      5    192
    231   1867 110747   1799 110502    635    242 110569    180    181
    182    467 110500   1824    468   1746    162    452  10020   2013
      7 111271   1971     79     31 100626   1915    236   1903    286
    894    246 110374 110636     25 111657    144    673 110556    674
   1860 110316   1888 110744 100632 110565 111429 110832    322   1805
    165     62     28    184    485     80 100634 100879    166     81
  10029   1952 111239     44    620 110745     45     29   1832     82
 111083 100081 110724    472   1862     46   1738   1739    347    873
 111091   1871     95  10018     64   1853    239     65      9   1844
    301   2007    217    897     66    169    573    453     10     11
   1893    219     68     12     69   1747     70   1900     83 111560
   1904   1891   1823     71 100737   1910     13     72   1792 112225
    171    477   1564 111540    682    479 100087   1892  10030   1843
     73     50   1754   1914 100741    200 111086 111087 110746   1570
   1790    247     15    456     86    480   1793    449    243    457
    571    203    379     74    744   1905   1838   1902    546     52
    631    874   1819   1837 111974     58   1913     34    324    481
 110770 111092    226     17 100646    670    237    459     48    898
 100805 110329 100804    680    232   1806    106   1960    260   1715
     54     18   1809    294   1908     55   1895    461 110456    462
    206     36    483   1909   1887    665 100651 110913   1795     38
    109     19    681   1917   1907   1873    175    110    435   1742
    900 110749    244 112512  15005]
with total 285


_____________________
column name :   team_api_id

column datatype :   <class 'numpy.int64'>

 unique values :
[  9930   8485   8576   8564  10215  10217   8593   9865   8635   8121
   8322 108893   9912 158085   9825  10252   8524   8315   9906   8406
   8583  10229   8634   9976   9931   8178   9823   9993  10211   9807
   6493   9772   8658   8655   8483   8613   9911   9857   8559   9827
   9789   9788   4170   8678  10264   9858   8521   8191   7819   8529
   7788   8344 208931   8530   9910   9925   9984   9880   8455   8533
   8342   7869   2186   9826   8262   8526   9783   9836   8284   9938
   8457   8372   9776   9810  10268   8534   8398   8558   7842   6351
   8668   4087  10218   8596   8722   6631   8674   9773   9908   9824
  10243  10235   8535   8194   8358   9891   9879   9987  10233   9991
   8305   6391   9764   8569   6433   8019   8020   7878   9956   9855
   8357   9747   9790   8429   9904   9860   9791  10278   8177  10251
   8226   8667   8234   8636   8066   1957   9885   8350   8295   8597
   8245   8571   8203   8306   7730   8543   9746   8682   9888   2182
   8030   8673   8197   6421   8588   8581   9989   8639   8650   8537
   8244   9994   8689  10199   9748   9905   9864   8661   8456  10260
  10212   8592   8550   8549   9829   9998  10249   8348   9927 274581
   9996   9761  10214   8481   9830   9809   8464  10261   9831   9850
   6269   8165   8388   8242   2033   8573   8371   1773   6403   8460
   8540   9847  10167   8426   6413   6547   9878   8028   8033   8023
   8031   2183   8462   8640  10172   8696   8548   8370   9798   8603
   8633   8560   8479   8690   9837   9851   7841  10219   8551   9803
   9999   8686   8649   1601   9853   9882   7943   7794  10228  10189
   9777   8302  10179   8025   9874   8466   8614   9986   9768   9869
   9875  10190   9800   8152   8467   9997   9985  10194   8472  10003
   9867  10191   9804   8586   9941  10242   8611   8600   9771  10267
   9873  10281   9876  10269  10205   8277   7844  10238   9839   8475
   9817   8697   8659   8654  10001   8024   8528   8525  10265   8721
   8602   7955   9868  10192   8021   8394   8027  10000]
with total 288


_____________________
column name :   date

column datatype :   <class 'str'>

 unique values :
['2010-02-22 00:00:00' '2014-09-19 00:00:00' '2015-09-10 00:00:00'
 '2011-02-22 00:00:00' '2012-02-22 00:00:00' '2013-09-20 00:00:00']
with total 6


_____________________
column name :   buildupplayspeed

column datatype :   <class 'numpy.int64'>

 unique values :
```

```
[60 52 47 70 58 62 59 65 45 48 30 53 38 56 40 31 35 55 42 46 50 23 41 39
 69 66 75 25 67 63 64 57 68 43 24 36 61 73 37 51 44 49 71 74 76 54 32 80
 34 72 29 78 33 26 28 20 77]
with total 57


_____________________
column name :   builduppla yspeedclass

column datatype :   <class 'str'>

 unique values :
['Balanced' 'Fast' 'Slow']
with total 3


_____________________
column name :   builduppla ydribbling

column datatype :   <class 'numpy.float64'>

 unique values :
[nan 48. 41. 64. 57. 70. 53. 47. 40. 43. 46. 61. 49. 66. 51. 32. 37. 45.
 52. 50. 38. 55. 35. 63. 30. 29. 34. 24. 39. 31. 60. 44. 36. 56. 54. 33.
 59. 58. 42. 69. 62. 67. 65. 77. 28. 68. 71. 26. 27. 74.]
with total 49


_____________________
column name :   builduppla ydribblingclass

column datatype :   <class 'str'>

 unique values :
['Little' 'Normal' 'Lots']
with total 3


_____________________
column name :   builduppla ypassing

column datatype :   <class 'numpy.int64'>

 unique values :
[50 56 54 70 52 62 45 53 40 30 44 35 47 55 66 38 33 39 65 41 51 37 48 58
 32 29 26 59 72 36 69 49 31 46 34 25 57 22 28 60 79 75 64 73 61 43 27 74
 67 42 68 77 71 63 24 20 23 80]
with total 58


_____________________
column name :   builduppla ypassingclass

column datatype :   <class 'str'>

 unique values :
['Mixed' 'Long' 'Short']
with total 3


_____________________
column name :   builduppla ypositioningclass

column datatype :   <class 'str'>

 unique values :
['Organised' 'Free Form']
with total 2


_____________________
column name :   chancecreationpassing

column datatype :   <class 'numpy.int64'>

 unique values :
[60 54 70 53 45 40 56 51 65 48 55 50 66 30 67 39 58 57 68 35 52 33 49 41
 28 44 63 38 36 61 47 59 37 77 34 21 43 69 32 42 72 46 62 71 64 73 31 80
 76 29]
with total 50


_____________________
column name :   chancecreationpassingclass

column datatype :   <class 'str'>

 unique values :
['Normal' 'Risky' 'Safe']
with total 3
```

```
_____________________
column name :   chancecreationcrossing

column datatype :   <class 'numpy.int64'>

 unique values :
[65 63 70 48 50 68 72 35 34 38 45 60 20 53 36 57 51 67 55 52 64 54 62 40
 33 59 44 30 47 49 78 73 69 74 56 25 24 31 66 46 37 71 61 58 43 26 42 77
 39 41 76 27 80 23 75 32]
with total 56


_____________________
column name :   chancecreationcrossingclass

column datatype :   <class 'str'>

 unique values :
['Normal' 'Lots' 'Little']
with total 3


_____________________
column name :   chancecreationshooting

column datatype :   <class 'numpy.int64'>

 unique values :
[55 64 70 52 57 63 50 75 69 60 65 66 44 38 67 46 39 30 40 47 48 35 43 42
 56 34 51 59 37 36 79 54 49 72 53 68 61 22 41 58 45 76 73 62 80 78 33 32
 71 28 31 23 77 24 27 74 29]
with total 57


_____________________
column name :   chancecreationshootingclass

column datatype :   <class 'str'>

 unique values :
['Normal' 'Lots' 'Little']
with total 3


_____________________
column name :   chancecreationpositioningclass

column datatype :   <class 'str'>

 unique values :
['Organised' 'Free Form']
with total 2


_____________________
column name :   defencepressure

column datatype :   <class 'numpy.int64'>

 unique values :
[50 47 60 40 42 41 49 30 45 38 48 58 52 39 46 57 65 68 64 70 37 53 44 25
 36 35 51 43 55 54 59 33 34 67 66 61 72 32 28 27 23 24 63 31 26 29 56 62]
with total 48


_____________________
column name :   defencepressureclass

column datatype :   <class 'str'>

 unique values :
['Medium' 'Deep' 'High']
with total 3


_____________________
column name :   defenceaggression

column datatype :   <class 'numpy.int64'>

 unique values :
[55 44 70 47 40 42 45 35 50 49 57 30 38 62 58 65 53 68 43 48 32 54 37 39
 41 66 63 67 60 34 61 51 46 72 52 59 56 33 69 71 64 27 28 36 24 31 29]
with total 47


_____________________
column name :   defenceaggressionclass

column datatype :   <class 'str'>
```

```
 unique values :
['Press' 'Double' 'Contain']
with total 3


 _____________________
column name :   defenceteamwidth

column datatype :   <class 'numpy.int64'>

 unique values :
[45 54 70 52 60 63 30 50 53 49 65 61 62 64 59 67 51 35 36 58 57 48 37 55
 68 42 56 41 40 66 47 38 46 43 39 44 33 69 32 34 29 31 73]
with total 43


 _____________________
column name :   defenceteamwidthclass

column datatype :   <class 'str'>

 unique values :
['Normal' 'Wide' 'Narrow']
with total 3


 _____________________
column name :   defencedefenderlineclass

column datatype :   <class 'str'>

 unique values :
['Cover' 'Offside Trap']
with total 2


 _____________________
column name :   team_short_name

column datatype :   <class 'str'>

 unique values :
['AAR' 'ABE' 'AJA' 'ACM' 'ACA' 'HAA' 'ALM' 'AND' 'ANG' 'ARK' 'ARL' 'BIE'
 'ARO' 'ARS' 'AVL' 'ATA' 'BIL' 'AMA' 'AUG' 'AUX' 'ALK' 'BAR' 'BAS' 'LEV'
 'BMU' 'BAC' 'B-M' 'BEL' 'BEN' 'BIR' 'BLB' 'BLA' 'BOA' 'BOC' 'BOL' 'BOR'
 'DOR' 'GLA' 'BOU' 'BRA' 'BRE' 'BUR' 'CAE' 'CAG' 'CAM' 'CAR' 'CAP' 'CAT'
 'CEL' 'CEB' 'CES' 'CHE' 'CHI' 'CLB' 'COR' 'CKR' 'CRY' 'DAR' 'GRA' 'DIJ'
 'DUF' 'DUU' 'DUN' 'EIB' 'EFR' 'ELC' 'EMP' 'COT' 'ESP' 'EST' 'EUP' 'EVE'
 'ETG' 'EXC' 'FAL' 'FCK' 'GRO' 'POR' 'UTR' 'VAD' 'ZUR' 'FEY' 'FIO' 'FDU'
 'FRE' 'FRO' 'FUL' 'GEN' 'GET' 'GAJ' 'GV' 'GAE' 'LEC' 'GOR' 'GRE' 'GRF'
 'GUI' 'HAM' 'HAN' 'HEA' 'HER' 'HBE' 'HIB' 'HOF' 'HUL' 'ING' 'INT' 'INV'
 'BIA' 'JUV' 'KAI' 'KAR' 'KIL' 'KKI' 'KOR' 'MEC' 'LAS' 'LAU' 'LAZ' 'LEH'
 'LEM' 'POZ' 'LGD' 'LEG' 'LEI' 'LEN' 'LIE' 'LIL' 'LIV' 'LOD' 'LOK' 'LOR'
 'LUZ' 'LYO' 'MAI' 'MAL' 'MCI' 'MUN' 'MAR' 'MET' 'MID' 'MON' 'MOR' 'MOT'
 'MOP' 'MOU' 'NAC' 'NAN' 'NAV' 'NEC' 'NEW' 'NIC' 'NOR' 'NOV' 'NUR' 'NUM'
 'ODR' 'OLH' 'OOS' 'OSA' 'O-H' 'FER' 'PAD' 'PAL' 'PSG' 'PAR' 'ZWO' 'PEN'
 'PES' 'PIG' 'POD' 'POG' 'POB' 'PWA' 'PSV' 'QPR' 'SAN' 'RAN' 'RAY' 'REA'
 'BET' 'SOC' 'HUE' 'REG' 'REI' 'REN' 'RA' 'RKC' 'SIE' 'ROD' 'ROS' 'ROM'
 'CHO' 'ETI' 'SAM' 'SAS' 'HEE' 'S04' 'SER' 'SEV' 'SIO' 'SLA' 'SOU' 'SPA'
 'CHA' 'SCP' 'SPG' 'NAP' 'GAL' 'MIR' 'STP' 'JOH' 'STT' 'STL' 'STK' 'SUN'
 'SWA' 'TEN' 'THU' 'TOR' 'TOT' 'TOU' 'TRO' 'TWE' 'UDI' 'ULE' 'VAL' 'VER'
 'STU' 'VIL' 'VIT' 'SET' 'VEN' 'WAA' 'WAT' 'WBR' 'WBA' 'WHU' 'WES' 'WID'
 'WIG' 'WII' 'WIS' 'WOL' 'XAM' 'XER' 'YB' 'ZAG' 'ZAR' 'ZAW' 'ZUL']
with total 251


 _____________________
column name :   team_long_name

column datatype :   <class 'str'>

 unique values :
['FC Aarau' 'Aberdeen' 'AC Ajaccio' 'Milan' 'Académica de Coimbra'
 'ADO Den Haag' 'Ajax' 'UD Almería' 'RSC Anderlecht' 'Angers SCO'
 'Arka Gdynia' 'AC Arles-Avignon' 'DSC Arminia Bielefeld' 'FC Arouca'
 'Arsenal' 'Aston Villa' 'Atalanta' 'Athletic Club de Bilbao'
 'Atlético Madrid' 'FC Augsburg' 'AJ Auxerre' 'AZ' 'FC Barcelona' 'Bari'
 'FC Basel' 'Bayer 04 Leverkusen' 'FC Bayern Munich' 'Beerschot AC'
 'SC Beira Mar' 'CF Os Belenenses' 'AC Bellinzona' 'SL Benfica'
 'Birmingham City' 'Blackburn Rovers' 'Blackpool' 'Boavista FC'
 'VfL Bochum' 'Bologna' 'Bolton Wanderers' 'Girondins de Bordeaux'
 'Borussia Dortmund' 'Borussia Mönchengladbach' "US Boulogne Cote D'Opale"
 'Bournemouth' 'SC Braga' 'Brescia' 'Stade Brestois 29' 'Burnley'
 'SM Caen' 'Cagliari' 'SC Cambuur' 'Cardiff City' 'Carpi' 'Catania'
 'RC Celta de Vigo' 'Celtic' 'KSV Cercle Brugge' 'Cesena' 'Chelsea'
 'Chievo Verona' 'Club Brugge KV' 'Córdoba CF' 'Cracovia' 'Crystal Palace'
 'SV Darmstadt 98' 'De Graafschap' 'RC Deportivo de La Coruña' 'Dijon FCO'
 'Dundee FC' 'Dundee United' 'Dunfermline Athletic' 'SD Eibar'
```

```
 'Eintracht Braunschweig' 'Eintracht Frankfurt' 'Elche CF' 'Empoli'
 'FC Energie Cottbus' 'RCD Espanyol' 'Estoril Praia' 'KAS Eupen' 'Everton'
 'Évian Thonon Gaillard FC' 'Excelsior' 'Falkirk' '1. FC Köln'
 'FC Dordrecht' 'FC Groningen' 'FC Porto' 'FC Utrecht' 'FC Vaduz'
 'FC Zürich' 'Feyenoord' 'Fiorentina' 'Fortuna Düsseldorf' 'SC Freiburg'
 'Frosinone' 'Fulham' 'KRC Genk' 'Genoa' 'KAA Gent' 'Getafe CF'
 'GFC Ajaccio' 'Gil Vicente FC' 'GKS Bełchatów' 'Go Ahead Eagles'
 'Górnik Łęczna' 'Polonia Bytom' 'Granada CF' 'Grasshopper Club Zürich'
 'Grenoble Foot 38' 'SpVgg Greuther Fürth' 'En Avant de Guingamp'
 'Hamburger SV' 'Hamilton Academical FC' 'Hannover 96'
 'Heart of Midlothian' 'Heracles Almelo' 'Hércules Club de Fútbol'
 'Hertha BSC Berlin' 'Hibernian' 'TSG 1899 Hoffenheim' 'Hull City'
 'FC Ingolstadt 04' 'Inter' 'Inverness Caledonian Thistle'
 'Jagiellonia Białystok' 'Juventus' '1. FC Kaiserslautern' 'Karlsruher SC'
 'Kilmarnock' 'Korona Kielce' 'KV Kortrijk' 'KV Mechelen' 'UD Las Palmas'
 'FC Lausanne-Sports' 'Lazio' 'Le Havre AC' 'Le Mans FC' 'Lecce'
 'Lech Poznań' 'Lechia Gdańsk' 'Legia Warszawa' 'Leicester City'
 'Leixões SC' 'RC Lens' 'Levante UD' 'Lierse SK' 'LOSC Lille' 'Liverpool'
 'Livorno' 'Widzew Łódź' 'Sporting Lokeren' 'FC Lorient' 'FC Luzern'
 'Olympique Lyonnais' '1. FSV Mainz 05' 'Málaga CF' 'RCD Mallorca'
 'Manchester City' 'Manchester United' 'CS Marítimo'
 'Olympique de Marseille' 'FC Metz' 'Middlesbrough' 'AS Monaco'
 'RAEC Mons' 'Montpellier Hérault SC' 'Moreirense FC' 'Motherwell'
 'Royal Excel Mouscron' 'NAC Breda' 'CD Nacional' 'AS Nancy-Lorraine'
 'FC Nantes' 'Naval 1° de Maio' 'N.E.C.' 'Newcastle United' 'OGC Nice'
 'Norwich City' 'Novara' '1. FC Nürnberg' 'CD Numancia' 'Odra Wodzisław'
 'S.C. Olhanense' 'KV Oostende' 'CA Osasuna' 'Oud-Heverlee Leuven'
 'FC Paços de Ferreira' 'SC Paderborn 07' 'Palermo' 'Paris Saint-Germain'
 'Parma' 'Partick Thistle F.C.' 'PEC Zwolle' 'FC Penafiel' 'Pescara'
 'Piast Gliwice' 'Podbeskidzie Bielsko-Biała' 'Pogoń Szczecin'
 'P. Warszawa' 'Portsmouth' 'PSV' 'Queens Park Rangers' 'Racing Santander'
 'Rangers' 'Rayo Vallecano' 'Reading' 'Real Betis Balompié'
 'Real Madrid CF' 'Real Sociedad' 'RC Recreativo' 'Reggio Calabria'
 'Stade de Reims' 'Stade Rennais FC' 'Rio Ave FC' 'RKC Waalwijk' 'Siena'
 'Roda JC Kerkrade' 'KSV Roeselare' 'Roma' 'Ross County FC' 'Ruch Chorzów'
 'AS Saint-Étienne' 'Sampdoria' 'Sassuolo' 'SC Bastia' 'SC Heerenveen'
 'FC Schalke 04' 'Servette FC' 'Sevilla FC' 'FC Sion' 'Śląsk Wrocław'
 'FC Sochaux-Montbéliard' 'Southampton' 'Sparta Rotterdam'
 'Sporting Charleroi' 'Sporting CP' 'Real Sporting de Gijón' 'Napoli'
 'FC St. Gallen' 'St. Mirren' 'FC St. Pauli' 'St. Johnstone FC'
 'Sint-Truidense VV' 'Standard de Liège' 'Stoke City' 'Sunderland'
 'Swansea City' 'CD Tenerife' 'FC Thun' 'Torino' 'Tottenham Hotspur'
 'Toulouse FC' 'ES Troyes AC' 'FC Twente' 'Udinese' 'União de Leiria, SAD'
 'Valencia CF' 'Valenciennes FC' 'Real Valladolid' 'Hellas Verona'
 'VfB Stuttgart' 'Villarreal CF' 'Vitesse' 'Vitória Guimarães'
 'Vitória Setúbal' 'VVV-Venlo' 'Waasland-Beveren' 'Watford'
 'SV Werder Bremen' 'West Bromwich Albion' 'West Ham United'
 'KVC Westerlo' 'Wigan Athletic' 'Willem II' 'Wisła Kraków'
 'VfL Wolfsburg' 'Wolverhampton Wanderers' 'Neuchâtel Xamax'
 'Xerez Club Deportivo' 'BSC Young Boys' 'Zagłębie Lubin' 'Real Zaragoza'
 'Zawisza Bydgoszcz' 'SV Zulte-Waregem']
with total 285


 ____________________


 ____________________________________________________
columns with null values count :
 id                                  0
team_fifa_api_id                    0
team_api_id                         0
date                                0
builduppla yspeed                   0
builduppla yspeedclass              0
builduppla ydribbling             969
builduppla ydribblingclass          0
builduppla ypassing                 0
builduppla ypassingclass            0
builduppla ypositioningclass        0
chancecreationpassing               0
chancecreationpassingclass          0
chancecreationcrossing              0
chancecreationcrossingclass         0
chancecreationshooting              0
chancecreationshootingclass         0
chancecreationpositioningclass      0
defencepressure                     0
defencepressureclass                0
defenceaggression                   0
defenceaggressionclass              0
defenceteamwidth                    0
defenceteamwidthclass               0
defencedefenderlineclass            0
team_short_name                     0
```

```
team_long_name                    0
dtype: int64
 with total 969


_____________________________________________________
columns with duplicates count :
0


_____________________________________________________
```

In [11]:

```
# print some summary statistics about this data
df_teams_info.describe()
```

Out[11]:

	id	team_fifa_api_id	team_api_id	buildupplayspeed	buildupplaydribbling	buildupplaypassing	chancecreationpassing
count	1458.000000	1458.000000	1458.000000	1458.000000	489.000000	1458.000000	1458.000000
mean	729.500000	17706.982167	9995.727023	52.462277	48.607362	48.490398	52.165295
std	421.032659	39179.857739	13264.869900	11.545869	9.678290	10.896101	10.360793
min	1.000000	1.000000	1601.000000	20.000000	24.000000	20.000000	21.000000
25%	365.250000	110.000000	8457.750000	45.000000	42.000000	40.000000	46.000000
50%	729.500000	485.000000	8674.000000	52.000000	49.000000	50.000000	52.000000
75%	1093.750000	1900.000000	9904.000000	62.000000	55.000000	55.000000	59.000000
max	1458.000000	112513.000000	274581.000000	80.000000	77.000000	80.000000	80.000000

- it seems that each team appears alot but with different date value
- id,team_fifa_api_id and team_api_id are unnecessary
- date attribute need to be coverted to date datatype
- date attribute ranges from 2010 to 2015
- all the attributes that have class at the end are categorical
- the rest of the attributes are continous random variables
- buildupplaydribbling attribute has a lot of null values so we have to drop it

Players Dataset

In [12]:

```
# first 5 rows of dataset
df_players_info.head()
```

Out[12]:

	player_name	birthday	height	weight	id	player_fifa_api_id	player_api_id	date	overall_rating	potential	...	vision	penalties
0	Aaron Appindangoye	1992-02-29 00:00:00	182.88	187	1	218353	505942	2016-02-18 00:00:00	67.0	71.0	...	54.0	48.0
1	Aaron Appindangoye	1992-02-29 00:00:00	182.88	187	2	218353	505942	2015-11-19 00:00:00	67.0	71.0	...	54.0	48.0
2	Aaron Appindangoye	1992-02-29 00:00:00	182.88	187	3	218353	505942	2015-09-21 00:00:00	62.0	66.0	...	54.0	48.0
3	Aaron Appindangoye	1992-02-29 00:00:00	182.88	187	4	218353	505942	2015-03-20 00:00:00	61.0	65.0	...	53.0	47.0
4	Aaron Appindangoye	1992-02-29 00:00:00	182.88	187	5	218353	505942	2007-02-22 00:00:00	61.0	65.0	...	53.0	47.0

5 rows × 46 columns

In [13]:

```
# players information dataset
explore_dataset(df_players_info)
```

```
we have 183766 rows and 46 columns


_____________________________________________________
column name :   player_name
```

```
column datatype :   <class 'str'>

 unique values :
['Aaron Appindangoye' 'Aaron Cresswell' 'Aaron Doran' ... 'Zsolt Low'
 'Zurab Khizanishvili' 'Zvjezdan Misimovic']
with total 10848


 _____________________
column name :   birthday

column datatype :   <class 'str'>

 unique values :
['1992-02-29 00:00:00' '1989-12-15 00:00:00' '1991-05-13 00:00:00' ...
 '1996-01-10 00:00:00' '1986-12-18 00:00:00' '1979-04-29 00:00:00']
with total 5762


 _____________________
column name :   height

column datatype :   <class 'numpy.float64'>

 unique values :
[182.88 170.18 172.72 165.1  190.5  175.26 187.96 177.8  185.42 180.34
 200.66 198.12 193.04 167.64 195.58 162.56 203.2  160.02 157.48 208.28]
with total 20


 _____________________
column name :   weight

column datatype :   <class 'numpy.int64'>

 unique values :
[187 146 163 198 154 161 139 181 170 150 168 143 176 159 185 172 165 157
 179 174 212 218 190 148 152 141 132 201 183 205 194 137 203 196 126 192
 134 214 130 209 128 207 216 123 220 225 227 117 243 121]
with total 50


 _____________________
column name :   id

column datatype :   <class 'numpy.int64'>

 unique values :
[     1      2      3 ... 183976 183977 183978]
with total 183766


 _____________________
column name :   player_fifa_api_id

column datatype :   <class 'numpy.int64'>

 unique values :
[218353 189615 186170 ... 111191  47058 102359]
with total 11060


 _____________________
column name :   player_api_id

column datatype :   <class 'numpy.int64'>

 unique values :
[505942 155782 162549 ...  36491  35506  39902]
with total 11060


 _____________________
column name :   date

column datatype :   <class 'str'>

 unique values :
['2016-02-18 00:00:00' '2015-11-19 00:00:00' '2015-09-21 00:00:00'
 '2015-03-20 00:00:00' '2007-02-22 00:00:00' '2016-04-21 00:00:00'
 '2016-04-07 00:00:00' '2016-01-07 00:00:00' '2015-12-24 00:00:00'
 '2015-12-17 00:00:00' '2015-10-16 00:00:00' '2015-09-25 00:00:00'
 '2015-01-09 00:00:00' '2014-12-05 00:00:00' '2014-11-07 00:00:00'
 '2014-09-18 00:00:00' '2014-05-02 00:00:00' '2014-04-04 00:00:00'
 '2014-03-14 00:00:00' '2013-12-13 00:00:00' '2013-11-08 00:00:00'
 '2013-10-04 00:00:00' '2013-09-20 00:00:00' '2013-05-03 00:00:00'
 '2013-03-22 00:00:00' '2013-03-15 00:00:00' '2013-02-22 00:00:00'
 '2013-02-15 00:00:00' '2012-08-31 00:00:00' '2012-02-22 00:00:00'
 '2011-08-30 00:00:00' '2010-08-30 00:00:00' '2010-02-22 00:00:00'
 '2009-08-30 00:00:00' '2009-02-22 00:00:00' '2008-08-30 00:00:00'
```

```
 '2015-10-09 00:00:00' '2014-12-12 00:00:00' '2014-04-18 00:00:00'
 '2014-01-31 00:00:00' '2013-11-29 00:00:00' '2013-05-31 00:00:00'
 '2013-04-26 00:00:00' '2013-04-19 00:00:00' '2013-04-05 00:00:00'
 '2013-03-08 00:00:00' '2011-02-22 00:00:00' '2015-10-02 00:00:00'
 '2015-07-03 00:00:00' '2015-06-12 00:00:00' '2015-01-16 00:00:00'
 '2014-11-14 00:00:00' '2014-06-06 00:00:00' '2014-04-11 00:00:00'
 '2013-05-10 00:00:00' '2007-08-30 00:00:00' '2015-05-08 00:00:00'
 '2015-04-10 00:00:00' '2014-01-17 00:00:00' '2016-04-28 00:00:00'
 '2016-02-25 00:00:00' '2015-09-04 00:00:00' '2014-02-28 00:00:00'
 '2014-02-14 00:00:00' '2013-10-18 00:00:00' '2016-02-04 00:00:00'
 '2014-10-02 00:00:00' '2015-06-05 00:00:00' '2015-02-06 00:00:00'
 '2014-03-21 00:00:00' '2014-02-07 00:00:00' '2013-11-01 00:00:00'
 '2013-05-24 00:00:00' '2016-01-28 00:00:00' '2014-12-27 00:00:00'
 '2014-10-31 00:00:00' '2014-10-10 00:00:00' '2015-12-03 00:00:00'
 '2015-11-26 00:00:00' '2015-10-30 00:00:00' '2014-01-03 00:00:00'
 '2013-03-01 00:00:00' '2016-01-21 00:00:00' '2015-11-06 00:00:00'
 '2015-05-22 00:00:00' '2015-05-15 00:00:00' '2015-02-13 00:00:00'
 '2015-01-30 00:00:00' '2014-09-19 00:00:00' '2013-11-22 00:00:00'
 '2014-04-25 00:00:00' '2013-12-27 00:00:00' '2016-04-14 00:00:00'
 '2015-11-12 00:00:00' '2015-03-06 00:00:00' '2013-12-20 00:00:00'
 '2016-03-10 00:00:00' '2016-03-03 00:00:00' '2014-12-19 00:00:00'
 '2013-12-06 00:00:00' '2013-10-25 00:00:00' '2013-10-11 00:00:00'
 '2013-09-27 00:00:00' '2013-08-16 00:00:00' '2015-02-27 00:00:00'
 '2015-01-02 00:00:00' '2014-01-10 00:00:00' '2016-05-12 00:00:00'
 '2016-01-14 00:00:00' '2016-06-23 00:00:00' '2013-03-28 00:00:00'
 '2016-03-17 00:00:00' '2014-07-18 00:00:00' '2013-06-07 00:00:00'
 '2015-01-23 00:00:00' '2015-05-29 00:00:00' '2014-05-16 00:00:00'
 '2014-05-09 00:00:00' '2013-04-12 00:00:00' '2014-10-24 00:00:00'
 '2014-11-28 00:00:00' '2014-11-26 00:00:00' '2013-05-17 00:00:00'
 '2016-06-09 00:00:00' '2016-03-24 00:00:00' '2015-03-27 00:00:00'
 '2014-03-28 00:00:00' '2014-03-07 00:00:00' '2014-02-21 00:00:00'
 '2014-01-24 00:00:00' '2015-12-10 00:00:00' '2016-03-31 00:00:00'
 '2015-04-17 00:00:00' '2015-04-01 00:00:00' '2008-02-22 00:00:00'
 '2015-02-20 00:00:00' '2016-05-05 00:00:00' '2016-02-11 00:00:00'
 '2014-11-21 00:00:00' '2014-07-25 00:00:00' '2013-07-12 00:00:00'
 '2014-10-17 00:00:00' '2013-07-05 00:00:00' '2015-10-23 00:00:00'
 '2015-03-13 00:00:00' '2013-11-15 00:00:00' '2016-02-19 00:00:00'
 '2015-04-24 00:00:00' '2015-08-14 00:00:00' '2016-07-07 00:00:00'
 '2014-05-30 00:00:00' '2014-09-23 00:00:00' '2016-06-02 00:00:00'
 '2016-05-19 00:00:00' '2015-05-01 00:00:00' '2014-05-23 00:00:00'
 '2016-06-16 00:00:00' '2015-03-10 00:00:00' '2013-09-06 00:00:00'
 '2015-10-19 00:00:00' '2013-06-14 00:00:00' '2016-05-26 00:00:00'
 '2015-08-27 00:00:00' '2015-07-31 00:00:00' '2013-08-23 00:00:00'
 '2013-08-30 00:00:00' '2013-08-09 00:00:00' '2015-07-24 00:00:00'
 '2014-08-22 00:00:00' '2014-08-15 00:00:00' '2014-08-08 00:00:00'
 '2013-07-26 00:00:00' '2015-01-26 00:00:00' '2013-06-21 00:00:00'
 '2013-06-28 00:00:00' '2013-08-02 00:00:00' '2013-07-19 00:00:00'
 '2015-07-10 00:00:00' '2014-09-12 00:00:00' '2013-09-13 00:00:00'
 '2015-12-30 00:00:00' '2014-08-29 00:00:00' '2015-08-21 00:00:00'
 '2016-06-30 00:00:00' '2015-07-16 00:00:00' '2014-08-01 00:00:00'
 '2015-08-07 00:00:00' '2013-03-04 00:00:00' '2015-01-28 00:00:00'
 '2014-09-05 00:00:00' '2015-06-19 00:00:00' '2014-09-26 00:00:00'
 '2015-09-10 00:00:00' '2015-06-26 00:00:00' '2015-09-01 00:00:00'
 '2016-02-13 00:00:00' '2014-07-20 00:00:00']
with total 197


 ____________________
column name :   overall_rating

column datatype :   <class 'numpy.float64'>

 unique values :
[67. 62. 61. 74. 73. 71. 70. 69. 68. 65. 64. 54. 51. 52. 47. 53. 66. 59.
 75. 72. 76. 78. 77. 79. 60. 80. 81. 82. 84. 48. 63. 83. 55. 58. 50. 56.
 nan 49. 57. 42. 46. 45. 85. 44. 86. 89. 87. 88. 91. 40. 90. 41. 43. 38.
 93. 92. 39. 33. 36. 37. 35. 94.]
with total 61


 ____________________
column name :   potential

column datatype :   <class 'numpy.float64'>

 unique values :
[71. 66. 65. 76. 75. 77. 78. 79. 80. 68. 64. 60. 67. 70. 72. 69. 82. 73.
 74. 81. 83. 86. 84. 85. 87. 90. 56. 57. 63. 62. 61. nan 59. 55. 58. 53.
 89. 54. 88. 52. 91. 92. 93. 51. 46. 44. 50. 47. 45. 95. 94. 48. 49. 42.
 97. 96. 39.]
with total 56


 ____________________
column name :   preferred_foot
```

```
column datatype :   <class 'str'>

 unique values :
['right' 'left' None]
with total 2


 _____________________
column name :   attacking_work_rate

column datatype :   <class 'str'>

 unique values :
['medium' 'high' None 'low' 'None' 'le' 'norm' 'stoc' 'y']
with total 8


 _____________________
column name :   defensive_work_rate

column datatype :   <class 'str'>

 unique values :
['medium' 'high' 'low' '_0' None '5' 'ean' 'o' '1' 'ormal' '7' '2' '8' '4'
 'tocky' '0' '3' '6' '9' 'es']
with total 19


 _____________________
column name :   crossing

column datatype :   <class 'numpy.float64'>

 unique values :
[49. 48. 80. 79. 78. 77. 74. 58. 57. 22. 64. 65. 67. 69. 72. 73. 63. 56.
 59. 60. 46. 45. 75. 76. 47. 82. 71. 12. 62. 26. 70. 66. 40. 53. 55. 54.
 61. 39. 41. 42. 52. 68. nan 35. 34. 50. 38. 84. 81. 25. 11.  6. 23. 29.
 36. 44. 43. 51. 32. 33. 15. 14.  9. 21. 28. 20. 37. 19. 18. 83.  8. 31.
 24. 92. 10. 30. 27. 86. 90. 88. 13. 17. 85. 87. 16. 91. 93.  3. 89.  7.
  5.  4. 94. 95.  2.  1.]
with total 95


 _____________________
column name :   finishing

column datatype :   <class 'numpy.float64'>

 unique values :
[44. 43. 53. 52. 51. 50. 40. 39. 48. 58. 56. 61. 69. 21. 20. 34. 33. 57.
 72. 73. 74. 71. 77. 79. 32. 31. 66. 65. 67. 68. 70. 62. 64. 15. 42. 41.
 45. 63. 54. 23. 75. 76. 26. 25. 55. 29. 17. 16. 22. 60. 37. nan 30. 49.
 47. 46. 38. 28. 27. 80. 78. 11. 10. 18. 59. 36. 82. 13.  9.  5.  8. 35.
 14. 24. 81. 88. 92. 83. 84. 86. 90. 89. 93. 85. 19.  6.  3. 12.  4. 87.
 91.  7.  2.  1. 95. 94. 97. 96.]
with total 97


 _____________________
column name :   heading_accuracy

column datatype :   <class 'numpy.float64'>

 unique values :
[71. 70. 58. 57. 56. 51. 50. 52. 60. 59. 62. 45. 68. 67. 73. 74. 79. 72.
 76. 64. 65. 66. 47. 46. 28. 27. 38. 49. 16. 61. 82. 42. 54. 53. 63. 55.
 43. 78. 77. 75. 48. 69. 39. 30. 80. nan 81. 84. 13. 25. 12. 23. 41. 44.
 37. 32. 90. 40. 11. 10. 21. 35. 24. 18. 17. 33. 31. 26. 36. 85. 86. 87.
 83. 22. 19. 34. 88. 89. 15.  8. 92. 20. 14.  4. 91.  9.  3. 93. 29.  6.
  7. 95.  5.  1. 94.  2. 98.]
with total 96


 _____________________
column name :   short_passing

column datatype :   <class 'numpy.float64'>

 unique values :
[61. 60. 71. 70. 69. 67. 64. 62. 59. 45. 44. 39. 66. 68. 63. 65. 53. 72.
 54. 79. 80. 75. 77. 78. 76. 23. 73. 84. 74. 58. 57. 52. 42. 83. 82. 85.
 55. 56. 40. 51. 49. nan 43. 47. 48. 34. 33. 41. 35. 81. 46. 25. 38. 16.
 15. 21. 26. 32. 28. 27. 50. 36. 37. 20. 30.  9. 13. 11. 10.  8. 29. 22.
 12. 86. 87. 89. 18. 19. 88. 31. 90. 92. 24.  3. 93. 91. 94. 95. 97. 14.
 17. 96.  7.  6.  5.  4.]
with total 95


 _____________________
column name :   volleys
```

```
column datatype :   <class 'numpy.float64'>

 unique values :
[44. 43. 40. 32. 29. 28. 30. 52. 51. 56. 63. 48. 47. 33. 77. 80. 34. 68.
 67. 69. 14. 60. 59. 65. 64. 57. 25. 61. 79. 81. 78. 76. 74. 73. 70. 42.
 41. 24. 55. 62. 36. 23. 72. nan 58. 31. 66. 37. 46. 45. 49. 13. 39. 50.
 53. 54. 35. 75. 71. 10. 11.  5. 22. 21. 16. 38. 15. 27. 26. 12. 20.  6.
 18. 17.  9. 19. 82. 84. 83. 87. 86. 85.  4.  8.  7.  2. 88. 89.  3. 90.
 91.  1. 93. 92.]
with total 93


 ____________________
column name :   dribbling

column datatype :   <class 'numpy.float64'>

 unique values :
[51. 50. 73. 71. 67. 66. 65. 64. 62. 44. 43. 26. 69. 70. 72. 74. 56. 55.
 59. 60. 52. 47. 46. 48. 53. 63. 78. 80. 79. 81. 82. 77. 54. 84. 83. 85.
 90. 88. 93. 94. 86. 15. 57. 75. 76. 68. 61. 49. 42. 45. 30. 41. 21. 58.
 nan 36. 35. 34. 31. 25. 14.  9. 23. 40. 28. 38. 37. 11. 10.  5. 20. 32.
 19. 18. 87. 33. 12. 89. 39. 16. 27. 22. 92. 13.  7.  8. 29.  1.  6. 91.
 17. 24. 95.  4. 97.  3. 96.  2.]
with total 97


 ____________________
column name :   curve

column datatype :   <class 'numpy.float64'>

 unique values :
[45. 44. 70. 68. 67. 66. 65. 63. 64. 41. 71. 72. 43. 38. 37. 42. 52. 77.
 78. 79. 56. 55. 62. 14. 69. 73. 59. 57. 58. 21. 51. 35. 76. 75. 27. 23.
 22. nan 46. 40. 26. 54. 49. 36. 53. 15. 25. 28. 29. 30. 39. 31. 47. 48.
 50. 33. 32. 61. 60. 80. 83. 81. 12. 18. 17. 34. 74. 20. 84. 82. 86. 85.
 13.  9. 11.  8.  6. 87. 19. 10.  5.  2.  7. 90. 88. 16. 24. 92. 94. 91.
 89.  4. 93.]
with total 92


 ____________________
column name :   free_kick_accuracy

column datatype :   <class 'numpy.float64'>

 unique values :
[39. 38. 69. 68. 43. 42. 26. 63. 62. 64. 41. 40. 25. 24. 81. 76. 74. 73.
 70. 57. 48. 53. 55. 54. 66. 18. 67. 65. 78. 71. 59. 61. 60. 58. 30. 50.
 77. 45. 23. 22. 47. 44. nan 32. 31. 49. 29. 52. 56. 28. 72. 14. 13.  9.
 75. 51. 33. 34. 79. 37. 83. 46. 80. 35. 12. 11. 27. 86. 36. 21. 20. 16.
 15. 82. 91. 87. 88. 84. 17. 19. 89.  6.  8. 85.  7. 10. 90. 93. 95. 96.
 92.  5. 94.  3.  4. 97.  2.  1.]
with total 97


 ____________________
column name :   long_passing

column datatype :   <class 'numpy.float64'>

 unique values :
[64. 63. 68. 67. 65. 46. 45. 49. 62. 61. 53. 57. 58. 54. 60. 55. 70. 48.
 59. 18. 69. 72. 73. 79. 77. 74. 71. 66. 56. 80. 81. 82. 83. 75. 52. 51.
 47. 39. 38. 33. 42. 27. 76. nan 35. 44. 43. 32. 41. 25. 24. 84. 78. 31.
 29. 40. 36. 12. 11. 30. 34. 37. 15. 26. 21. 50. 23. 20. 17. 28. 22.  8.
 14. 13. 85. 86. 87. 16. 19.  7. 90. 92. 94. 95. 96. 97. 89. 88. 10.  5.
 91.  6.  9. 93.  4.  3.]
with total 95


 ____________________
column name :   ball_control

column datatype :   <class 'numpy.float64'>

 unique values :
[49. 48. 71. 70. 68. 67. 66. 65. 64. 43. 42. 34. 73. 72. 74. 54. 62. 61.
 69. 58. 57. 59. 63. 79. 78. 76. 75. 77. 81. 80. 82. 84. 88. 83. 22. 60.
 52. 51. 44. 35. 46. 47. nan 53. 55. 50. 17. 28. 56. 85. 18. 25. 21. 19.
 24. 27. 26. 86. 87. 45. 30. 32. 89. 40. 36. 37. 92. 23. 31. 39. 29. 38.
 41. 13. 14. 10. 20. 15. 11. 91. 90. 94. 33. 16. 12. 93. 95.  6.  9. 96.
  7. 97.  8.  5.]
with total 93


 ____________________
```

```
column name :   acceleration

column datatype :   <class 'numpy.float64'>

 unique values :
[60. 79. 80. 84. 85. 69. 43. 42. 66. 77. 81. 78. 82. 74. 76. 68. 71. 65.
 33. 37. 50. 55. 75. 73. 49. 54. 52. 53. 70. 72. 89. 90. 92. 94. 96. 93.
 95. 15. 63. 67. 64. 51. 34. 61. 56. 83. 62. 57. nan 59. 86. 48. 40. 31.
 26. 36. 47. 87. 88. 44. 58. 91. 41. 35. 46. 39. 32. 25. 45. 29. 30. 18.
 21. 20. 28. 23. 27. 24. 38. 22. 13. 97. 14. 17. 10. 16. 19.]
with total 86


 ____________________
column name :   sprint_speed

column datatype :   <class 'numpy.float64'>

 unique values :
[64. 78. 82. 81. 72. 47. 46. 59. 74. 75. 80. 79. 77. 34. 37. 40. 48. 55.
 57. 61. 73. 31. 53. 54. 71. 69. 67. 89. 91. 95. 93. 94. 92. 90. 26. 65.
 66. 68. 76. 63. 60. 85. 58. 70. 84. 62. nan 49. 88. 83. 87. 86. 56. 52.
 32. 33. 38. 50. 42. 39. 45. 43. 51. 44. 41. 21. 30. 23. 29. 24. 35. 36.
 28. 27. 22. 20. 25. 19. 96. 97. 15. 17. 12. 14. 16. 13.]
with total 85


 ____________________
column name :   agility

column datatype :   <class 'numpy.float64'>

 unique values :
[59. 78. 79. 81. 77. 74. 85. 76. 66. 62. 63. 41. 45. 49. 57. 60. 93. 94.
 88. 31. 69. 72. 67. 55. 71. 68. 82. 75. 70. 73. 44. 48. 33. 36. 80. 86.
 65. 50. 51. nan 56. 46. 47. 83. 34. 53. 87. 58. 32. 42. 52. 35. 91. 90.
 64. 84. 54. 61. 43. 40. 38. 39. 92. 37. 22. 89. 28. 25. 26. 95. 23. 30.
 21. 29. 16. 24. 27. 15. 19. 96. 11. 20.]
with total 81


 ____________________
column name :   reactions

column datatype :   <class 'numpy.float64'>

 unique values :
[47. 46. 67. 71. 69. 70. 66. 62. 61. 65. 51. 50. 57. 56. 64. 68. 80. 77.
 79. 81. 78. 74. 76. 75. 73. 60. 84. 45. 72. 58. 52. 82. 53. 63. 55. 42.
 nan 59. 54. 41. 48. 49. 83. 39. 35. 33. 44. 43. 24. 37. 38. 90. 85. 88.
 32. 40. 22. 23. 36. 87. 86. 89. 34. 26. 31. 29. 92. 91. 27. 30. 96. 28.
 21. 93. 95. 94. 25. 20. 17.]
with total 78


 ____________________
column name :   balance

column datatype :   <class 'numpy.float64'>

 unique values :
[65. 90. 87. 62. 92. 84. 56. 41. 44. 45. 52. 59. 66. 76. 72. 73. 67. 80.
 94. 24. 79. 77. 71. 64. 53. 82. 75. 74. 70. 68. 60. 61. 54. 49. 78. 57.
 63. nan 58. 69. 25. 31. 50. 43. 81. 55. 47. 51. 38. 83. 88. 86. 48. 85.
 40. 30. 37. 36. 28. 33. 42. 29. 32. 34. 39. 91. 35. 27. 95. 93. 89. 46.
 17. 23. 21. 22. 20. 26. 96. 15. 18. 12.]
with total 81


 ____________________
column name :   shot_power

column datatype :   <class 'numpy.float64'>

 unique values :
[55. 54. 71. 70. 65. 48. 47. 61. 60. 56. 62. 67. 74. 64. 59. 68. 76. 78.
 77. 73. 53. 52. 69. 72. 26. 66. 63. 37. 81. 75. 58. 50. 57. 42. 82. nan
 41. 40. 46. 49. 19. 34. 45. 51. 43. 33. 32. 39. 88. 85. 84. 83. 20. 80.
 79. 16. 35. 23. 44. 17. 25. 21. 36. 27. 86. 30. 24. 12. 31. 29. 87. 90.
 89. 93. 94. 96. 38. 28. 22. 14. 11. 18. 91. 13. 15.  6. 10.  8. 92.  9.
 95.  5.  4.  7.  2. 97.  3.]
with total 96


 ____________________
column name :   jumping

column datatype :   <class 'numpy.float64'>
```

```
 unique values :
[58. 85. 84. 77. 73. 64. 48. 65. 71. 56. 70. 69. 67. 78. 83. 81. 52. 38.
 63. 75. 72. 62. 66. 61. 68. 79. 46. 60. 54. nan 74. 57. 43. 76. 51. 55.
 33. 50. 53. 80. 59. 90. 88. 87. 49. 82. 47. 86. 35. 37. 89. 34. 44. 91.
 42. 45. 39. 94. 41. 92. 93. 30. 40. 36. 32. 14. 31. 25. 96. 95. 24. 27.
 26. 29. 28. 19. 20. 21. 23. 22.]
with total 79


 _____________________
column name :   stamina

column datatype :   <class 'numpy.float64'>

 unique values :
[54. 79. 80. 77. 76. 74. 73. 63. 59. 55. 56. 66. 72. 81. 68. 69. 49. 39.
 48. 75. 60. 62. 78. 85. 84. 86. 87. 18. 67. 70. 83. 61. 53. 92. 93. 90.
 58. 64. 65. 50. 47. 71. 88. nan 57. 45. 52. 42. 43. 46. 82. 31. 37. 89.
 35. 36. 34. 51. 33. 40. 21. 27. 41. 44. 91. 28. 22. 38. 30. 32. 29. 25.
 19. 24. 14. 94. 26. 23. 95. 16. 20. 96. 15. 17. 10.]
with total 84


 _____________________
column name :   strength

column datatype :   <class 'numpy.float64'>

 unique values :
[76. 56. 50. 49. 48. 43. 37. 38. 63. 68. 71. 90. 87. 86. 81. 78. 77. 75.
 72. 70. 74. 69. 65. 66. 62. 59. 52. 57. 41. 33. 44. 73. 51. 30. 64. 61.
 82. 47. 60. 45. 67. 40. 79. 55. 58. 83. 53. nan 46. 95. 39. 42. 88. 84.
 85. 89. 91. 54. 80. 31. 92. 94. 22. 21. 35. 93. 32. 27. 34. 36. 29. 28.
 25. 26. 20. 23. 24. 96. 18. 16. 12. 13. 10.]
with total 82


 _____________________
column name :   long_shots

column datatype :   <class 'numpy.float64'>

 unique values :
[35. 34. 62. 60. 59. 58. 56. 55. 54. 53. 57. 51. 52. 61. 76. 67. 63. 29.
 28. 33. 26. 25. 20. 15. 75. 77. 78. 73. 72. 68. 38. 37. 12. 66. 24. 74.
 79. 70. 30. 23. 47. 46. 43. 48. 71. 39. 69. 50. nan 44. 27. 65. 64. 11.
 49. 41. 31. 32. 42. 45. 22. 40. 18. 14. 13.  8. 21. 19. 81. 80. 82. 16.
 84. 10. 83. 85. 88. 90.  6.  9. 86. 91.  5.  3.  4. 36. 87. 93. 17. 89.
  7. 92.  1. 94. 95.  2. 96.]
with total 96


 _____________________
column name :   aggression

column datatype :   <class 'numpy.float64'>

 unique values :
[71. 63. 62. 68. 67. 66. 64. 60. 59. 70. 69. 72. 65. 77. 75. 76. 57. 55.
 51. 49. 36. 74. 56. 37. 46. 24. 21. 73. 78. 30. 45. 44. 43. 53. 54. 41.
 58. 48. 39. 38. 85. 84. 61. 52. 40. nan 80. 79. 83. 81. 87. 91. 89. 90.
 93. 86. 50. 31. 18. 25. 17. 23. 82. 88. 47. 26. 33. 32. 34. 35. 20. 19.
 42. 22. 29. 10. 27. 28. 16. 94. 12. 14. 92. 15. 11. 13.  8. 97. 96.  6.
 95.  9.]
with total 91


 _____________________
column name :   interceptions

column datatype :   <class 'numpy.float64'>

 unique values :
[70. 41. 40. 67. 66. 65. 62. 59. 31. 32. 55. 54. 44. 35. 61. 68. 71. 77.
 80. 81. 83. 74. 56. 57. 37. 36. 60. 73. 19. 64. 63. 58. 45. 43. 39. 69.
 72. 82. 30. 29. 24. 23. 51. 49. 48. 21. 27. 20. 25. 33. 28. 47. 50. 79.
 nan 52. 26. 76. 75. 42. 46. 84. 53. 12. 78. 34. 13. 38. 22. 15. 16. 10.
 18. 85. 11. 14. 17. 87.  7. 88. 93. 86. 92. 90.  9. 91.  8. 89. 95. 96.
 94.  6.  2.  5.  1.  3.  4.]
with total 96


 _____________________
column name :   positioning

column datatype :   <class 'numpy.float64'>

 unique values :
[45. 44. 60. 58. 57. 56. 19. 27. 28. 64. 67. 68. 66. 62. 50. 30. 26. 25.
```

```
 78. 81. 29. 76. 77. 71. 74. 75. 73. 39. 79. 69. 14. 65. 63. 55. 21. 70.
 41. 83. 84. 82. 80. 61. 52. 51. 49. 48. 72. 38. 23. 47. 53. 36. 17. 46.
 31. 54. nan 24. 22. 20. 11. 10. 18. 42. 35. 32. 59. 40. 85. 37. 33. 43.
 13. 12. 16. 15. 34. 87. 88.  4.  3. 89. 91. 95. 86. 90. 93.  5.  8.  9.
  6. 94.  2. 92.  7. 96.]
with total 95


_____________________
column name :   vision

column datatype :   <class 'numpy.float64'>

 unique values :
[54. 53. 66. 65. 64. 61. 58. 63. 47. 38. 68. 71. 72. 73. 67. 41. 40. 60.
 76. 80. 82. 79. 83. 75. 77. 81. 15. 70. 62. 78. 31. 55. 50. 49. 44. 36.
 43. 74. 52. 51. 46. nan 33. 32. 69. 30. 57. 42. 56. 39. 35. 24. 25. 59.
 45. 34. 29. 48. 21. 18. 17. 20. 23. 16. 27. 26. 22. 28. 85. 87. 37. 14.
 10. 84. 12.  9. 13. 86.  2. 89. 90.  7.  5.  6. 19.  8. 94. 95. 96. 92.
 11. 93. 88. 91.  4.  1.  3. 97.]
with total 97


_____________________
column name :   penalties

column datatype :   <class 'numpy.float64'>

 unique values :
[48. 47. 59. 58. 35. 28. 29. 61. 60. 63. 64. 66. 36. 37. 45. 44. 81. 82.
 76. 72. 68. 67. 73. 53. 42. 41. 62. 84. 70. 74. 56. 55. 52. 34. 69. 65.
 75. 71. 79. 54. 40. 39. 50. 85. 80. 32. 31. 22. 46. 57. nan 49. 43. 51.
 77. 38. 20. 25. 33. 83. 21. 78. 18. 17. 27. 86. 30. 12. 88. 94.  7. 16.
 19. 26. 23. 15. 93. 24. 91. 90. 92. 14.  9. 11. 13.  6. 87. 95. 10. 89.
  8.  5.  3.  2. 96.]
with total 94


_____________________
column name :   marking

column datatype :   <class 'numpy.float64'>

 unique values :
[65. 62. 76. 73. 72. 66. 64. 53. 52. 23. 22. 21. 67. 78. 80. 77. 75. 74.
 81. 79. 82. 69. 28. 36. 30. 51. 29. 25. 18. 15. 63. 58. 60. 68. 56. 54.
 59. 57. 35. 34. 46. 43. 42. 61. 32. 26. 70. 13. 20. 47. 45. 83. nan 55.
 19. 44. 38. 17. 71. 48. 37. 39. 24. 14. 33. 49. 50. 12.  9. 31. 40. 27.
 16.  5. 84. 85. 10. 41. 11.  7.  6.  1. 88. 86. 87. 94. 93.  8.  4. 90.
 89. 91. 92.  3.  2. 96.]
with total 95


_____________________
column name :   standing_tackle

column datatype :   <class 'numpy.float64'>

 unique values :
[69. 66. 63. 75. 72. 68. 64. 60. 59. 45. 22. 21. 71. 76. 78. 74. 70. 73.
 79. 80. 83. 34. 37. 30. 27. 25. 58. 56. 33. 23. 29. 15. 65. 62. 61. 54.
 20. 31. 24. 77. 67. 53. 47. 46. 19. 26. 42. 41. 32. 36. 51. 50. 57. 39.
 nan 55. 14. 13. 44. 43. 35. 81. 48. 52. 28. 17. 16. 84. 82. 11. 10. 40.
 18.  9. 12. 86. 85. 87. 88. 49.  8. 38.  2. 89. 90. 93. 95.  7. 91.  5.
 92.  6.  4.  3. 94.  1.]
with total 95


_____________________
column name :   sliding_tackle

column datatype :   <class 'numpy.float64'>

 unique values :
[69. 66. 78. 72. 67. 63. 24. 21. 68. 65. 70. 71. 74. 75. 76. 77. 35. 32.
 29. 57. 56. 34. 25. 14. 12. 61. 60. 62. 73. 51. 44. 43. 17. 54. 52. 37.
 36. 45. 64. 59. 19. 18. 23. 33. 31. 38. 22. 30. nan 40. 53. 42. 55. 27.
 13. 82. 84. 79. 58. 46. 15. 11. 20. 41. 81. 47. 49. 26. 16. 50. 48. 39.
 80. 28. 10.  9. 83. 85.  6.  5.  7.  2.  4. 89. 90. 86. 87.  8. 88. 92.
  3. 91. 93. 94. 95.]
with total 94


_____________________
column name :   gk_diving

column datatype :   <class 'numpy.float64'>

 unique values :
```

```
[ 6.  5. 14. 13. 16. 15.  8.  7. 12.  9. 53. 11. 10. 24. 33. nan  2.  4.
 70. 66. 65. 58.  3. 60. 51. 46. 77. 73. 75. 72. 63. 55. 69. 68. 64. 67.
 74. 71.  1. 80. 79. 78. 56. 61. 62. 49. 76. 59. 57. 20. 81. 22. 21. 31.
 54. 88. 83. 82. 48. 84. 18. 35. 90. 85. 86. 45. 19. 87. 17. 43. 44. 28.
 23. 52. 39. 47. 91. 93. 50. 26. 34. 32. 92. 89. 25. 94. 41. 40. 42. 29.
 27. 30. 36. 37.]
with total 93


 ____________________
column name :   gk_handling

column datatype :   <class 'numpy.float64'>

 unique values :
[11. 10.  7.  6. 22. 21. 12.  5. 20.  9. 13. 25.  8. 41. 15. 14. 23. 30.
 24. nan 16. 63. 62. 59.  4.  3.  2. 61. 49. 44. 71. 66. 72. 67. 56. 46.
 60. 58. 65. 69. 68. 48.  1. 75. 76. 79. 82. 70. 74. 73. 64. 55. 57. 53.
 51. 78. 77. 52. 19. 45. 43. 26. 54. 50. 32. 81. 83. 42. 29. 80. 84. 17.
 47. 86. 88. 18. 28. 87. 85. 91. 35. 92. 93. 90. 37. 27. 33. 89. 39. 36.
 40.]
with total 90


 ____________________
column name :   gk_kicking

column datatype :   <class 'numpy.float64'>

 unique values :
[10.  9.  8. 45. 46. 49. 12. 11. 54. 13. 64. 65. 61. 58. 16. 15. 57. 55.
  7.  6. 63. 48. 14. 59. 39. 73.  5. 79. 75. 72. 67. 21. 38. 33. 47. 52.
 42. 62. 27. 71. 76. nan 35. 53. 43. 51. 69. 44. 60. 66.  3.  2. 56. 70.
 78. 68. 31. 29. 74. 20. 41. 82. 81. 84. 23.  4. 36. 32. 50. 28. 25. 83.
 86. 37. 77. 30. 80. 34. 24. 40. 26.  1. 95. 96. 97. 89. 90. 88. 18. 91.
 22. 19. 87. 85. 94. 92. 93. 17.]
with total 97


 ____________________
column name :   gk_positioning

column datatype :   <class 'numpy.float64'>

 unique values :
[ 8.  7.  9. 22. 21. 12. 11. 20. 10. 16. 15.  6. 14. 13. 25. 51. 31. 24.
 23. nan 70. 65. 64. 39.  5.  3.  2. 19. 18. 62. 58. 63. 71. 72. 68. 60.
 50. 57. 53. 54. 59. 69. 67. 66.  4. 75. 76. 74. 61. 55. 56. 79. 78. 77.
 82. 81. 73. 52. 30. 80. 47. 32. 49. 43. 48. 84. 42.  1. 44. 83. 17. 86.
 85. 87. 88. 45. 28. 46. 92. 38. 93. 91. 90. 94. 34. 41. 89. 96. 35. 27.
 37. 29. 33. 26. 36.]
with total 94


 ____________________
column name :   gk_reflexes

column datatype :   <class 'numpy.float64'>

 unique values :
[ 8.  7. 12. 11. 22. 13. 21. 10. 20.  6. 15. 14.  9. 25. 53. 30.  5. 24.
 23. nan  4. 16. 75. 74.  3.  2. 64. 60. 58. 55. 78. 76. 73. 72. 68. 54.
 69. 63. 62. 66. 56. 80. 86. 85. 84. 81. 79. 52. 70. 18. 67. 71. 65. 59.
 61. 57. 83. 77. 82. 38. 17.  1. 48. 33. 50. 49. 45. 89. 88. 51. 87. 43.
 47. 46. 27. 37. 92. 90. 41. 19. 29. 44. 42. 91. 35. 26. 40. 93. 94. 96.
 32. 34. 31.]
with total 92


 ____________________


 ____________________________________________________
columns with null values count :
 player_name               0
birthday                   0
height                     0
weight                     0
id                         0
player_fifa_api_id         0
player_api_id              0
date                       0
overall_rating           750
potential                750
preferred_foot           750
attacking_work_rate     3144
defensive_work_rate      750
crossing                 750
finishing                750
```

```
heading_accuracy        750
short_passing           750
volleys                2627
dribbling               750
curve                  2627
free_kick_accuracy      750
long_passing            750
ball_control            750
acceleration            750
sprint_speed            750
agility                2627
reactions               750
balance                2627
shot_power              750
jumping                2627
stamina                 750
strength                750
long_shots              750
aggression              750
interceptions           750
positioning             750
vision                 2627
penalties               750
marking                 750
standing_tackle         750
sliding_tackle         2627
gk_diving               750
gk_handling             750
gk_kicking              750
gk_positioning          750
gk_reflexes             750
dtype: int64
 with total 44033
```

```
columns with duplicates count :
0
```

In [14]:

```
# summary statistics
df_players_info.describe()
```

Out[14]:

	height	weight	id	player_fifa_api_id	player_api_id	overall_rating	potential	crossing	1
count	183766.000000	183766.000000	183766.000000	183766.000000	183766.000000	183016.000000	183016.000000	183016.000000	
mean	181.875022	168.769974	91973.292715	165645.222642	135957.515514	68.597522	73.457851	55.081687	
std	6.395603	15.092227	53104.857009	53870.761415	136979.374220	7.041099	6.591720	17.237884	
min	157.480000	117.000000	1.000000	2.000000	2625.000000	33.000000	39.000000	1.000000	
25%	177.800000	159.000000	45986.250000	155715.750000	34763.000000	64.000000	69.000000	45.000000	
50%	182.880000	168.000000	91946.500000	183480.000000	77767.000000	69.000000	74.000000	59.000000	
75%	185.420000	179.000000	137950.750000	199848.000000	191081.000000	73.000000	78.000000	68.000000	
max	208.280000	243.000000	183978.000000	234141.000000	750584.000000	94.000000	97.000000	95.000000	

8 rows × 40 columns

In [15]:

```
# inspect the null values with corresponding player name
df_players_info[df_players_info['heading_accuracy'].isnull()][['player_name']]
```

Out[15]:

	player_name
483	Abdeslam Ouaddou
983	Abel Gomez
1752	Adam Johnson
2089	Adam Rooney
2482	Adil Chihi
...	...
182375	Youssouf Hadji
183037	Zbigniew Malkowski
183097	Zdenek Pospech
183149	Zdravko Kuzmanovic
183275	Ze Roberto

750 rows × 1 columns

In [16]:

```
# we will use the player "Abdeslam Ouaddou" as example
# let's search for heading_accuracy values  for that player
df_players_info.query('player_name == "Abdeslam Ouaddou"')[['heading_accuracy']]
```

Out[16]:

	heading_accuracy
478	70.0
479	80.0
480	80.0
481	80.0
482	80.0
483	NaN

Comment

one of the best ways to solve this problem is to fill null values with the mean value of the same calss
let D be a data set with $C_1, C_2, C_3, \ldots . C_n$ *columns.*
Suppose that C_i *is the class column.Hence, we can devide each column into multiple categories* $G_1, G_2, G_3, \ldots . G_j$
Each category contain a list of elements $e_1, e_2, e_3, \ldots . e_k$ *such that* e_k *is the last element before null value.Hence,we will fill the the null value as follows :*

$e_{k+1} = \sum_{k}^{i=1} \frac{e_i}{k}$

In [17]:

```
# but what about categorical variables ?
# let's inspect the minimum number of occurrences for the players
# notice count ignore null values
print(df_players_info.groupby('player_name')['player_name'].count().min())
```

2

In [18]:

```
# we will use the player "Abdeslam Ouaddou" as example
# let's search for preferred_foot values  for that player
df_players_info.query('player_name == "Abdeslam Ouaddou"')[['preferred_foot']]
```

Out[18]:

	preferred_foot
478	right
479	right
480	right
481	right
482	right
483	None

Comment

We can easily replace the null value with the previous value because we are 100% sure that the minimum number of occurrences of each player is 2

In [19]:

```
# but if all the values is null then it would be impossible that the previous two methods work
# let's give an example
df_players_info.query('player_name == "Abdeslam Ouaddou"')[['vision']]
```

Out[19]:

	vision
478	NaN
479	NaN
480	NaN
481	NaN
482	NaN
483	NaN

Comment

The only two ways to deal with this problem is :
1. drop the records
2. Replace them with the previous available value in the previous column

- it seems that each player appears alot but with different date
- id , player_fifa_api_id and player_api_id are unnecessary so we will drop them
- date , birthday attributes need to be coverted to date datatype
- attacking_work_rate , preferred_foot and defensive_work_rate attributes are categorical
- the rest of the attributes are continous random variables
- The best solution to deal with null values in the numerical attributes here to use linear interpolation or the mean with the previuos player values in the same attribute .
  For Example : "Abdeslam Ouaddou" has only one null value so we can replace it depending on the previous values
- since all players have occurred at least twice then we can use thier previous categorical value to fill nulls
- the player "Abdeslam Ouaddou" all of his vision values are null so i will drop them since no way to fill them

Matches Dataset

In [20]:

```
df_mathces_info.head()
```

Out[20]:

	home_team_short_name	home_team_long_name	away_team_short_name	away_team_long_name	league_name	id	country_id	league_
0	GEN	KRC Genk	BAC	Beerschot AC	Belgium Jupiler League	1	1	
1	ZUL	SV Zulte-Waregem	LOK	Sporting Lokeren	Belgium Jupiler League	2	1	
2	CEB	KSV Cercle Brugge	AND	RSC Anderlecht	Belgium Jupiler League	3	1	
3	GEN	KAA Gent	MON	RAEC Mons	Belgium Jupiler League	4	1	
4	DEN	FCV Dender EH	STL	Standard de Liège	Belgium Jupiler League	5	1	

5 rows × 120 columns

In [21]:

```
explore_dataset(df_mathces_info)
```

```
we have 25979 rows and 120 columns


 ____________________________________________________
column name :   home_team_short_name

column datatype :   <class 'str'>

 unique values :
['GEN' 'ZUL' 'CEB' 'DEN' 'MEC' 'ROS' 'TUB' 'WES' 'CLB' 'STL' 'LOK' 'MOU'
 'BAC' 'AND' 'MON' 'CHA' 'KOR' 'STT' 'LIE' 'EUP' 'O-H' 'WAA' 'OOS' 'MOP'
 'MUN' 'ARS' 'SUN' 'WHU' 'AVL' 'EVE' 'MID' 'BOL' 'HUL' 'CHE' 'STK' 'LIV'
 'NEW' 'FUL' 'TOT' 'WBA' 'POR' 'MCI' 'BLB' 'WIG' 'WOL' 'BUR' 'BIR' 'BLA'
 'QPR' 'NOR' 'SWA' 'REA' 'SOU' 'CRY' 'CAR' 'LEI' 'BOU' 'WAT' 'AUX' 'BOR'
 'LEH' 'LEM' 'LYO' 'NAN' 'REN' 'SOC' 'VAL' 'LIL' 'LOR' 'MAR' 'NIC' 'ETI'
 'TOU' 'CAE' 'GRE' 'PSG' 'LEN' 'ARL' 'BRE' 'AJA' 'DIJ' 'ETG' 'REI' 'TRO'
 'BAS' 'GUI' 'MET' 'ANG' 'GAJ' 'BMU' 'LEV' 'S04' 'EFR' 'BIE' 'COT' 'GLA'
 'KAR' 'HAM' 'WBR' 'HBE' 'FCK' 'BOC' 'DOR' 'STU' 'HAN' 'HOF' 'FRE' 'NUR'
 'MAI' 'KAI' 'STP' 'AUG' 'GRF' 'FDU' 'BRA' 'PAD' 'DAR' 'ING' 'ATA' 'CAG'
 'CAT' 'CHI' 'FIO' 'ACM' 'ROM' 'SAM' 'TOR' 'UDI' 'SIE' 'REG' 'PAL' 'LAZ'
 'JUV' 'NAP' 'LEC' 'INT' 'PAR' 'BAR' 'CES' 'NOV' 'PES' 'VER' 'SAS' 'EMP'
 'FRO' 'CAP' 'VIT' 'ROD' 'WII' 'NEC' 'UTR' 'HER' 'SPA' 'VOL' 'ALK' 'GRA'
 'GRO' 'FEY' 'HAA' 'NAC' 'HEE' 'TWE' 'PSV' 'RKC' 'VEN' 'EXC' 'ZWO' 'CAM'
 'GAE' 'WIS' 'GOR' 'LEG' 'SLA' 'LOD' 'POZ' 'ARK' 'PIG' 'BEL' 'BIA' 'CKR'
 'CHO' 'PWA' 'ODR' 'LGD' 'POB' 'KKI' 'ZAG' 'WID' 'POD' 'POG' 'ZAW' 'TBN'
 'SCP' 'FER' 'AMA' 'RA' 'NAV' 'BEN' 'SET' 'ACA' 'ULE' 'OLH' 'B-M' 'FEI'
 'GV' 'MOR' 'EST' 'ARO' 'PEN' 'BOA' 'MAD' 'TON' 'FAL' 'HEA' 'KIL' 'ABE'
 'CEL' 'DUU' 'INV' 'RAN' 'MOT' 'MIR' 'HIB' 'JOH' 'DUN' 'DUF' 'OSA' 'COR'
 'NUM' 'SAN' 'SPG' 'BET' 'ESP' 'BIL' 'SEV' 'VIL' 'GET' 'MAL' 'ALM' 'HUE'
 'ZAR' 'TEN' 'XER' 'RAY' 'ELC' 'EIB' 'LAS' 'YB' 'AAR' 'LUZ' 'XAM' 'SIO'
 'VAD' 'ZUR' 'GAL' 'THU' 'SER' 'LAU' 'LUG']
with total 259


 ____________________
column name :   home_team_long_name

column datatype :   <class 'str'>

 unique values :
['KRC Genk' 'SV Zulte-Waregem' 'KSV Cercle Brugge' 'KAA Gent'
 'FCV Dender EH' 'KV Mechelen' 'KSV Roeselare' 'Tubize' 'KVC Westerlo'
 'Club Brugge KV' 'Standard de Liège' 'Sporting Lokeren'
 'Royal Excel Mouscron' 'Beerschot AC' 'RSC Anderlecht' 'RAEC Mons'
 'Sporting Charleroi' 'KV Kortrijk' 'Sint-Truidense VV' 'Lierse SK'
 'KAS Eupen' 'Oud-Heverlee Leuven' 'Waasland-Beveren' 'KV Oostende'
 'Manchester United' 'Arsenal' 'Sunderland' 'West Ham United'
 'Aston Villa' 'Everton' 'Middlesbrough' 'Bolton Wanderers' 'Hull City'
 'Chelsea' 'Stoke City' 'Liverpool' 'Newcastle United' 'Fulham'
 'Tottenham Hotspur' 'West Bromwich Albion' 'Portsmouth' 'Manchester City'
 'Blackburn Rovers' 'Wigan Athletic' 'Wolverhampton Wanderers' 'Burnley'
 'Birmingham City' 'Blackpool' 'Queens Park Rangers' 'Norwich City'
 'Swansea City' 'Reading' 'Southampton' 'Crystal Palace' 'Cardiff City'
 'Leicester City' 'Bournemouth' 'Watford' 'AJ Auxerre'
```

```
 'Girondins de Bordeaux' 'Le Havre AC' 'Le Mans FC' 'Olympique Lyonnais'
 'AS Monaco' 'AS Nancy-Lorraine' 'Stade Rennais FC'
 'FC Sochaux-Montbéliard' 'Valenciennes FC' 'LOSC Lille' 'FC Lorient'
 'Olympique de Marseille' 'OGC Nice' 'AS Saint-Étienne' 'Toulouse FC'
 'SM Caen' 'Grenoble Foot 38' 'FC Nantes' 'Paris Saint-Germain'
 'Montpellier Hérault SC' "US Boulogne Cote D'Opale" 'RC Lens'
 'AC Arles-Avignon' 'Stade Brestois 29' 'AC Ajaccio' 'Dijon FCO'
 'Évian Thonon Gaillard FC' 'Stade de Reims' 'ES Troyes AC' 'SC Bastia'
 'En Avant de Guingamp' 'FC Metz' 'Angers SCO' 'GFC Ajaccio'
 'FC Bayern Munich' 'Bayer 04 Leverkusen' 'FC Schalke 04' 'VfL Wolfsburg'
 'Eintracht Frankfurt' 'DSC Arminia Bielefeld' 'FC Energie Cottbus'
 'Borussia Mönchengladbach' 'Karlsruher SC' 'Hamburger SV'
 'SV Werder Bremen' 'Hertha BSC Berlin' '1. FC Köln' 'VfL Bochum'
 'Borussia Dortmund' 'VfB Stuttgart' 'Hannover 96' 'TSG 1899 Hoffenheim'
 'SC Freiburg' '1. FC Nürnberg' '1. FSV Mainz 05' '1. FC Kaiserslautern'
 'FC St. Pauli' 'FC Augsburg' 'SpVgg Greuther Fürth' 'Fortuna Düsseldorf'
 'Eintracht Braunschweig' 'SC Paderborn 07' 'SV Darmstadt 98'
 'FC Ingolstadt 04' 'Atalanta' 'Cagliari' 'Catania' 'Chievo Verona'
 'Fiorentina' 'Milan' 'Roma' 'Sampdoria' 'Torino' 'Udinese' 'Siena'
 'Reggio Calabria' 'Palermo' 'Lazio' 'Juventus' 'Bologna' 'Napoli' 'Lecce'
 'Inter' 'Genoa' 'Livorno' 'Parma' 'Bari' 'Cesena' 'Brescia' 'Novara'
 'Pescara' 'Hellas Verona' 'Sassuolo' 'Empoli' 'Frosinone' 'Carpi'
 'Vitesse' 'Roda JC Kerkrade' 'Willem II' 'N.E.C.' 'FC Utrecht'
 'Heracles Almelo' 'Sparta Rotterdam' 'FC Volendam' 'AZ' 'De Graafschap'
 'Ajax' 'FC Groningen' 'Feyenoord' 'ADO Den Haag' 'NAC Breda'
 'SC Heerenveen' 'FC Twente' 'PSV' 'RKC Waalwijk' 'VVV-Venlo' 'Excelsior'
 'PEC Zwolle' 'SC Cambuur' 'Go Ahead Eagles' 'FC Dordrecht' 'Wisła Kraków'
 'Polonia Bytom' 'Legia Warszawa' 'Śląsk Wrocław' 'Widzew Łódź'
 'Lech Poznań' 'Arka Gdynia' 'Piast Gliwice' 'GKS Bełchatów'
 'Jagiellonia Białystok' 'Cracovia' 'Ruch Chorzów' 'P. Warszawa'
 'Odra Wodzisław' 'Lechia Gdańsk' 'Korona Kielce' 'Zagłębie Lubin'
 'Podbeskidzie Bielsko-Biała' 'Pogoń Szczecin' 'Zawisza Bydgoszcz'
 'Górnik Łęczna' 'Termalica Bruk-Bet Nieciecza' 'FC Porto' 'Sporting CP'
 'Vitória Guimarães' 'FC Paços de Ferreira' 'Amadora' 'Rio Ave FC'
 'Leixões SC' 'Naval 1° de Maio' 'SL Benfica' 'CF Os Belenenses'
 'SC Braga' 'Trofense' 'CS Marítimo' 'Vitória Setúbal' 'CD Nacional'
 'Académica de Coimbra' 'União de Leiria, SAD' 'S.C. Olhanense'
 'SC Beira Mar' 'Portimonense' 'Feirense' 'Gil Vicente FC' 'Moreirense FC'
 'Estoril Praia' 'FC Arouca' 'FC Penafiel' 'Boavista FC'
 'Uniao da Madeira' 'Tondela' 'Falkirk' 'Heart of Midlothian' 'Kilmarnock'
 'Aberdeen' 'Celtic' 'Hamilton Academical FC' 'Dundee United'
 'Inverness Caledonian Thistle' 'Rangers' 'Motherwell' 'St. Mirren'
 'Hibernian' 'St. Johnstone FC' 'Dunfermline Athletic' 'Ross County FC'
 'Dundee FC' 'Partick Thistle F.C.' 'Valencia CF' 'CA Osasuna'
 'RC Deportivo de La Coruña' 'CD Numancia' 'Racing Santander'
 'Real Sporting de Gijón' 'Real Betis Balompié' 'RCD Espanyol'
 'Athletic Club de Bilbao' 'Atlético Madrid' 'Sevilla FC' 'Villarreal CF'
 'Real Madrid CF' 'FC Barcelona' 'Getafe CF' 'RCD Mallorca' 'UD Almería'
 'Málaga CF' 'Real Valladolid' 'RC Recreativo' 'Real Zaragoza'
 'CD Tenerife' 'Xerez Club Deportivo' 'Hércules Club de Fútbol'
 'Levante UD' 'Real Sociedad' 'Rayo Vallecano' 'Granada CF'
 'RC Celta de Vigo' 'Elche CF' 'SD Eibar' 'Córdoba CF' 'UD Las Palmas'
 'Grasshopper Club Zürich' 'BSC Young Boys' 'FC Aarau' 'FC Luzern'
 'Neuchâtel Xamax' 'AC Bellinzona' 'FC Basel' 'FC Sion' 'FC Vaduz'
 'FC Zürich' 'FC St. Gallen' 'FC Thun' 'Servette FC' 'FC Lausanne-Sports'
 'Lugano']
with total 296


_____________________
column name :   away_team_short_name

column datatype :   <class 'str'>

 unique values :
['BAC' 'LOK' 'AND' 'MON' 'STL' 'CLB' 'KOR' 'MOU' 'CHA' 'GEN' 'WES' 'ROS'
 'CEB' 'ZUL' 'DEN' 'TUB' 'MEC' 'STT' 'LIE' 'EUP' 'O-H' 'WAA' 'OOS' 'MOP'
 'NEW' 'WBA' 'LIV' 'WIG' 'MCI' 'BLB' 'TOT' 'STK' 'FUL' 'POR' 'WHU' 'EVE'
 'CHE' 'SUN' 'HUL' 'AVL' 'ARS' 'MUN' 'MID' 'BOL' 'BIR' 'BUR' 'WOL' 'BLA'
 'SWA' 'NOR' 'QPR' 'SOU' 'REA' 'CAR' 'CRY' 'LEI' 'WAT' 'BOU' 'NAN' 'CAE'
 'NIC' 'LOR' 'TOU' 'PSG' 'LIL' 'MAR' 'GRE' 'ETI' 'LYO' 'VAL' 'SOC' 'BOR'
 'LEM' 'LEH' 'AUX' 'REN' 'LEN' 'ARL' 'BRE' 'ETG' 'DIJ' 'AJA' 'BAS' 'TRO'
 'REI' 'GUI' 'MET' 'ANG' 'GAJ' 'HAM' 'DOR' 'HAN' 'FCK' 'HBE' 'WBR' 'HOF'
 'STU' 'BOC' 'LEV' 'GLA' 'BMU' 'COT' 'S04' 'BIE' 'EFR' 'KAR' 'FRE' 'NUR'
 'MAI' 'KAI' 'STP' 'AUG' 'FDU' 'GRF' 'BRA' 'PAD' 'ING' 'DAR' 'SIE' 'LAZ'
 'REG' 'JUV' 'NAP' 'INT' 'LEC' 'PAL' 'FIO' 'TOR' 'CHI' 'CAT' 'ROM' 'SAM'
 'ACM' 'UDI' 'ATA' 'CAG' 'BAR' 'PAR' 'CES' 'NOV' 'PES' 'SAS' 'VER' 'EMP'
 'CAP' 'FRO' 'GRO' 'TWE' 'GRA' 'PSV' 'FEY' 'HAA' 'HEE' 'NAC' 'VIT' 'ROD'
 'SPA' 'VOL' 'UTR' 'HER' 'WII' 'NEC' 'ALK' 'VEN' 'RKC' 'EXC' 'ZWO' 'GAE'
 'CAM' 'POB' 'CHO' 'PWA' 'LGD' 'ODR' 'BEL' 'BIA' 'CKR' 'LOD' 'WIS' 'SLA'
 'ARK' 'PIG' 'GOR' 'POZ' 'LEG' 'ZAG' 'KKI' 'WID' 'POD' 'POG' 'ZAW' 'TBN'
 'SET' 'ACA' 'BEN' 'AMA' 'NAV' 'RA' 'SCP' 'FER' 'OLH' 'ULE' 'B-M' 'FEI'
 'GV' 'MOR' 'EST' 'ARO' 'BOA' 'PEN' 'TON' 'MAD' 'RAN' 'MOT' 'HIB' 'INV'
 'MIR' 'DUU' 'ABE' 'FAL' 'CEL' 'KIL' 'HEA' 'JOH' 'DUN' 'DUF' 'MAL' 'VIL'
```

 'SEV' 'GET' 'HUE' 'ALM' 'SPG' 'BET' 'ESP' 'BIL' 'SAN' 'NUM' 'COR' 'OSA'
 'XER' 'TEN' 'ZAR' 'RAY' 'ELC' 'EIB' 'LAS' 'SIO' 'VAD' 'ZUR' 'YB' 'AAR'
 'LUZ' 'XAM' 'GAL' 'THU' 'LAU' 'SER' 'LUG']
with total 259

---

column name : away_team_long_name

column datatype : <class 'str'>

 unique values :
['Beerschot AC' 'Sporting Lokeren' 'RSC Anderlecht' 'RAEC Mons'
 'Standard de Liège' 'Club Brugge KV' 'KV Kortrijk' 'Royal Excel Mouscron'
 'Sporting Charleroi' 'KAA Gent' 'KVC Westerlo' 'KSV Roeselare'
 'KSV Cercle Brugge' 'KRC Genk' 'SV Zulte-Waregem' 'FCV Dender EH'
 'Tubize' 'KV Mechelen' 'Sint-Truidense VV' 'Lierse SK' 'KAS Eupen'
 'Oud-Heverlee Leuven' 'Waasland-Beveren' 'KV Oostende' 'Newcastle United'
 'West Bromwich Albion' 'Liverpool' 'Wigan Athletic' 'Manchester City'
 'Blackburn Rovers' 'Tottenham Hotspur' 'Stoke City' 'Fulham' 'Portsmouth'
 'West Ham United' 'Everton' 'Chelsea' 'Sunderland' 'Hull City'
 'Aston Villa' 'Arsenal' 'Manchester United' 'Middlesbrough'
 'Bolton Wanderers' 'Birmingham City' 'Burnley' 'Wolverhampton Wanderers'
 'Blackpool' 'Swansea City' 'Norwich City' 'Queens Park Rangers'
 'Southampton' 'Reading' 'Cardiff City' 'Crystal Palace' 'Leicester City'
 'Watford' 'Bournemouth' 'FC Nantes' 'SM Caen' 'OGC Nice' 'FC Lorient'
 'Toulouse FC' 'Paris Saint-Germain' 'LOSC Lille' 'Olympique de Marseille'
 'Grenoble Foot 38' 'AS Saint-Étienne' 'Olympique Lyonnais'
 'Valenciennes FC' 'FC Sochaux-Montbéliard' 'Girondins de Bordeaux'
 'Le Mans FC' 'AS Monaco' 'Le Havre AC' 'AJ Auxerre' 'AS Nancy-Lorraine'
 'Stade Rennais FC' 'RC Lens' "US Boulogne Cote D'Opale"
 'Montpellier Hérault SC' 'AC Arles-Avignon' 'Stade Brestois 29'
 'Évian Thonon Gaillard FC' 'Dijon FCO' 'AC Ajaccio' 'SC Bastia'
 'ES Troyes AC' 'Stade de Reims' 'En Avant de Guingamp' 'FC Metz'
 'Angers SCO' 'GFC Ajaccio' 'Hamburger SV' 'Borussia Dortmund'
 'Hannover 96' '1. FC Köln' 'Hertha BSC Berlin' 'SV Werder Bremen'
 'TSG 1899 Hoffenheim' 'VfB Stuttgart' 'VfL Bochum' 'Bayer 04 Leverkusen'
 'Borussia Mönchengladbach' 'FC Bayern Munich' 'FC Energie Cottbus'
 'FC Schalke 04' 'DSC Arminia Bielefeld' 'VfL Wolfsburg'
 'Eintracht Frankfurt' 'Karlsruher SC' 'SC Freiburg' '1. FC Nürnberg'
 '1. FSV Mainz 05' '1. FC Kaiserslautern' 'FC St. Pauli' 'FC Augsburg'
 'Fortuna Düsseldorf' 'SpVgg Greuther Fürth' 'Eintracht Braunschweig'
 'SC Paderborn 07' 'FC Ingolstadt 04' 'SV Darmstadt 98' 'Siena' 'Lazio'
 'Genoa' 'Reggio Calabria' 'Juventus' 'Bologna' 'Napoli' 'Inter' 'Lecce'
 'Palermo' 'Fiorentina' 'Torino' 'Chievo Verona' 'Catania' 'Roma'
 'Sampdoria' 'Milan' 'Udinese' 'Atalanta' 'Cagliari' 'Bari' 'Parma'
 'Livorno' 'Cesena' 'Brescia' 'Novara' 'Pescara' 'Sassuolo'
 'Hellas Verona' 'Empoli' 'Carpi' 'Frosinone' 'FC Groningen' 'FC Twente'
 'Ajax' 'De Graafschap' 'PSV' 'Feyenoord' 'ADO Den Haag' 'SC Heerenveen'
 'NAC Breda' 'Vitesse' 'Roda JC Kerkrade' 'Sparta Rotterdam' 'FC Volendam'
 'FC Utrecht' 'Heracles Almelo' 'Willem II' 'N.E.C.' 'AZ' 'VVV-Venlo'
 'RKC Waalwijk' 'Excelsior' 'PEC Zwolle' 'Go Ahead Eagles' 'SC Cambuur'
 'FC Dordrecht' 'Polonia Bytom' 'Ruch Chorzów' 'P. Warszawa'
 'Lechia Gdańsk' 'Odra Wodzisław' 'GKS Bełchatów' 'Jagiellonia Białystok'
 'Cracovia' 'Widzew Łódź' 'Wisła Kraków' 'Śląsk Wrocław' 'Arka Gdynia'
 'Piast Gliwice' 'Lech Poznań' 'Legia Warszawa' 'Zagłębie Lubin'
 'Korona Kielce' 'Podbeskidzie Bielsko-Biała' 'Pogoń Szczecin'
 'Zawisza Bydgoszcz' 'Górnik Łęczna' 'Termalica Bruk-Bet Nieciecza'
 'CF Os Belenenses' 'Trofense' 'Vitória Setúbal' 'SC Braga'
 'Académica de Coimbra' 'SL Benfica' 'CD Nacional' 'CS Marítimo'
 'Vitória Guimarães' 'Amadora' 'Naval 1° de Maio' 'Rio Ave FC'
 'Leixões SC' 'Sporting CP' 'FC Porto' 'FC Paços de Ferreira'
 'S.C. Olhanense' 'União de Leiria, SAD' 'Portimonense' 'SC Beira Mar'
 'Feirense' 'Gil Vicente FC' 'Moreirense FC' 'Estoril Praia' 'FC Arouca'
 'Boavista FC' 'FC Penafiel' 'Tondela' 'Uniao da Madeira' 'Rangers'
 'Motherwell' 'Hibernian' 'Inverness Caledonian Thistle' 'St. Mirren'
 'Dundee United' 'Aberdeen' 'Falkirk' 'Hamilton Academical FC' 'Celtic'
 'Kilmarnock' 'Heart of Midlothian' 'St. Johnstone FC'
 'Dunfermline Athletic' 'Dundee FC' 'Ross County FC'
 'Partick Thistle F.C.' 'RCD Mallorca' 'Villarreal CF' 'Real Madrid CF'
 'FC Barcelona' 'Sevilla FC' 'Getafe CF' 'RC Recreativo' 'Real Valladolid'
 'UD Almería' 'Málaga CF' 'Real Sporting de Gijón' 'Real Betis Balompié'
 'RCD Espanyol' 'Atlético Madrid' 'Valencia CF' 'Athletic Club de Bilbao'
 'Racing Santander' 'CD Numancia' 'RC Deportivo de La Coruña' 'CA Osasuna'
 'Xerez Club Deportivo' 'CD Tenerife' 'Real Zaragoza'
 'Hércules Club de Fútbol' 'Real Sociedad' 'Levante UD' 'Granada CF'
 'Rayo Vallecano' 'RC Celta de Vigo' 'Elche CF' 'Córdoba CF' 'SD Eibar'
 'UD Las Palmas' 'AC Bellinzona' 'FC Basel' 'FC Sion' 'FC Vaduz'
 'FC Zürich' 'Grasshopper Club Zürich' 'BSC Young Boys' 'FC Aarau'
 'FC Luzern' 'Neuchâtel Xamax' 'FC St. Gallen' 'FC Thun'
 'FC Lausanne-Sports' 'Servette FC' 'Lugano']
with total 296

```
column name :   league_name

column datatype :   <class 'str'>

 unique values :
['Belgium Jupiler League' 'England Premier League' 'France Ligue 1'
 'Germany 1. Bundesliga' 'Italy Serie A' 'Netherlands Eredivisie'
 'Poland Ekstraklasa' 'Portugal Liga ZON Sagres' 'Scotland Premier League'
 'Spain LIGA BBVA' 'Switzerland Super League']
with total 11


 _____________________
column name :   id

column datatype :   <class 'numpy.int64'>

 unique values :
[    1     2     3 ... 25977 25978 25979]
with total 25979


 _____________________
column name :   country_id

column datatype :   <class 'numpy.int64'>

 unique values :
[    1  1729  4769  7809 10257 13274 15722 17642 19694 21518 24558]
with total 11


 _____________________
column name :   league_id

column datatype :   <class 'numpy.int64'>

 unique values :
[    1  1729  4769  7809 10257 13274 15722 17642 19694 21518 24558]
with total 11


 _____________________
column name :   season

column datatype :   <class 'str'>

 unique values :
['2008/2009' '2009/2010' '2010/2011' '2011/2012' '2012/2013' '2013/2014'
 '2014/2015' '2015/2016']
with total 8


 _____________________
column name :   stage

column datatype :   <class 'numpy.int64'>

 unique values :
[ 1 10 11 12 13 14 15 16 17 18 19  2 20 21 22 23 24 25 26 27 28 29  3 30
 31 32 33 34  4  5  6  7  8  9 35 36 37 38]
with total 38


 _____________________
column name :   date

column datatype :   <class 'str'>

 unique values :
['2008-08-17 00:00:00' '2008-08-16 00:00:00' '2008-09-24 00:00:00' ...
 '2016-05-22 00:00:00' '2016-05-25 00:00:00' '2015-08-13 00:00:00']
with total 1694


 _____________________
column name :   match_api_id

column datatype :   <class 'numpy.int64'>

 unique values :
[ 492473  492474  492475 ... 1992093 1992094 1992095]
with total 25979


 _____________________
column name :   home_team_api_id

column datatype :   <class 'numpy.int64'>

 unique values :
```

```
[  9987  10000   9984   9991   7947   8203   9999   4049  10001   8342
   9985   9994   9996   9993   8635   9998   9986   8571   9997   9989
   6351   1773   8475   8573 274581  10260   9825   8472   8654  10252
   8668   8549   8559   8667   8455  10194   8650  10261   9879   8586
   8659   8462   8456   8655   8528   8602   8191   8658   8483  10172
   9850  10003   9798   8466   9826   8344   8197   8678   9817   8583
   9827   9746   8682   9748   9829   8481   9851   9874   9873   8639
   8689   8592   9831   9853   9941   7819   9855   9830   9847  10249
   4170   8588 108893   8521   8576   9836   4087   9837  10242   7794
   9747   8550   8121   6391   9823   8178  10189   8721   9810   9912
   8398   9788   8295   9790   8697   8177   8722   9911   9789  10269
   9904   8226   8358   8165   9905   8350   8152   8406   8357   8194
   9776   8460   8262   8234   8524   8529   8530   8533   8535   8564
   8686   9882   9804   8600   8551   8690   8540   8543   9885   9857
   9875   9888   8636  10233   8537  10167   9976   9880   9858   6269
   9878   9876   7943   8534   9891 208931   8277   9803   8525   8464
   9908   9791   8614   6601  10229   8526   8593   8674  10235  10217
   9761  10228   8611   8640  10219   9839  10218   6413   7788   6433
   6631  10265   8020   8673   8025   8244   2182   8322   8028   8569
   1957   2186   1601   2183   8242   8030   8031   8245   8021   8024
   8033   8023   8027   8019 177361   9773   9768   7844   6403  10213
   7841   6421   9809   9772   9807  10264   7992  10212  10238  10214
  10215   9771   2033  10211   9765   4064   9764   8348   7842 158085
   6547   8613   6367 188163   8596   9860   8597   8485   9925   8429
   9938   8066   8548   9927   9800  10251   8467   8457   8649   8284
   8426  10267   8371   9783   8388   8696   9869   8603   8558   8315
   9906   8302  10205   8633   8634   8305   8661   9865   9864  10281
   8479   8394   9867   9868  10278   8581   8560   8370   7878   9910
  10268   8372   7869   8306   9956  10192   9930  10199   7955   6493
   9931  10179   9824  10243  10190  10191   9777   7730   7896]
with total 299


 ____________________
column name :   away_team_api_id

column datatype :   <class 'numpy.int64'>

 unique values :
[  9993   9994   8635   9998   9985   8342   8571   9996   9986   9991
  10001   9999   9984   9987  10000   7947   4049   8203   9997   9989
   6351   1773   8475   8573 274581  10261   8659   8650   8528   8456
   8655   8586  10194   9879   8462   8654   8668   8455   8472   8667
  10252   9825  10260   8549   8559   8658   8191   8602   8483  10003
   9850  10172   8466   9798   8344   9826   8197   9817   8678   9830
   7819   9831   8689   9941   9847   8639   8592   9855   9853   9748
   9873   9874   9827   8682   9829   9746   8583   8481   9851   8588
   4170  10249 108893   8521   4087   9836   8576   7794  10242   9837
   9747   8550   8121   6391   9790   9789   9904   8722   8177   8697
   8226  10269   9911   8178   9788   9823   8398  10189   9912   8721
   9810   8295   8358   8165   9905   8350   8152   8406   8194   8357
   9776   8460   8234   8262   8551   8543  10233   8690   9885   9857
   9875   8636   9888   8540   8535   9804   8533   8530   8686   9882
   8564   8600   8524   8529   9976  10167   8537   9880   9858   6269
   9878   7943   9876   8534 208931   9891   8674   8611   8593   8526
   8640  10235  10217  10228   9761   8277   9803   8614   6601   9908
   9791   8525   8464  10229   9839  10219  10218   6413   6433   7788
   6631   8031   1601   2183   8030   8242   8569   1957   2186   8244
  10265   8025   8322   8028   8020   2182   8673   8021   8245   8024
   8033   8023   8027   8019 177361   9807   7992  10238  10264  10215
   9772  10214  10212   7844  10213   9809   7841   6421   9768   9773
   6403   2033   9771   9765  10211   4064   9764   8348   7842 158085
   8613   6547 188163   6367   8548   9927  10251   8066   9800   9938
   8485   8596   8429   9925   8597   9860   8467   8457   8284   8649
   8426   8661  10205   8633   8634   8302   8305   8479  10281   9865
   9864   9869   8603   8558   9906  10267   8315   8696   8388   9783
   8371   9868   9867   8394  10278   8560   8581   7878   8370   9910
  10268   7869   8372   8306   6493   9931  10179   9824  10243   9956
  10192   9930  10199   7955  10190  10191   7730   9777   7896]
with total 299


 ____________________
column name :   home_team_goal

column datatype :   <class 'numpy.int64'>

 unique values :
[ 1  0  5  2  4  3  7  6  9  8 10]
with total 11


 ____________________
column name :   away_team_goal

column datatype :   <class 'numpy.int64'>
```

```
 unique values :
[1 0 3 2 4 5 6 7 9 8]
with total 10


 _____________________
column name :   home_player_x1

column datatype :   <class 'numpy.float64'>

 unique values :
[nan  1.  2.  0.]
with total 3


 _____________________
column name :   home_player_x2

column datatype :   <class 'numpy.float64'>

 unique values :
[nan  2.  4.  3.  1.  5.  6.  8.  7.  0.]
with total 9


 _____________________
column name :   home_player_x3

column datatype :   <class 'numpy.float64'>

 unique values :
[nan  4.  6.  8.  5.  3.  7.  2.  1.]
with total 8


 _____________________
column name :   home_player_x4

column datatype :   <class 'numpy.float64'>

 unique values :
[nan  6.  8.  4.  7.  5.  3.  2.]
with total 7


 _____________________
column name :   home_player_x5

column datatype :   <class 'numpy.float64'>

 unique values :
[nan  8.  6.  2.  7.  1.  3.  4.  9.  5.]
with total 9


 _____________________
column name :   home_player_x6

column datatype :   <class 'numpy.float64'>

 unique values :
[nan  2.  6.  4.  1.  3.  9.  5.  7.  8.]
with total 9


 _____________________
column name :   home_player_x7

column datatype :   <class 'numpy.float64'>

 unique values :
[nan  4.  8.  6.  5.  3.  7.  2.  9.  1.]
with total 9


 _____________________
column name :   home_player_x8

column datatype :   <class 'numpy.float64'>

 unique values :
[nan  6.  2.  8.  3.  7.  5.  4.  9.  1.]
with total 9


 _____________________
column name :   home_player_x9

column datatype :   <class 'numpy.float64'>

 unique values :
```

```
[nan  8.  4.  2.  6.  7.  3.  9.  5.  1.]
with total 9


 ____________________
column name :   home_player_x10

column datatype :   <class 'numpy.float64'>

 unique values :
[nan  4.  6.  9.  5.  7.  8.  3.  2.  1.]
with total 9


 ____________________
column name :   home_player_x11

column datatype :   <class 'numpy.float64'>

 unique values :
[nan  6.  4.  5.  7.  3.  1.]
with total 6


 ____________________
column name :   away_player_x1

column datatype :   <class 'numpy.float64'>

 unique values :
[nan  1.  2.  6.]
with total 3


 ____________________
column name :   away_player_x2

column datatype :   <class 'numpy.float64'>

 unique values :
[nan  2.  4.  3.  1.  6.  8.  5.  7.]
with total 8


 ____________________
column name :   away_player_x3

column datatype :   <class 'numpy.float64'>

 unique values :
[nan  4.  6.  5.  3.  8.  2.  7.  9.]
with total 8


 ____________________
column name :   away_player_x4

column datatype :   <class 'numpy.float64'>

 unique values :
[nan  6.  8.  2.  7.  5.  4.  3.  1.]
with total 8


 ____________________
column name :   away_player_x5

column datatype :   <class 'numpy.float64'>

 unique values :
[nan  8.  6.  4.  2.  7.  3.  1.  9.  5.]
with total 9


 ____________________
column name :   away_player_x6

column datatype :   <class 'numpy.float64'>

 unique values :
[nan  2.  4.  3.  9.  1.  5.  6.  7.  8.]
with total 9


 ____________________
column name :   away_player_x7

column datatype :   <class 'numpy.float64'>

 unique values :
[nan  4.  6.  5.  3.  7.  8.  2.  1.  9.]
with total 9
```

```
_____________________
column name :   away_player_x8

column datatype :   <class 'numpy.float64'>

 unique values :
[nan  6.  8.  7.  5.  4.  3.  9.  1.  2.]
with total 9


_____________________
column name :   away_player_x9

column datatype :   <class 'numpy.float64'>

 unique values :
[nan  8.  2.  6.  4.  3.  5.  7.  9.  1.]
with total 9


_____________________
column name :   away_player_x10

column datatype :   <class 'numpy.float64'>

 unique values :
[nan  4.  6.  7.  5.  9.  8.  3.  1.  2.]
with total 9


_____________________
column name :   away_player_x11

column datatype :   <class 'numpy.float64'>

 unique values :
[nan  6.  4.  3.  7.  5.  8.]
with total 6


_____________________
column name :   home_player_y1

column datatype :   <class 'numpy.float64'>

 unique values :
[nan  1.  3.  0.]
with total 3


_____________________
column name :   home_player_y2

column datatype :   <class 'numpy.float64'>

 unique values :
[nan  3.  0.]
with total 2


_____________________
column name :   home_player_y3

column datatype :   <class 'numpy.float64'>

 unique values :
[nan  3.  5.]
with total 2


_____________________
column name :   home_player_y4

column datatype :   <class 'numpy.float64'>

 unique values :
[nan  3.  5.]
with total 2


_____________________
column name :   home_player_y5

column datatype :   <class 'numpy.float64'>

 unique values :
[nan  3.  7.  6.  5.  8.]
with total 5

 _____________________
```

```
column name :   home_player_y6

column datatype :   <class 'numpy.float64'>

 unique values :
[nan  7.  3.  6.  5.  8.  9.]
with total 6


_____________________
column name :   home_player_y7

column datatype :   <class 'numpy.float64'>

 unique values :
[nan  7.  6.  8.  5.  3.  9.]
with total 6


_____________________
column name :   home_player_y8

column datatype :   <class 'numpy.float64'>

 unique values :
[nan  7.  8.  6.  5.  3.  9. 10.]
with total 7


_____________________
column name :   home_player_y9

column datatype :   <class 'numpy.float64'>

 unique values :
[nan  7. 10.  8.  6.  9.  1.]
with total 6


_____________________
column name :   home_player_y10

column datatype :   <class 'numpy.float64'>

 unique values :
[nan 10.  7.  8.  9.  6. 11.  3.]
with total 7


_____________________
column name :   home_player_y11

column datatype :   <class 'numpy.float64'>

 unique values :
[nan 10. 11.  1.  3.]
with total 4


_____________________
column name :   away_player_y1

column datatype :   <class 'numpy.float64'>

 unique values :
[nan  1.  3.]
with total 2


_____________________
column name :   away_player_y2

column datatype :   <class 'numpy.float64'>

 unique values :
[nan  3.]
with total 1


_____________________
column name :   away_player_y3

column datatype :   <class 'numpy.float64'>

 unique values :
[nan  3.  7.]
with total 2


_____________________
column name :   away_player_y4
```

```
column datatype :   <class 'numpy.float64'>

 unique values :
[nan  3.  5.  7.]
with total 3


_____________________
column name :   away_player_y5

column datatype :   <class 'numpy.float64'>

 unique values :
[nan  3.  7.  6.  5.  9.]
with total 5


_____________________
column name :   away_player_y6

column datatype :   <class 'numpy.float64'>

 unique values :
[nan  7.  3.  6.  8.  5.  9. 10.]
with total 7


_____________________
column name :   away_player_y7

column datatype :   <class 'numpy.float64'>

 unique values :
[nan  7.  6.  8.  5.  3.  9. 10.]
with total 7


_____________________
column name :   away_player_y8

column datatype :   <class 'numpy.float64'>

 unique values :
[nan  7.  8.  6.  5.  9.  3. 10.]
with total 7


_____________________
column name :   away_player_y9

column datatype :   <class 'numpy.float64'>

 unique values :
[nan  7. 10.  8.  9.  6. 11.  5.]
with total 7


_____________________
column name :   away_player_y10

column datatype :   <class 'numpy.float64'>

 unique values :
[nan 10.  7.  8.  9. 11.  6.]
with total 6


_____________________
column name :   away_player_y11

column datatype :   <class 'numpy.float64'>

 unique values :
[nan 10. 11.  8.  7.]
with total 4


_____________________
column name :   home_player_1

column datatype :   <class 'numpy.float64'>

 unique values :
[    nan  39890.  38327.  95597.  30934.  37990.  38391.  39153.  37900.
  36835.  38252.  34480.  33676.  37937.  38341.  38318. 104378. 148308.
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with total 906


_____________________
column name :   home_player_2

column datatype :   <class 'numpy.float64'>

 unique values :
[    nan  67950.  39580. ...  92252. 197757. 214344.]
with total 2414


_____________________
column name :   home_player_3

column datatype :   <class 'numpy.float64'>

 unique values :
[    nan  38788.  67958. ... 134132. 678384. 705484.]
with total 2375


_____________________
column name :   home_player_4

column datatype :   <class 'numpy.float64'>

 unique values :
[    nan  38312.  67959. ... 115700. 155075.  39646.]
with total 2606


_____________________
column name :   home_player_5

column datatype :   <class 'numpy.float64'>

 unique values :
[    nan  26235.  37112. ... 406283. 239959. 733787.]
with total 2769


_____________________
column name :   home_player_6

column datatype :   <class 'numpy.float64'>

 unique values :
[    nan  36393.  46004. ... 119839. 185518. 186524.]
with total 3798


_____________________
column name :   home_player_7

column datatype :   <class 'numpy.float64'>

 unique values :
[    nan 148286. 164732. ...   8893. 634310.  35831.]
with total 3422


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column name :   home_player_8

column datatype :   <class 'numpy.float64'>

 unique values :
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with total 4076


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column datatype :   <class 'numpy.float64'>

 unique values :
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with total 4114
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column datatype :   <class 'numpy.float64'>

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with total 3642

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column datatype :   <class 'numpy.float64'>

 unique values :
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with total 2890

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with total 2504


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with total 2470


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with total 2657


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 unique values :
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column datatype :   <class 'numpy.float64'>

 unique values :
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with total 3891

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column datatype :   <class 'numpy.float64'>

 unique values :
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  6.   5.25 11.   3.25 2.3   2.62 6.5   1.36 2.4 13.   4.75 2.
  1.95 1.66 2.7   1.72 2.15 3.8   3.1   2.37 5.75 2.45 2.87 1.55
   nan 1.8   1.6   1.53 1.73 15.   1.2 19.   1.4 12.   1.5   2.55
  1.44 1.91 3.75 6.25 1.7   3.7   2.63 4.4   1.62 4.6 16.   17.
  1.33 6.75 4.8   1.45 4.1 21.   23.   1.3   1.61 1.29 1.22 26.
 10.5 14.   18.   3.9 29.   2.35 2.65 34.   1.25 1.9 51.   4.25
  1.18 1.17 7.25 1.1   1.14 41.   1.08 1.13]
with total 115

____
column name :   bwh

column datatype :   <class 'numpy.float64'>

 unique values :
[1.75 1.8   2.4   1.4   5.   4.85 2.05 2.55 2.3   1.25 2.6   1.85
  2.75 2.35 5.1   4.3   2.25 3.25 1.38 1.95 2.5   3.4   2.2   1.23
  2.1   4.6   1.35 1.55 1.32 1.65 1.3   5.35 5.25 2.15 1.2   1.28
  1.6   3.   2.95 3.35 1.45 7.15 1.5   1.7   2.9   1.16 2.8   2.85
  4.4   2.   4.7   1.17 4.2   2.7   2.65 5.5   1.9   3.1   6.2   nan
  4.   3.75 4.8   1.71 4.35 1.67 2.45 4.05 1.15 3.9 12.   3.7
  1.58 1.14 6.5   4.55 1.22 5.7   8.   1.48 3.6   1.18 1.26 1.66
  1.46 3.3   5.95 3.2   3.5   4.9   1.36 3.45 3.85 4.5   6.   3.55
  7.25 6.8   4.15 4.1   5.2   1.88 1.57 1.91 3.95 3.8   6.25 3.05
  1.72 1.42 1.52 4.75 1.34 1.44 6.75 3.65 1.78 5.75 4.33 1.87

```
  1.31  1.62  1.53  1.37  1.12  1.33  8.5   4.25  1.83  1.19  7.5   7.75
  7.   10.    4.45  9.    4.65  1.73  6.15  1.27  1.41  5.4   2.28  5.3
  3.15  8.25  5.85  6.35  6.95 11.    1.1   5.45  6.4   8.75  5.65  1.29
 12.5   5.15  1.11  1.13  2.38  2.62  4.95  1.82  1.68  1.92  5.8   6.85
  7.4   5.9   1.43  9.25 11.5   9.5   9.75  1.47  5.55  2.08  2.02 10.5
  2.07  1.06  1.09  1.08 15.   14.   13.   13.5   1.24 16.    2.27  2.12
  5.6   3.62  1.77  2.48  6.45  2.37  3.22  2.58  1.49  1.79 18.    8.1
  6.1   1.63  1.93 21.   17.    5.05  6.65  7.05  6.55  2.17  1.98  9.65
  2.22  8.35  7.35  1.07  7.7   7.95  1.56  1.05  6.3   8.2  15.5  14.5
  1.54  1.96  2.68  2.18  1.03  6.9  16.5  34.    1.04 19.  ]
with total 237


_____________________
column name :   bwd

column datatype :   <class 'numpy.float64'>

 unique values :
[ 3.35  3.3   4.    3.5   3.4   3.25  5.    3.2   3.45  3.6   3.15  3.1
  3.85  4.25  3.    4.5   4.7   5.1   3.55  3.65  3.05  3.7   3.75  6.
  5.6   5.5   4.55   nan  3.8   3.9   3.95  4.35  5.35  6.25  6.2   4.6
  5.25  4.2   5.8   6.5   4.65  5.2   4.3   4.4   4.1   4.85  4.75  4.9
  2.95  5.55  4.33  6.75  7.25  7.    5.75  4.95  3.56  4.15  8.    8.5
  8.25  8.75  7.75  4.05  6.05  5.65  7.5   2.9   9.25  2.75  2.85  2.8
  5.3   2.7   4.8   2.3   2.45  5.85  4.45  2.65  9.    9.75 10.    9.5
  6.8   5.15  6.55  6.7   5.7   6.3   5.4   6.85  6.35 12.5  10.5  11.
  6.4   2.68  2.55  3.37  3.38  8.35  3.27  2.15  1.9   2.35  1.8   2.
  1.65  2.4   2.5   1.95  1.67  2.2   5.05  3.73  6.6   7.4   3.58  5.45
  6.15  7.3  12.    5.9   3.12 15.   11.5  14.   13.   15.5  17.   16.
 13.5  19.5 ]
with total 133


_____________________
column name :   bwa

column datatype :   <class 'numpy.float64'>

 unique values :
[ 4.2   3.95  2.55  6.8   1.6   1.65  3.15  2.4   2.7  10.    3.8   2.25
  4.    1.55  1.68  9.    2.8   2.1   3.65  7.2   3.9   3.4   2.45  1.95
  3.    3.2   2.    2.95  3.6   3.1   1.7   2.75  7.75  8.    5.9   5.85
  2.9   8.25  4.9   8.5   3.3   3.05  6.   12.    2.15  5.65  7.15  2.35
  1.4   2.65  3.7   5.7   7.    5.    4.6   2.2   5.5   2.3   7.1   2.85
  5.75  4.5   7.5   5.15  4.3   5.2   2.6   4.1  13.    4.55  1.75  3.75
 10.5   4.8   4.05  6.5   2.5   1.5   3.85   nan  4.35  5.05  1.8   1.9
  5.25  5.8  10.25  7.3   3.55  9.5   4.7   1.52 11.    4.4  14.    6.25
  1.85  1.15  1.57  5.55  1.82  3.35  1.45  5.1   7.8   5.35  8.1   1.35
  5.3   4.25  7.25  4.65  6.85  6.3   4.15  9.1   4.75  9.55  9.75  6.75
  2.05  3.25 12.5   3.45  6.4   4.45  6.95  3.5   6.1   1.87  1.83  6.9
  6.6  11.5   1.62  6.65  6.15  8.75  1.78  1.42  6.2   4.33 15.   15.5
 16.    9.25  1.88 20.    1.67  1.91 13.5   1.72  1.48 14.5  17.    1.53
  1.25  5.4   1.3   7.4   7.85  6.05  8.9   1.58 18.    4.85  2.08  8.15
  7.65  1.22  1.47 18.5   1.63 17.5   1.33 21.    1.44  1.34  1.31 16.5
  1.37  1.36  7.6   2.62  1.73  8.85  3.62  5.45  2.42  4.95  9.35  8.3
  5.6   8.2   9.6   2.18  9.4   6.45  8.55  8.05  1.56 19.5  23.   26.
  1.26  6.7   6.35  7.7   8.65  7.9   7.45 10.75  1.2   1.28  1.24  1.23
 19.    1.18  1.38 29.   31.   34.    1.17 12.7   2.07  8.7   7.55  2.77
  8.6   7.35  6.55  2.17  7.05  2.72  1.77  4.77  5.95  1.1   9.2   9.15
  1.43  1.93  1.27  1.13 10.6   8.4   2.02  9.85  2.38 11.25  1.16  1.14
  8.35  1.19  4.22  7.95  1.66  1.12 36.    1.76 51.   41.  ]
with total 261


_____________________
column name :   iwh

column datatype :   <class 'numpy.float64'>

 unique values :
[ 1.85  1.9   2.6   1.4   4.    3.7   2.4   2.1   1.3   1.8   2.5   1.7
  2.2   4.6   3.1   1.75  2.    2.45  3.9   2.8   3.4   2.3   1.35  3.8
  1.55  1.6   1.65  4.2   1.2   3.2   1.45  6.    1.5   1.37  1.33  2.9
  3.3   2.75  3.    1.17  4.4   1.15  4.8   5.    1.25   nan  1.27 12.
  1.22  3.5   2.85  3.6   5.4   2.7   2.55  4.3   2.25  2.65  4.1   4.5
  7.    4.7   6.5   5.5   2.15  7.3   6.1   5.1   5.6   1.95  8.5   7.5
  8.    2.35  1.43  5.9   6.7   6.3   2.05  4.9   5.3   7.6   5.2   3.35
  9.5   1.57  9.    1.12 10.    3.05  2.95  1.05  1.1   3.55  1.77  1.23
  7.2   1.42  7.8   5.7   1.32  1.53  1.28  1.47  1.18  1.67  7.1   3.85
  1.72  4.25  6.6   6.8   3.15  3.45  3.25  1.52  3.75  4.35  5.8   2.62
  4.85  2.83  7.9   4.65  8.3   1.62 11.    1.73  1.08  1.11  4.75 10.3
 13.   11.5   2.57  2.53  1.13  1.07 12.5  15.   14.    4.15  7.7   1.03
 10.5   6.2   6.4  20.  ]
with total 147
```

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____________________
column name :   iwd

column datatype :   <class 'numpy.float64'>

 unique values :
[ 3.2   3.1   3.9   3.3   4.2   3.4   3.    4.    3.5   5.    3.8   3.7
  5.5   6.    3.6   4.5    nan  4.3   4.7   4.8   4.9   4.1   4.6   4.4
  5.7   5.2   3.45  5.8   3.35  3.25  5.3   3.15  6.5   7.    6.2  10.
  7.3   5.4   3.75  8.    3.55  5.6   5.1   3.85  3.05  3.65  2.8   2.9
  2.85  2.95  2.6   2.7   2.1   2.4   2.5   4.25  9.5   1.9   2.2   1.7
  2.    7.5   1.55  2.3   1.85  1.8   1.5   1.6   9.    5.9   6.4   7.2
  6.7  11.  ]
with total 73


____________________
column name :   iwa

column datatype :   <class 'numpy.float64'>

 unique values :
[ 3.5   2.3   6.    1.7   1.8   2.4   3.    8.    3.8   4.2   2.8   1.6
  2.1   4.    3.1   2.45  1.75  3.2   2.2   1.85  2.6   7.    4.8   4.6
  2.7   2.9   1.65 10.    4.4   2.    2.5   5.4   1.4   3.4   5.    3.7
  1.9   2.75 11.    3.9  12.    5.8   1.55  1.5   9.     nan  3.3   4.3
  8.5   1.15  9.5   3.6   5.2   1.45  2.65  2.05  4.1   7.5   4.5   5.5
  1.35  6.5   2.55  5.1   5.6   7.3  10.5  10.3   6.1  12.5   8.3  13.
  4.9   4.7   7.6   1.3   1.37  6.7   2.95  2.85  5.3   3.35  1.43  2.15
  3.25 14.   15.    1.42  1.33 22.    8.2   1.27  2.25  2.35  3.55 25.
  5.7   4.45  3.45  1.47  1.28  7.8   7.2   1.67  1.52  1.57  6.6   1.72
  1.87  1.95 16.    6.8   7.1   6.3   4.25  7.9   3.85  3.75  6.4   3.05
  6.2   7.4   3.15  5.9   4.85  1.53  4.35  2.83  4.65  2.62  7.65  3.65
  1.23  8.4   1.62  3.95  2.77  4.05  7.7   1.25 20.    1.22  1.2   2.57
  2.53  1.1   1.77  9.2   1.63  1.17  1.12  4.15  2.73 18.   17.   11.5
  1.32 21.    1.48 19.  ]
with total 159


____________________
column name :   lbh

column datatype :   <class 'numpy.float64'>

 unique values :
[ 1.8   1.9   2.5   1.44  4.    5.    1.83  2.25  1.25  1.29  2.6   1.67
  2.2   5.5   1.36  2.75  1.73  1.33  1.91  3.75  2.    3.    2.1   2.4
  1.5   1.57  1.72  4.5   4.33  2.3   1.17  1.62  2.38  2.88  2.37  6.
  1.53  2.7   1.4   2.8   4.2   3.1   1.7   1.2   1.22  1.16  3.2   1.66
   nan  1.75  1.61  3.6   2.62  3.5   3.4   9.    1.14  7.    2.9   1.85
  1.3   1.28  2.87  3.25  6.5   1.12  1.1   8.    1.6   2.85  2.05  2.55
  1.18  3.8   4.75  2.15  2.45  4.8   7.5   1.55  1.95  4.1   1.48  3.3
  1.35  1.65  5.75 11.   12.   10.    1.08  1.11  1.45  1.15  5.25 10.5
  1.87  8.5   1.47  2.29  2.04  9.5   4.6   1.09 13.   17.   15.    1.13
  1.07  1.77  1.26  1.86  3.9   1.06  1.05  2.35  4.25  2.65  2.63  5.2
  6.75 14.   20.    1.21 21.    3.7   1.04 19.   26.   23.  ]
with total 129


____________________
column name :   lbd

column datatype :   <class 'numpy.float64'>

 unique values :
[ 3.3   3.2   3.6   3.4   3.25  4.5   4.33  4.    3.1   3.5   3.    5.5
  3.75  5.     nan  6.    4.75  3.8   4.2   6.5   2.25  5.75  3.9   3.7
  5.25  7.    5.2   4.6   4.1   2.88  8.   10.    7.5   9.    4.8   2.9
  2.8   2.87  2.3   2.4   2.75  2.5   8.5   6.25  4.3  11.   12.    2.6
  1.8   1.9   2.1   1.91  1.65  2.7   2.2   2.38  1.73  2.    1.4   1.67
  1.44  2.62  1.83  4.4   4.25  9.5  13.    2.85  4.59 10.5  15.   17.
 19.  ]
with total 72


____________________
column name :   lba

column datatype :   <class 'numpy.float64'>

 unique values :
[ 3.75  3.5   2.5   6.5   1.72  1.62  3.6   2.75 10.    9.    2.38  4.5
  2.8   1.5   1.73  7.    2.2   4.    8.    3.4   1.8   3.2   2.1   3.
  2.6   6.    5.    2.7   1.61  1.66  2.62 12.    2.25  5.5   1.44  4.33
  2.37  3.25  2.   11.    1.67  2.4   2.88  1.57   nan  1.83  2.3   1.53
  1.9   2.87  1.91  1.2   1.4   1.85  8.5   4.2  13.   17.    1.29  3.8
  7.5   1.6   3.1   9.5   1.95  2.9  14.    4.1   1.75  3.3   3.7  15.
```

```
  4.75  2.15  2.05  5.75  5.25  1.48  1.36  1.33  1.3  21.   19.   26.
  1.25 23.    1.7   4.8   1.22 10.5   2.29  1.45  4.6   2.55  1.55  1.65
  3.9  16.    2.45  2.63  4.59 29.    1.35 34.    2.04  1.28  1.16  1.17
 41.   51.    1.18  1.1   1.77  1.76  4.25  2.35  2.65  5.2   2.85 18.
 20.   31.   36.    4.3   1.38  1.14 11.5   1.12  1.13]
with total 128


 ____________________
column name :   psh

column datatype :   <class 'numpy.float64'>

 unique values :
[   nan  5.1    2.48   1.83   1.74   1.58   1.29   1.37   1.76   3.07
  3.15   2.19   1.79   1.65   2.09   2.63   1.24   1.53   1.55   1.99
  4.52   1.89   3.02   2.35   1.59   1.5    1.86   7.74   2.53   1.78
  3.13   1.6    1.92   1.7    2.36   1.54   5.04   2.16   2.25   1.71
  1.56   2.14   3.24   5.42   1.94   1.64   2.67   2.7    2.32   2.15
  3.28   1.33   2.93   2.44   2.18   3.61   4.85   3.34   1.43   1.96
  6.02   1.95   1.62   1.3    2.97   1.57   3.17   2.54   4.63   1.36
  1.38   1.46   4.36   2.55   2.52   5.13   6.     2.78   3.9    5.22
  3.42   1.48   2.3    3.35   2.65   3.49   1.41   2.39   1.77   1.52
  1.28   2.72   2.58   4.2    1.45   1.4    2.71   2.77   2.03   5.35
  2.46   4.57   2.69   2.4    1.67   2.22   1.47   3.18   1.81   1.44
  3.71   2.29   2.31   2.68   6.94   1.22   1.66   2.1    4.07   2.98
  1.93   2.13   4.31   2.     1.34   4.12   2.56   2.27   2.62   1.85
  2.95   1.68   3.97   4.06   2.75   1.39   4.35   2.02   3.76   5.01
  5.37   1.87   1.88   4.23   2.01   1.97   2.79   1.42   3.29   2.88
  1.61   2.45   3.82   3.92   2.61   1.63   1.98   3.04   2.59   4.45
  3.95   3.12   2.64   1.23   2.51   3.41   3.     1.84   2.84   3.69
  3.4    4.67   4.49   2.07   4.28   3.21   3.26   2.38   2.33   1.19
  1.27   3.77   4.43   2.8    4.26   2.66   4.04   2.92   4.91   2.11
  2.74   2.06   2.83   1.72   5.19   2.37   6.71   2.08   1.69   8.37
  1.21   2.04   4.64   2.57   8.66   1.2    5.38   3.19   1.49   3.53
  7.41   3.3    2.91   2.34   3.32   4.29   1.51   1.32   3.67   5.68
  4.1    3.66   2.41   2.23   1.9    7.81   2.89   4.81   4.3    2.86
  4.11   2.43   2.73   6.96   3.05   4.47   3.75   4.01   4.9    2.17
  4.34   5.67   2.42   1.8    2.99   3.88   5.09   2.9    4.89   5.45
  3.46   2.76   1.31   4.46   3.47   2.21   1.73   2.28   3.55   2.12
  3.79   3.2    4.71   2.82   5.66   3.51   4.54   2.96   1.25   3.44
  3.09   6.6    2.26   7.84   1.35   4.18   2.5    3.94   6.45   2.05
  4.62   3.59   4.22   3.03   3.39   3.85   6.26   6.83   1.26   1.91
  3.7    5.96   4.27   1.82   4.39   6.05   5.18   7.1    7.25   4.53
  3.89   5.06   1.18   3.57   7.75   4.21   2.24   5.05   3.23   5.36
  5.5    1.15   5.34   3.14   4.78   3.62   7.26   2.2    2.49   6.52
  3.31   5.24   6.13   4.4    1.75   3.93   4.65   7.48   7.52   5.73
  4.     3.56   5.65   4.59   3.78   6.66   3.65   7.62   4.48   4.87
  5.71   6.25   3.06   3.8    1.16   5.03   3.38   4.19   7.35   8.35
  4.68   5.9    4.6    6.4    4.5    5.3    3.52   3.01   3.98   6.2
  5.16   6.79   5.93   3.36   6.32   8.97   3.48   7.05   6.76   6.09
  6.42   2.85   5.31   6.59   2.47   3.33   9.03   6.58   2.94   1.13
  4.03   6.51   7.99   5.63   6.43   5.98   3.16   3.63   3.87   6.95
  5.89   9.51   8.     1.17   3.22   6.89   7.44   3.58   5.97   5.
  7.65   6.62   3.11   9.27   4.41   9.63   9.37   4.72   4.86   9.19
  8.91   4.95   4.25   8.38   2.6    3.27   5.79   3.45   6.87   5.62
  6.46   5.85   4.8    4.55   5.7    9.85   9.77   5.8    3.96   7.14
  5.54   3.72   3.08  10.2    2.87   7.23   6.88   5.55   6.77   6.21
  6.65   4.83   3.25   4.58   4.88   6.29   7.17  10.8    5.64   4.93
  5.58   4.14   4.24   6.11   8.52   6.15   3.5    5.6    9.2    4.15
  5.52   4.66   4.56   8.05   8.5    5.21   5.75   3.91   4.02   8.15
  4.79   6.68   5.25   4.75   6.24   3.37   3.6    5.51   5.14   2.81
  7.5    4.32   3.84   4.44   7.27   3.64   6.61   5.39   7.91   4.37
  4.51   6.55   4.08   4.7    8.34   7.42   4.05   3.1    5.46   5.82
  9.     5.02   3.73   8.36  10.27   5.33   9.68   3.81  16.92   9.82
  4.96   5.27  11.02   7.33   3.99   9.48   9.1    4.74   7.3    7.87
  6.18   4.97  10.47   5.84  10.88  11.07   7.98   7.94   6.01   4.38
  8.31   3.43   9.14   4.84   4.42   4.13  10.3    3.74   6.36   5.07
 11.25   4.98   7.32   3.68   1.14   7.28   3.83   7.29   5.41   6.64
 10.76   7.58   1.1   11.96   7.12   7.95   1.09   8.55   5.53  13.
  5.77   4.73   7.09   4.61   8.95  10.71   8.69   9.29   8.99  13.95
  7.15   8.4    6.17   8.61  14.24   7.83   4.09   6.37   5.2    7.68
  6.1   11.     8.25   1.11  11.9    1.12   1.07   5.88  13.51   4.17
 12.45   7.69  11.95   3.54  12.8    8.74  14.35  13.26   8.63   4.16
 10.78   9.34  15.25   8.84  13.6    9.7    5.81   5.15  14.15  18.1
  9.79  16.6    5.95   5.49   7.07   5.11  15.5   22.3   15.17   7.03
 10.55   4.82   5.56   5.4   11.8    9.92   8.82  19.24  12.9    9.55
  6.82  17.1   16.2    4.77  10.19  13.83   1.08   8.3    8.39  10.85
  6.84   8.71   7.06  16.77  18.7   13.31  15.     6.74  12.22   5.92
  9.74   6.56   6.7    6.27   9.78   1.909  5.94  23.6   18.5   20.
  4.33   9.76   4.69   8.64  10.33   8.42   8.68   9.46   7.04   6.5
  3.86   8.7    7.88   4.99   9.3    8.01   9.36  10.26   9.15   5.76
 16.43   5.28   5.99  11.93  10.37   5.12   7.46   8.75   4.76   8.03
  6.93   7.7   13.91   8.07   6.54   7.71  14.85   5.48   7.64  12.72
```

```
  6.99   6.19   6.41   5.17   6.57   7.82   7.16   5.59  12.5    9.5
  9.44   6.22   7.67  11.28   6.34   7.47   9.45  11.26   6.12   7.01
  6.8    5.87   5.83   6.69   8.24   9.72   6.06   6.78   5.29   6.08
  4.94   8.48  11.15  10.25   8.2    5.26  11.01   5.57   8.67   6.48
 10.02   6.75   5.23   5.69   7.86   6.33  10.79   8.23  20.5    6.9
 10.56  13.58  15.39   5.74  11.3   11.7   10.53   9.75  10.    13.5
 10.82  12.    13.59   9.66   7.19   8.85  13.65   9.54   6.3   14.4
  9.24   9.52  14.     8.93   7.8    6.14   5.08  12.1    5.91  12.48
  7.89   8.89  15.77   8.8   11.69   5.43   7.93  13.43  14.49  12.74
 26.     7.02   9.38   8.78  15.9   17.51   8.47   9.96  15.66   9.91
  8.14  10.61  15.3   16.8   19.    14.79  11.11   6.49   8.29   9.64
 11.29  12.47  25.5    6.81   7.96   7.72  11.6    8.08  13.81  10.65
 10.08  10.7   11.55   9.07  15.1   11.21   9.53  10.93   9.98  14.3
 11.62   9.62  17.52  11.82  14.9    7.66   6.63   9.11   7.08   8.32
 11.5    7.34   8.92   7.13   9.59  10.09   1.188  1.794  1.862  7.76
  9.43  11.33   6.73  10.39  12.36  14.76  12.2    6.44   9.28   6.92
 11.77  10.69  12.77   9.08  10.96  13.48  13.4    7.59  10.24  12.18
 11.45  11.24  13.7   15.37  10.81  11.04   9.41   7.78   8.1   11.19
 10.92  11.1   11.39  11.22  12.65  11.42  13.78   8.59   5.47   8.81
 19.86   9.25  13.07   8.22   1.06  16.19  12.62   1.05   9.61   8.56
 12.43  14.06   7.2   16.81  14.2   16.85  18.09  10.03  14.45  21.08
  6.04  17.05   6.07  16.4   21.2   10.21  17.    14.17  23.    16.
 20.85  22.4   12.24  36.    11.58  18.43   5.44  10.9   18.07  12.98
 11.4    6.97  10.05  21.1    6.85  15.2   11.08  18.95   7.45  18.
 16.56  13.2   11.2   15.6   25.51   1.04  18.89  13.27  31.13 ]
with total 948


 ____________________
column name :   psd

column datatype :   <class 'numpy.float64'>

 unique values :
[  nan  3.82  3.52  3.79  4.27  5.74  5.16  3.93  4.    3.64  3.63  3.81
  4.01  3.51  3.56  6.71  4.6   4.44  3.76  3.88  3.59  3.57  4.4   4.79
  4.39  4.04  4.7   3.95  3.58  4.37  4.02  3.7   4.43  3.87  3.62  3.96
  4.46  3.71  4.08  3.68  3.97  4.26  4.38  4.3   3.47  3.61  5.65  3.49
  3.67  4.2   3.66  4.11  3.69  5.35  4.9   4.58  3.73  4.18  4.53  6.
  3.48  4.42  3.55  3.54  5.32  5.2   4.72  3.35  4.14  3.89  5.94  4.31
  3.84  3.65  4.65  3.3   4.95  3.5   3.53  6.03  4.35  4.85  5.09  3.45
  3.75  4.05  3.6   3.74  3.94  5.08  3.36  4.52  7.19  3.44  3.72  4.28
  5.41  4.15  3.34  5.45  3.4   5.58  3.9   6.2   4.03  4.24  3.85  5.13
  4.99  4.12  3.8   3.41  4.84  3.46  3.29  4.98  6.67  4.33  3.43  4.25
  4.22  3.86  4.09  4.54  4.1   3.31  6.23  4.47  5.28  7.63  6.09  3.77
  4.73  3.78  4.62  5.95  3.92  3.32  4.86  7.15  3.19  4.91  7.64  3.39
  4.06  4.82  7.75  4.67  3.38  5.43  5.25  4.5   5.52  3.42  4.74  7.42
  5.66  5.68  6.02  5.55  4.69  7.28  4.51  4.19  3.37  4.88  7.52  3.83
  6.82  4.57  5.04  4.63  3.91  5.44  6.75  4.29  4.45  4.93  6.05  6.87
  4.64  4.55  4.36  4.17  7.25  6.55  3.21  3.2   6.69  5.03  3.22  5.72
  4.68  7.41  4.34  6.06  4.07  3.98  4.48  6.42  5.76  4.76  4.16  7.5
  4.56  7.49  3.99  8.2   6.68  4.8   4.83  3.26  6.76  9.64  3.25  4.59
  6.8   3.24  5.6   4.94  5.83  7.2   5.05  5.77  5.4   5.75  6.66  7.02
  4.78  5.47  5.26  5.73  6.07  6.15  7.65  5.15  9.07  5.42  5.5   3.33
  6.54  6.38  4.61  6.16  4.96  5.62  5.9   3.12  6.77  5.69  6.22  5.01
  7.11  5.99  4.77  5.48  5.79  5.18  7.4   5.86  7.9   6.25  5.06  4.32
  4.21  3.27  4.13  7.    6.26  3.28  7.7   3.18  7.8   5.    5.21  4.49
 10.4   4.75  6.32  6.9  10.2   3.17  7.45  6.88  9.12  5.3   6.01  8.6
  5.29  8.65 11.03  5.89  8.04  5.23  3.16  3.23  9.47  5.92  5.8   4.71
  7.73  8.1   5.51  6.45  6.29  7.12  5.61  5.02  8.03  8.8   5.93  7.04
  5.87  4.23  4.81  5.1   6.21  6.64  5.36  5.12  4.41  7.92  5.7   6.4
  5.56  8.55  4.92  8.    6.14  5.98  3.14  6.63  5.85  5.46  5.33  6.33
  7.05  4.87  5.07  6.47  5.34  3.04  3.13  7.08  6.35  5.91  6.28  9.35
  6.12  3.08  3.11  3.15  3.1   4.66  8.5   7.61  3.09  7.69  2.93  2.96
  3.07  3.    4.97  8.75  3.06  6.61  6.89  5.63  3.02  5.19  9.2   6.3
  6.34  6.37  5.31  2.94  5.96  5.39  2.97  7.51  4.89  2.98  2.95  3.03
  6.46  9.    2.99  5.38  3.01  5.24  6.65  6.11  8.7   9.98  7.13  9.96
  6.08  3.05  5.64  2.9  11.5  10.   12.    7.83  5.22  7.09  5.11  6.81
  5.88  8.46  8.11  6.36  8.26 12.3   7.26  6.31  6.6   5.71  9.68  6.85
  7.31  5.78  7.79  5.14  8.91  5.57  6.59 10.08 10.87 15.76 13.85 11.07
  9.42  6.74 12.5   6.44  7.93  6.98  8.61 12.17  8.47  7.14  6.1   6.56
 10.1   8.45 12.14  9.04  6.78 13.5   7.38  9.8   6.92 12.55  5.59  8.4
  6.93  5.37  5.81  7.85  6.51  8.95  6.5   7.27 10.33 11.7   7.21 12.87
  8.05  8.52 12.4   5.97  5.27 13.    7.68  7.29  7.3   8.3  14.9   9.9
 10.3  12.6   7.06  5.53  6.86 14.3   9.75  6.13  9.5   6.79  5.67  7.01
  7.84  2.89  2.5   6.04  8.35  2.62  2.2   7.62  7.48  7.6   5.82  7.66
  6.91  9.21  6.24  7.33  5.17  8.25  5.84  8.82  7.32  9.67  6.7   6.52
  8.57  8.77 12.19  8.18  6.27  6.73  6.83  5.54  9.37  8.71  8.07  6.84
  8.41  6.19  8.66  7.78  5.49  6.18  7.94  7.46  8.02  6.62  6.39  7.07
  8.92  8.54  6.17  7.44  8.74  6.95 10.9  10.76 14.06  7.54  6.53  8.28
  8.86  7.1   6.43  7.47  8.06  7.99  7.81 12.83  7.35  8.69 11.79  8.15
  7.39  7.55 15.    8.76  8.81  7.97  8.32 12.2   9.09  9.27 10.8   8.67
 11.87 10.7  11.37 10.85 11.96  7.71  6.48  9.85  8.72  7.76  7.24  9.7
  7.36  9.53 10.01  6.58  8.31 13.19 13.3   6.57  8.08 12.1   9.08 13.34
```

```
  7.95 10.47 10.52  9.06 16.75 10.51 14.    9.45  6.72 14.65 18.88 15.29
 20.36 18.34 18.37 22.68 18.31 19.   15.99  8.48 11.39  8.23 13.15 16.85
 10.39 17.49  7.34 13.52 14.32 19.8  13.4  22.5  11.6  19.75 16.    8.9
 17.4  25.   13.25 19.08 10.84 13.49  8.19 15.34 15.5  14.99  9.15 11.1
 18.8  11.45 20.5  11.4  15.75 12.22  8.68 20.    8.94  9.25 10.49 29.
 13.64 16.5  12.8   9.55  9.84 11.  ]
with total 665


 _____________________
column name :   psa

column datatype :   <class 'numpy.float64'>

 unique values :
[  nan  1.76  2.96 ... 13.21  1.13 31.5 ]
with total 1475


 _____________________
column name :   whh

column datatype :   <class 'numpy.float64'>

 unique values :
[ 1.7   1.83  2.5   1.44  4.2   2.7   2.2   1.35  1.25  2.6   1.8   2.75
  5.25  4.    1.3   2.3   3.    1.4   1.9   2.05  3.25  2.15  3.2   2.1
  2.25  1.45  1.5   1.6   1.33  1.36  5.    1.22  1.65  1.57  6.5   2.4
  2.    1.73  1.67  1.17  2.9   2.8   1.62  3.8   1.12  4.33  4.5   1.91
  2.38  2.62  4.8    nan  5.5   1.29  3.75  3.6   1.53  1.95  1.2   3.5
  9.    7.    2.65  1.55  6.    1.14  1.85  2.87  1.75  3.3   3.1   1.61
  7.5   1.18  2.88  3.4   2.45  2.55  2.35  1.11  8.    2.37  4.6   1.15
  4.4   4.75 11.    8.5   9.5  10.5   3.9  10.    1.1  12.    1.28  3.7
  1.72  4.1  15.    1.08  4.35  4.25 13.    6.2  19.   17.    5.2   3.15
  1.07 21.    1.16  1.13  1.06  1.05  1.04  1.66  4.9   2.85  3.05  7.25
  3.45  5.1   1.02  5.7  23.   26.  ]
with total 125


 _____________________
column name :   whd

column datatype :   <class 'numpy.float64'>

 unique values :
[ 3.3   3.25  3.75  3.4   4.2   4.5   3.1   3.2   3.5   4.    4.8   4.3
  3.8   3.6   3.15  5.    6.    6.5   5.5    nan  4.33  5.3   3.9   5.1
  3.    4.6   7.5   4.75  2.9   5.25  5.75  7.    8.    4.1   9.    8.5
  9.5   4.4   2.8   2.88  2.87  2.95  2.85  2.75  2.5   3.7   2.7   1.02
  5.8  10.    2.6   1.8   1.83  2.05  1.6   1.95  1.91  1.67  2.62  4.25
  2.1   2.25  2.2   2.4   1.7   1.4   1.73  1.53  1.2  11.    3.45  3.05
  3.35 12.    6.2  13.   15.    2.38 17.  ]
with total 78


 _____________________
column name :   wha

column datatype :   <class 'numpy.float64'>

 unique values :
[ 4.33  3.6   2.4   6.    1.7   2.25  2.75  7.    9.5   3.75  4.2   2.8
  1.55  1.75  8.5   2.6   2.1   3.25  3.    1.95  9.    3.5   2.    2.7
  6.25  7.75  5.75  5.    3.2   2.62  2.9   7.5   8.    1.57  1.6   5.5
  4.5   1.44  2.5   4.8   2.3  10.    2.2   3.1   2.38  1.8  12.    1.67
  1.62  3.4   3.8    nan  1.53  1.83  1.73  3.3   4.    1.65  2.15 11.
  1.9   1.2   1.61  1.91  1.4   2.65  1.45 10.5   6.5  15.    2.37 13.
  2.05  2.88  1.5   1.36  4.6   1.85  2.45 17.    2.55  2.87  4.75  4.4
 19.    1.3   1.33  5.25  3.9  21.    1.25  1.28 23.    1.22 26.    3.15
  3.05  3.7   4.1   2.85  2.35  5.2  34.    1.29  3.55  2.95  1.35  5.4
 29.    1.15  6.8   5.7   6.2   1.12  4.3   5.8   1.14  1.17  1.18  1.72
  3.65  3.45  4.7   4.35  5.3   3.35  4.25 14.    5.1   4.05  6.9   6.6
  5.6  51.   41.    1.1   1.08]
with total 136


 _____________________
column name :   sjh

column datatype :   <class 'numpy.float64'>

 unique values :
[ 1.9    1.95   2.63   1.44   4.5    5.5    1.91   2.6    2.2    1.27
  1.8    2.8    1.7    2.3    5.25   4.25   1.33   2.4    3.3    1.85
  1.4    1.83   2.05   3.6    2.15   2.1    3.5    2.25   4.33   1.36
  4.75   1.62   2.38   1.67   6.     1.2    3.2    3.4    1.5    6.5
  1.57   1.73   3.     2.5    1.18   3.25   2.75   1.25   5.     2.35
  1.22   2.     1.75   3.05   6.25   1.29     nan  4.2    4.     4.8
```

```
  1.17   3.1    1.14   1.53   3.75  11.     1.45   1.6    7.     4.65
  1.3    2.88   8.     3.8    1.65   1.55   1.15   2.9    2.55   2.7
  1.42   8.5    1.88   3.13   2.45   6.75   3.88   1.48   5.2    3.9
  9.     7.5    3.12   1.571  1.909  1.727  2.375  1.533  2.62   5.8
  4.1    9.5   15.    12.     1.13  10.     1.11   1.87  10.5    5.75
  6.15   1.38   1.23   2.65   1.47   1.64  13.     1.35   1.08   1.86
  1.41  17.     1.1    1.06   1.09   4.6    3.15  21.    14.     1.04
  1.05   1.07   6.2    8.25   3.7    1.12  23.    19.   ]
with total 137


 ____________________
column name :   sjd

column datatype :   <class 'numpy.float64'>

 unique values :
[ 3.3    4.     3.5    3.75   3.4    5.     3.25   3.2    4.5    4.33
  5.5    3.6    6.5    3.8    5.75   5.25   6.     3.15     nan  3.1
  3.35   4.2    3.65   3.45   7.5    3.7    4.75   4.8    6.75   7.
  4.6    3.9    3.     5.8    6.25   3.13   4.1    5.2    8.     9.
  8.5    3.33   2.88   2.8    2.75   2.3    2.4    2.9    3.05   3.12
  2.5    4.25  10.     1.73   5.6    1.5    2.1    2.25   1.91   2.2
  2.63   2.     1.4    1.83   1.62   2.7    1.8    2.375  4.4    3.85
 13.     9.5   11.     2.6    6.2    5.4   12.     5.1   14.    15.   ]
with total 79


 ____________________
column name :   sja

column datatype :   <class 'numpy.float64'>

 unique values :
[ 4.     3.8    2.5    7.5    1.73   1.67   3.6    2.4    3.1   10.
  4.25   2.38   4.75   2.88   1.62   1.8    9.     2.75   2.1    7.
  3.5    2.6    1.95   3.3    3.4    3.2    1.83   2.8    8.5    5.5
  3.     8.     5.     3.25  13.     5.25   2.25   2.15   6.5    1.5
  6.     2.3    3.75  12.     2.05   2.2    4.5   11.     1.7    2.
  2.95   4.1    1.53     nan  4.33   2.7    9.5    1.75   2.63   1.57
 14.    16.     1.18   1.45   1.44   1.85   1.9   15.     5.75   4.8
  4.6    2.45   2.33   4.2    1.91   2.55   2.91   3.7    1.4    8.75
  5.2    2.9   17.     1.65   3.9    1.33   2.62   5.8    2.875  1.727
  3.13   3.12   6.25  19.     1.3    1.36   5.3    1.25  21.     1.29
 29.     1.87   1.6    1.47   3.33   6.75   2.65   3.45   1.2   23.
  1.86   1.88  26.     1.27  34.     1.22   1.1    1.55   1.64   1.571
  1.167  1.615 18.     1.17   1.13  12.5    5.6   41.     1.38  25.
  1.56   1.15   8.25 ]
with total 132


 ____________________
column name :   vch

column datatype :   <class 'numpy.float64'>

 unique values :
[ 1.65   2.     2.35   1.45   4.5    4.35   2.1    2.8    2.25   1.3
  1.28   2.65   2.75   1.7    2.2    5.5    3.6    3.25   1.75   1.35
  1.8    2.4    3.75   1.25   3.2    4.     2.5    1.5    1.6    1.4
  5.     1.55   1.2    2.3    2.6    3.     1.95   6.5    2.7    2.9
  1.33   1.85   1.15   1.9    1.83   2.05     nan  3.4    1.91   1.22
  6.     1.18  10.     1.14   1.57   1.44   3.1    1.53   2.62   2.55
  2.38   1.73   1.62   3.5    1.29   4.33   1.67   2.88   4.75   1.36
  7.5    1.17   2.15   3.3    4.2    3.8    3.12   4.6    5.25   7.
  1.12   5.4    1.364  1.444  1.667  1.615  4.333  9.5    4.3    4.4
  1.87   5.75   2.45   4.8    4.1    3.9    3.7    1.92   6.25   8.
  1.47   5.2    3.13   2.63   1.93   3.35   3.15   9.     1.72  11.
  5.3    2.85   6.2    6.75   7.2    8.5   15.     1.11   1.09   1.1
  2.875  1.571  1.909  1.13  10.5   13.     1.533  1.286  2.375  1.98
 17.    12.     1.78   1.06   1.07  19.     1.833  1.952  2.625  1.083
 11.5   18.    21.     1.08  20.     4.7    1.05   1.143 26.    23.
  1.333  1.16   1.04   3.125  1.222 29.     1.925 22.     1.03  36.
 31.   ]
with total 160


 ____________________
column name :   vcd

column datatype :   <class 'numpy.float64'>

 unique values :
[ 3.4    3.25   3.75   4.35   4.5    3.3    3.2    3.5    4.     3.1
  5.     3.6    5.5    3.8    4.2    3.7    6.       nan  6.5    4.75
  3.     4.33   3.12   4.4    4.6    5.25   7.5    7.     5.4    8.
  8.5    5.75   3.9    5.2    4.3    4.1    4.8    6.25   6.1    3.35
```

```
  3.85   3.45   6.7    5.8    4.7    4.9   10.     9.     9.5    2.5
  3.13   2.9    2.8    2.88   2.75   2.25   2.38   2.4   11.5   11.
 10.5   12.    13.     2.65   3.05   1.62   2.     1.73   2.62   1.7
  3.125  2.2    2.3    2.45   2.15  15.    17.    19.     4.333 22.
 18.    23.    26.   ]
with total 82


 ____________________
column name :   vca

column datatype :   <class 'numpy.float64'>

 unique values :
[ 4.5    3.25   2.65   6.5    1.65   1.7    3.     2.25   2.8    8.5
  2.3    3.4    4.35   2.9    1.55   1.9    2.     7.5    4.     2.6
  1.85   9.     3.1    2.1    1.75   6.     2.75   7.     8.     1.6
  5.    11.     2.35   2.7    1.4    2.5    3.2   12.     4.75   2.2
  5.5    2.4    3.75  10.     3.5    3.6    9.5      nan  3.3    1.45
  1.5    1.2    1.8   13.     1.44   2.15   1.57   2.62   4.33   1.67
  1.62   1.91   2.88   2.38   1.95   2.05   1.73   1.83   4.6    3.8
  3.12   5.25   4.2   15.    19.     1.53   4.4   17.     5.4   26.
  1.833  6.25  23.     1.36  10.5    3.9    4.1    4.8    3.7    5.75
  2.45   2.55   4.3   11.5    1.98   5.2    1.87   3.13   1.92   2.63
  1.93   5.8    1.3    4.7    1.35   1.72   1.29   3.55   2.95   3.35
 16.    21.     5.9    3.45   4.9    1.33   1.25   1.22  29.     1.615
  4.333  2.875 20.    18.    22.     3.125  1.364  1.952 31.    36.
 41.     1.18  34.    51.     1.17   1.15   6.75   1.09   1.909  1.444
 14.     1.12   1.14   2.625  1.667  2.375  1.78  67.     1.533 46.
  1.13   1.08 ]
with total 151


 ____________________
column name :   gbh

column datatype :   <class 'numpy.float64'>

 unique values :
[ 1.78  1.85  2.5   1.5   4.5   2.8   2.2   1.25  2.6   2.75  1.75  2.3
  5.25  4.1   1.3   3.1   1.8   1.4   1.95  3.6   2.1   1.27  2.    3.2
  4.25  2.45  1.45  1.37  4.6   1.53  1.62  2.25  1.33  1.7   2.15  4.75
  1.6   1.2   1.67  2.35  2.85  2.05  7.    1.55  1.65  3.    2.4   1.35
  2.9   1.18  3.4   2.65  1.57  2.7   2.55  1.73  1.83  6.25   nan  4.
  4.4   1.36  1.15  3.75 10.    1.47  1.9   6.5   1.22  5.5   5.    3.7
  6.    3.3   3.5   4.33  1.72  1.42  1.38  4.2   3.25  1.44  1.48  6.75
  3.15  1.28  1.14  1.87  8.5   2.95  1.91  1.34  5.75  1.26  1.88  3.9
  8.    7.25  1.16  9.    7.5   2.63  3.45  1.77  1.17 11.    1.13  3.8
  1.1   1.12  9.5   1.23 12.    7.75  2.38  3.65  3.55  1.32  3.05  1.19
  1.63  3.35  4.7   4.3  13.    9.25  1.11 10.5   2.07  1.31 17.    3.85
  1.58  1.43  5.4   1.93  8.75  5.3  21.    4.9   5.05 16.    1.82  1.52
  1.05  1.08  1.09  9.75  1.06  1.56  1.89 11.5   8.25 12.5   2.86  1.66
  1.29  1.07 15.   14.  ]
with total 159


 ____________________
column name :   gbd

column datatype :   <class 'numpy.float64'>

 unique values :
[ 3.25  3.2   3.75  3.5   3.4   3.3   5.    3.6   4.75  4.2   3.8   4.25
  4.5   5.5   3.1   4.    6.    4.1   3.9   5.75  5.25  4.33  3.35   nan
  6.5   6.25  3.15  4.4   3.7   4.6   7.    2.95  3.    7.5   3.65  3.45
  3.33  7.25  3.85  8.    6.75  8.5   2.9   2.8   2.85  2.75  2.35  2.4
  2.65  9.25  9.    6.35  3.05  2.55  1.95  1.85  2.1   1.7   2.05  1.8
  2.6   2.25  2.3   2.2   1.75  1.45  2.5   2.7   3.55  5.35  3.95  4.3
  4.05  8.25  2.15  5.85  1.67  2.    5.05  7.75  9.75 11.   10.    8.75
  9.5 ]
with total 84


 ____________________
column name :   gba

column datatype :   <class 'numpy.float64'>

 unique values :
[ 4.    3.75  2.5   5.5   1.65  1.7   2.25  2.8  10.    2.35  4.25  2.85
  1.6   1.8   7.5   2.75  2.15  4.2   7.    3.5   1.95  3.2   8.5   2.1
  3.    1.75  8.    1.73  6.    5.25  3.1   2.9   4.4   5.   11.    4.6
  2.3   2.2   3.3   2.6   1.4   5.75  4.75  2.7   2.45 12.    6.5   2.
  4.5   1.67  4.33  3.7   1.55  9.     nan  3.6   1.83  2.05  3.15  1.72
  4.8   2.4   7.75  3.8   3.4   4.3  13.    1.85  1.18  1.45  2.65  1.9
  6.25  3.9   1.5   1.77  3.25  2.55  9.5   4.1   1.62  1.57 15.    3.85
  1.53 16.    1.33  9.25  1.87  6.75  7.25  1.88  2.95 17.    2.38  1.48
```

```
  1.3  14.    1.42  1.36  2.63  3.35  1.46  1.44  1.37 12.5   1.28  1.27
 19.    1.35 21.    4.9   1.25 10.5   1.91 13.5   8.25  9.75 11.5   1.78
  8.75  4.7   3.55  1.47  4.15 15.5  20.   17.5  18.5  14.5   5.6   1.63
  5.2   1.2   1.34 18.    1.22  3.45  1.12  6.15  6.35  3.95  5.85  4.55
  3.65  7.85  4.65  7.9   3.05  6.9   7.7  19.5   5.35  1.13  1.15  5.05
  6.8   1.93  1.38  1.17 26.    1.23 25.    1.26  1.32 16.5   2.86  6.2
 24.   34.    1.52 23.   29.  ]
with total 172


 _____________________
column name :   bsh

column datatype :   <class 'numpy.float64'>

 unique values :
[ 1.73  1.91  2.3   1.44  4.75   nan  2.1   2.88  2.25  1.29  1.25  2.62
  1.83  2.75  1.7   6.    3.8   1.3   3.1   1.36  1.8   2.    2.5   3.5
  2.2   4.33  4.2   1.5   1.6   1.33  4.5   5.    2.38  1.57  1.2   1.67
  3.3   2.7   7.    1.53  2.4   1.14  1.62  2.8   1.4   3.    1.75  1.17
  1.18  5.5   1.95  1.22  3.4   9.    3.6   2.15  2.6   6.5   2.05  3.25
  3.2   2.37  4.    3.75  5.4   1.28  1.12  8.    1.61  2.87  8.5   7.5
 10.    1.85  1.65 11.    6.75  2.9  12.    5.25  1.9   6.25  1.1   1.11
  3.9  13.    9.5   2.45  2.17  2.63 17.    1.55 15.    5.75  1.08  1.06
  1.07  1.04  1.05  1.45  1.97  2.55]
with total 101


 _____________________
column name :   bsd

column datatype :   <class 'numpy.float64'>

 unique values :
[ 3.4   3.25  3.2   3.75  3.3    nan  4.5   5.    3.6   4.2   3.1   3.5
  6.    4.    4.33  5.5   4.75  6.5   3.8   7.    5.4   5.25  3.7   3.
  3.9   6.75  7.5   5.75  8.    8.5   2.88  2.9   2.38  2.8   2.4   2.62
  2.75  1.91  2.1   1.67  2.    1.7   1.33  2.25  1.4   2.6   1.73  1.44
  2.5   2.7   2.15  2.2   9.   10.   13.   11.   12.    3.45  5.95  4.4 ]
with total 59


 _____________________
column name :   bsa

column datatype :   <class 'numpy.float64'>

 unique values :
[ 4.2   3.6   2.75  6.5   1.67   nan  3.1   2.2   2.8   9.    2.38  3.8
  2.3   4.33  1.5   1.83  8.5   2.7   2.1   4.5   7.    4.    3.3   2.5
  1.91  2.9   3.    3.4   1.73  6.    5.    2.88  7.5   1.62  2.62  5.5
 10.    4.75  2.    1.4   3.5  15.    2.25  2.15 11.    1.75 12.    2.6
  1.53  1.7   1.95  5.4   1.2   1.57  1.85 13.    2.4   1.44  3.2   8.
  3.75  2.05  2.37  1.61  1.8   3.25  2.87 17.    1.33  1.29 23.   19.
  1.36  9.5   5.75  5.25  3.7  21.    1.3   1.25  1.55 26.    1.22  3.9
  1.6   2.63 10.5   1.12  4.6   1.17 16.   29.   34.    1.14  1.18  2.55
  3.15]
with total 96


 _____________________


 ____________________________________________________________
columns with null values count :
 home_team_short_name        0
home_team_long_name         0
away_team_short_name        0
away_team_long_name         0
league_name                 0
                           ...
gbd                     11817
gba                     11817
bsh                     11818
bsd                     11818
bsa                     11818
Length: 120, dtype: int64
 with total 407395


 ____________________________________________________________
columns with duplicates count :
0


 ____________________________________________________________
```

In [22]:

```
df_mathces_info.describe()
```

Out[22]:

	id	country_id	league_id	stage	match_api_id	home_team_api_id	away_team_api_id	home_team_goal	a
count	25979.000000	25979.000000	25979.000000	25979.000000	2.597900e+04	25979.000000	25979.000000	25979.000000	
mean	12990.000000	11738.630317	11738.630317	18.242773	1.195429e+06	9984.371993	9984.475115	1.544594	
std	7499.635658	7553.936759	7553.936759	10.407354	4.946279e+05	14087.453758	14087.445135	1.297158	
min	1.000000	1.000000	1.000000	1.000000	4.831290e+05	1601.000000	1601.000000	0.000000	
25%	6495.500000	4769.000000	4769.000000	9.000000	7.684365e+05	8475.000000	8475.000000	1.000000	
50%	12990.000000	10257.000000	10257.000000	18.000000	1.147511e+06	8697.000000	8697.000000	1.000000	
75%	19484.500000	17642.000000	17642.000000	27.000000	1.709852e+06	9925.000000	9925.000000	2.000000	
max	25979.000000	24558.000000	24558.000000	38.000000	2.216672e+06	274581.000000	274581.000000	10.000000	

8 rows × 105 columns

Comments :

- The data from the matches seems missy
- Attributes like shoton , goal ,...etc are in xml format
- Attributes like sja, vch, vcd are numerical values which are odds from different websits in decimal formats
- Fortunately we don't need any of these attributes to answer our questions .so, we will drop them and just keep home_team_goal and away_team_goal ,home_team_name and away_team_name,season
- season attribute ranges from season 2008/2009 to 2015/2016
- Null values in card attribute means there is no red/yellow cards in this match or it's unknown

Data Cleaning

Note :
This part of the section depend on the previous part. We will focus on the problems we have stated earlier and try to solve it.

Teams_Dataset

In [23]:

```
# first let's drop unneccessary columns
df_teams_info.drop(['id','team_fifa_api_id','team_api_id','builduplaydribbling'],axis=1,inplace=True)
```

In [24]:

```
# change datatype for date
df_teams_info['date'] = pd.to_datetime(df_teams_info['date'])
# check for that
df_teams_info[['date']].dtypes
```

Out[24]:

```
date    datetime64[ns]
dtype: object
```

In [25]:

```
# we have to rearange our dataset suchthat team name followed by the other attributes
# let's change short name attribute first
short_name = df_teams_info.pop('team_short_name')
df_teams_info.insert(0,'team_short_name',short_name)
# change long name attribute
long_name = df_teams_info.pop('team_long_name')
df_teams_info.insert(1,'team_long_name',long_name)
```

In [26]:

```
# check for changes
df_teams_info.head()
```

Out[26]:

	team_short_name	team_long_name	date	buildupplayspeed	buildupplayspeedclass	buildupplaydribblingclass	buildupplaypassing	bui
0	AAR	FC Aarau	2010-02-22	60	Balanced	Little	50	
1	AAR	FC Aarau	2014-09-19	52	Balanced	Normal	56	
2	AAR	FC Aarau	2015-09-10	47	Balanced	Normal	54	
3	ABE	Aberdeen	2010-02-22	70	Fast	Little	70	
4	ABE	Aberdeen	2011-02-22	47	Balanced	Little	52	

5 rows × 23 columns

Note :
The dataset came from a database that's why it seems almost clean

Players_Dataset

In [27]:

```
# first let's drop unneccessary columns
df_players_info.drop(['id','player_fifa_api_id'],axis=1,inplace=True)
```

In [28]:

```
# change datatype for date and birthday
df_players_info['date'] = pd.to_datetime(df_players_info['date'])
df_players_info['birthday'] = pd.to_datetime(df_players_info['birthday'])
# check for that
df_players_info[['date','birthday']].dtypes
```

Out[28]:

```
date        datetime64[ns]
birthday    datetime64[ns]
dtype: object
```

In [29]:

```
# change datatype from object to int or float
# since we have many attributes so using ""infer_objects" method will ease our mission
df_players_info = df_players_info.infer_objects()
# check for the datatypes
df_players_info.dtypes
```

Out[29]:

```
player_name                 object
birthday            datetime64[ns]
height                     float64
weight                       int64
player_api_id                int64
date                datetime64[ns]
overall_rating             float64
potential                  float64
preferred_foot              object
attacking_work_rate         object
defensive_work_rate         object
crossing                   float64
finishing                  float64
heading_accuracy           float64
short_passing              float64
volleys                    float64
dribbling                  float64
curve                      float64
free_kick_accuracy         float64
long_passing               float64
ball_control               float64
acceleration               float64
sprint_speed               float64
agility                    float64
reactions                  float64
balance                    float64
shot_power                 float64
jumping                    float64
stamina                    float64
strength                   float64
long_shots                 float64
aggression                 float64
interceptions              float64
positioning                float64
vision                     float64
penalties                  float64
marking                    float64
standing_tackle            float64
sliding_tackle             float64
gk_diving                  float64
gk_handling                float64
gk_kicking                 float64
gk_positioning             float64
gk_reflexes                float64
dtype: object
```

In [30]:

```
df_players_info.head()
```

Out[30]:

	player_name	birthday	height	weight	player_api_id	date	overall_rating	potential	preferred_foot	attacking_work_rate	...	vision
0	Aaron Appindangoye	1992-02-29	182.88	187	505942	2016-02-18	67.0	71.0	right	medium	...	54.0
1	Aaron Appindangoye	1992-02-29	182.88	187	505942	2015-11-19	67.0	71.0	right	medium	...	54.0
2	Aaron Appindangoye	1992-02-29	182.88	187	505942	2015-09-21	62.0	66.0	right	medium	...	54.0
3	Aaron Appindangoye	1992-02-29	182.88	187	505942	2015-03-20	61.0	65.0	right	medium	...	53.0
4	Aaron Appindangoye	1992-02-29	182.88	187	505942	2007-02-22	61.0	65.0	right	medium	...	53.0

5 rows × 44 columns

In [31]:

```
# dealing with null values
# select columns that have null values by index then select columns with numeric datatype
null_column = df_players_info.iloc[:,5:].select_dtypes(include = np.number).columns
# loop through all the null column
for column in null_column :
    # replace each null value with the mean of "player" previous scores
    df_players_info[column] = df_players_info.groupby('player_name')[column].transform(lambda x:np.where(np.isnan
(x),x.mean(),x))
```

In [32]:

```
# check for heading_accuracy value of Abdeslam Ouaddou player
# what we have done her is just calculate the mean of the previous score for Abdeslam Ouaddou (70+80+80+80+80)/5
=
df_players_info.query('player_name == "Abdeslam Ouaddou"')[['heading_accuracy']]
```

Out[32]:

	heading_accuracy
478	70.0
479	80.0
480	80.0
481	80.0
482	80.0
483	78.0

In [33]:

```
# select null columns which are categorical
null_column = ['preferred_foot','attacking_work_rate','defensive_work_rate']
# loop through all of these columns
for column in null_column :
    # replace each null value with the previous value
    df_players_info[column].fillna(method = 'ffill',inplace = True)
```

In [34]:

```
# check for preferred_foot value of Abdeslam Ouaddou player
df_players_info.query('player_name == "Abdeslam Ouaddou"')[['preferred_foot']]
```

Out[34]:

	preferred_foot
478	right
479	right
480	right
481	right
482	right
483	right

In [35]:

```
# let's check again for null values
df_players_info.isnull().sum()
```

Out[35]:

```
player_name               0
birthday                  0
height                    0
weight                    0
player_api_id             0
date                      0
overall_rating            0
potential                 0
preferred_foot            0
attacking_work_rate       0
defensive_work_rate       0
crossing                  0
finishing                 0
heading_accuracy          0
short_passing             0
volleys                1848
dribbling                 0
curve                  1848
free_kick_accuracy        0
long_passing              0
ball_control              0
acceleration              0
sprint_speed              0
agility                1848
reactions                 0
balance                1848
shot_power                0
jumping                1848
stamina                   0
strength                  0
long_shots                0
aggression                0
interceptions             0
positioning               0
vision                 1848
penalties                 0
marking                   0
standing_tackle           0
sliding_tackle         1848
gk_diving                 0
gk_handling               0
gk_kicking                0
gk_positioning            0
gk_reflexes               0
dtype: int64
```

In [36]:

```
# we will use fowrard filling method to fill this null values
df_players_info = df_players_info.fillna(method='ffill',axis = 1)
```

In [37]:

```
# check for vision value of Abdeslam Ouaddou player
df_players_info.query('player_name == "Abdeslam Ouaddou"')[['vision']]
```

Out[37]:

	vision
478	70.0
479	71.0
480	71.0
481	71.0
482	71.0
483	70.8

In [38]:

```
# let's check again for null values
df_players_info.isnull().sum()
```

Out[38]:

```
player_name            0
birthday               0
height                 0
weight                 0
player_api_id          0
date                   0
overall_rating         0
potential              0
preferred_foot         0
attacking_work_rate    0
defensive_work_rate    0
crossing               0
finishing              0
heading_accuracy       0
short_passing          0
volleys                0
dribbling              0
curve                  0
free_kick_accuracy     0
long_passing           0
ball_control           0
acceleration           0
sprint_speed           0
agility                0
reactions              0
balance                0
shot_power             0
jumping                0
stamina                0
strength               0
long_shots             0
aggression             0
interceptions          0
positioning            0
vision                 0
penalties              0
marking                0
standing_tackle        0
sliding_tackle         0
gk_diving              0
gk_handling            0
gk_kicking             0
gk_positioning         0
gk_reflexes            0
dtype: int64
```

Matches_Dataset

In [39]:

```
# store card and date columns in seperate dataframe to converted to tabular form
cards_info = df_mathces_info[['card','date']]
# we will just kepp the attributes that we want and drop the rest of them
df_mathces_info = df_mathces_info[['home_team_short_name', 'home_team_long_name','home_team_goal', 'away_team_sho
rt_name','away_team_long_name','away_team_goal','league_name', 'date', 'season','home_team_api_id','away_team_api
_id']]
```

In [40]:

```
# change datatype for date
df_mathces_info['date'] = pd.to_datetime(df_mathces_info['date'])
# check for that
df_mathces_info[['date']].dtypes
```

Out[40]:

```
date    datetime64[ns]
dtype: object
```

In [41]:

```
# check for the selected columns
df_mathces_info.columns
```

Out[41]:

```
Index(['home_team_short_name', 'home_team_long_name', 'home_team_goal',
       'away_team_short_name', 'away_team_long_name', 'away_team_goal',
       'league_name', 'date', 'season', 'home_team_api_id',
       'away_team_api_id'],
      dtype='object')
```

In [42]:

```
# in this section we will extract the players and the cards they have taken in specific date from xml files
# remove nulls from card column
cards_info = cards_info[cards_info.card.notnull()]
# let's extract players ids with card type red/yellow using beautifulsoup
# define the following empty lists
player_id = []
card_type = []
dates = []
# extract the each xml file with the corresponding date
for xml, date in zip( cards_info.card, cards_info.date) :
    soup = BeautifulSoup( xml, 'lxml')         # parse the xml file to be converted into html
    players = [id.string for id in soup.find_all('player1')]  # find all the players within player1 tag
    cards = [type.string for type in soup.find_all('card_type')]  # find all the cards within card_type tag
    # sometimes card_type tag is not present so we replace it with  comment tag
    comments = [comment.string for comment in soup.find_all('comment')]
    # we need to make the two lists cards and players consistent
    # if the we have  players equal to cards that means our lists are consistent
    if len(players) == len(cards) :
        player_id.extend(players) # append the current list with the bigger list
        card_type.extend(cards)   # the samething here
        dates.extend([date for e in range(len(players))])  # repeat the date along with the players list
    # if the we have  players not equal  cards then use comments instead
    elif len(players) == len(comments) :
        player_id.extend(players)
        card_type.extend(comments)
        dates.extend([date for e in range(len(players))])
    # if the we have  players not equal to cards or comments then there isn't enough information
    # that means we have palyers with unknown card types or card types with unknown players
    else :
        continue
# store the data into dataframe
cards_info = pd.DataFrame({"player_id":player_id,"card_type":card_type,"date":dates})
```

In [43]:

```
# explore the new dataset
explore_dataset(cards_info)
```

```
we have 61767 rows and 3 columns


 ____________________________________________________
column name :   player_id

column datatype :   <class 'bs4.element.NavigableString'>

 unique values :
['24157' '30362' '30829' ... '25794' '95861' '214344']
with total 5864


 ____________________
column name :   card_type

column datatype :   <class 'bs4.element.NavigableString'>

 unique values :
['y' 'y2' 'r']
with total 3


 ____________________
column name :   date

column datatype :   <class 'str'>

 unique values :
['2008-08-17 00:00:00' '2008-08-16 00:00:00' '2008-10-29 00:00:00' ...
 '2016-05-16 00:00:00' '2016-05-22 00:00:00' '2016-05-25 00:00:00']
with total 1347


 ____________________


 ____________________________________________________
columns with null values count :
 player_id    0
card_type    0
date         0
dtype: int64
 with total 0


 ____________________________________________________
columns with duplicates count :
9


 ____________________________________________________
```

In [44]:

```
# change the datetype of date
cards_info.date = pd.to_datetime(cards_info.date)
```

In [45]:

```
# print the first 5 rows
cards_info.head()
```

Out[45]:

	player_id	card_type	date
0	24157	y	2008-08-17
1	30362	y	2008-08-17
2	30829	y	2008-08-17
3	37442	y	2008-08-16
4	46621	y	2008-08-16

Exploratory Data Analysis

Sections:

Research Question 1 :

which teams has improved through all seasons in Spain LIGA BBVA ?

Main Points :

1. *select the Spain LIGA BBVA league*
2. *define a function to plot the results to avoid code redundency*
3. *call the function and comment on each season*

----------select the Spain LIGA BBVA league----------

In [46]:

```
df_matches_spain = df_mathces_info.query('league_name == "Spain LIGA BBVA"')
```

In [47]:

```
# unique seasons
df_matches_spain.season.unique()
```

Out[47]:

```
array(['2008/2009', '2009/2010', '2010/2011', '2011/2012', '2012/2013',
       '2013/2014', '2014/2015', '2015/2016'], dtype=object)
```

----------define a function to plot the results to avoid code redundency----------

In [48]:

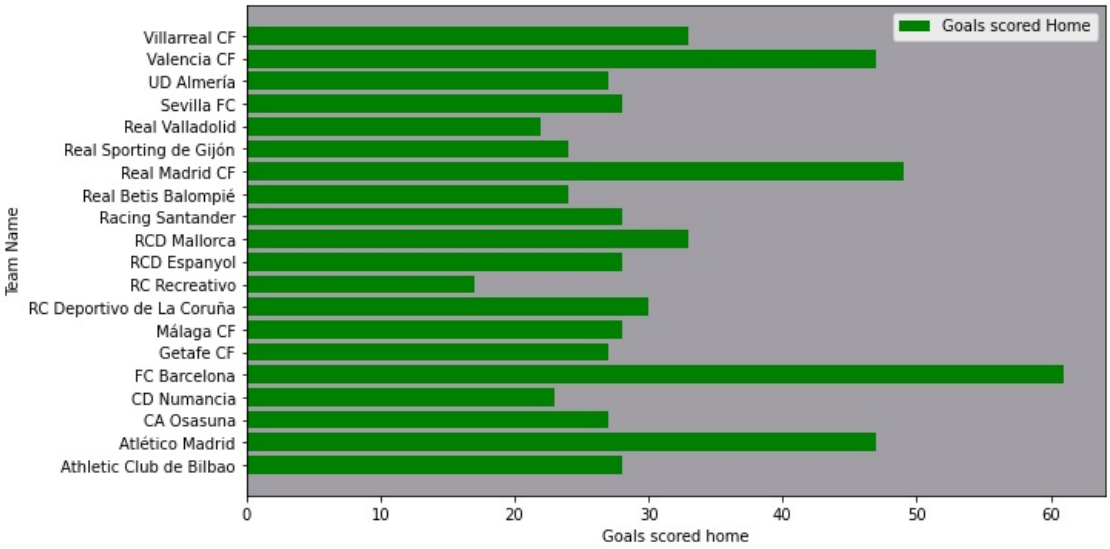
```
def compare_goals(season ,league,df):
    fig , (ax1 , ax2, ax3) = plt.subplots(3,figsize=(10,20))
    fig.suptitle("comparison Between goals scored Away and Home "+"\n"+"season : "+season+"\n"+league+" League")
    fig.patch.set_facecolor("#FFFFFF")
    # get the data related with season variable
    q = df.query("season == @season")
    # group by home goals
    home_goals = q.groupby(['season','home_team_long_name'])[['home_team_goal']].sum().reset_index()
    # select x and height for home teams
    x1 = home_goals['home_team_long_name']
    height1 = home_goals['home_team_goal']
    # group by away goals
    away_goals = q.groupby(['season','away_team_long_name'])[['away_team_goal']].sum().reset_index()
    # select x and height for away teams
    x2 = away_goals['away_team_long_name']
    height2 = away_goals['away_team_goal']
    # plot the home team goals
    ax1.set_xlabel("Goals scored home")
    ax1.set_ylabel("Team Name")
    ax1.set_facecolor('#A19FA5')
    ax1.barh( x1, height1, color = "g",label = "Goals scored Home")
    ax1.legend()
    # plot the away team goals
    ax2.set_xlabel("Goals scored away")
    ax2.set_ylabel("Team Name")
    ax2.set_facecolor('#A19FA5')
    ax2.barh(x2,height2,color='r', label = "Goals scored Away")
    ax2.legend()
    # stacked barchart to easily compare between them
    labels = list(home_goals['home_team_long_name'])
    x = np.arange(len(labels))
    width = 0.8
    ax3.set_facecolor('#A19FA5')
    ax3.barh( labels, height1, width ,label = 'Goals scored Home', color = 'g')
    ax3.barh( labels, height2, width,left = height1, label = 'Goals scored Away', color = 'r')
    ax3.set_xlabel("Goals scored [home-away]")
    ax3.set_ylabel("Team Name")
    ax3.legend()
    plt.show()
```

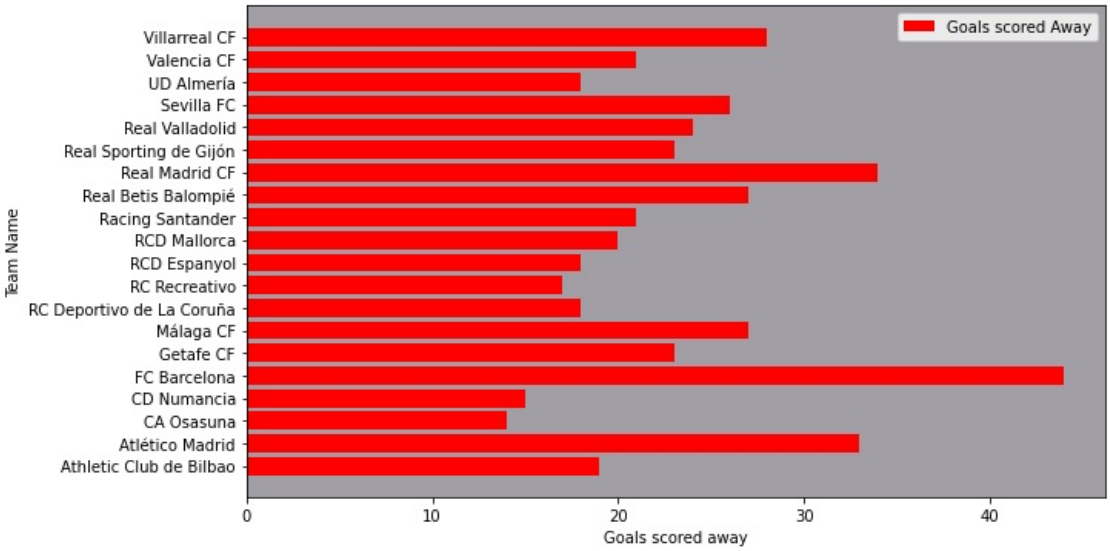
----------call the function and comment on each season----------

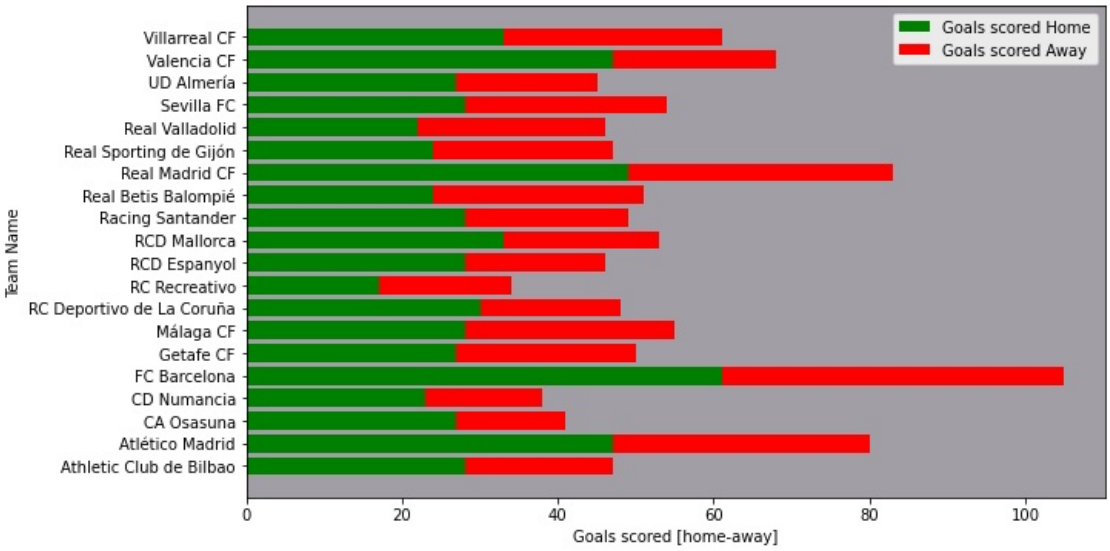
In [49]:

```
compare_goals('2008/2009','Spain LIGA BBVA',df_matches_spain)
```

comparison Between goals scored Away and Home
season : 2008/2009
Spain LIGA BBVA League







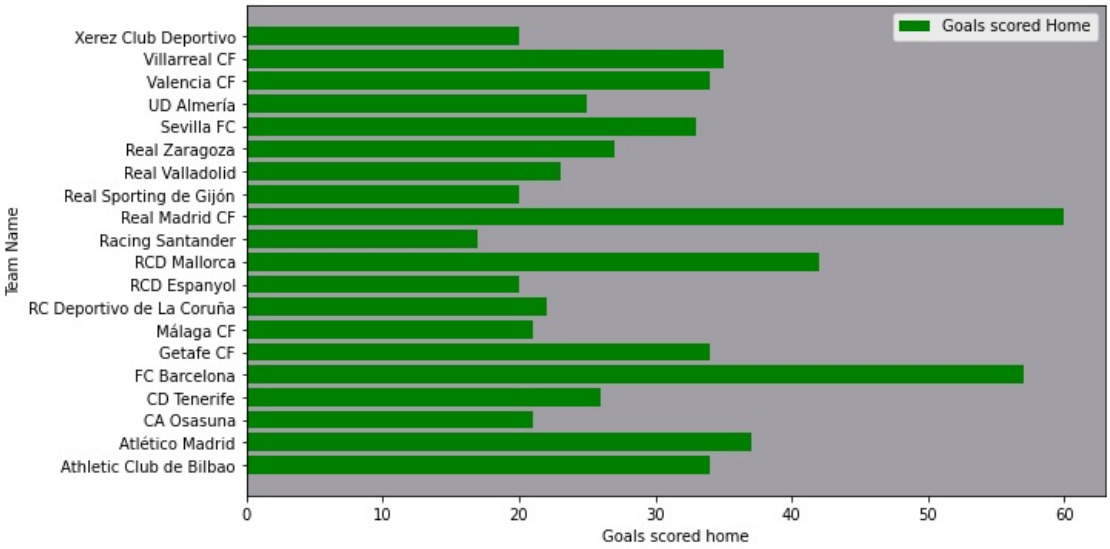
season 2008/2009 :

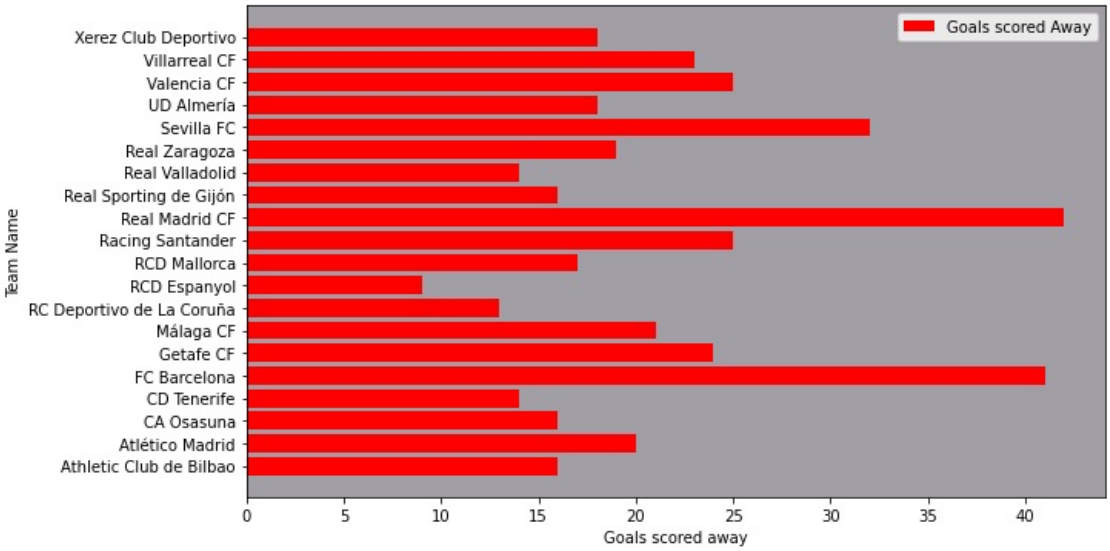
Barcelona **has the heighest score with more than 100 goals most of them scored Home**
Real Madrid **has the second heighest score with more than 80 goals most of them scored Home**
Atlitco Madrid **has the third heighest score with 80 goalsmost of them scored Home**
Recreativo **has the lowest score with less than 40 goals**

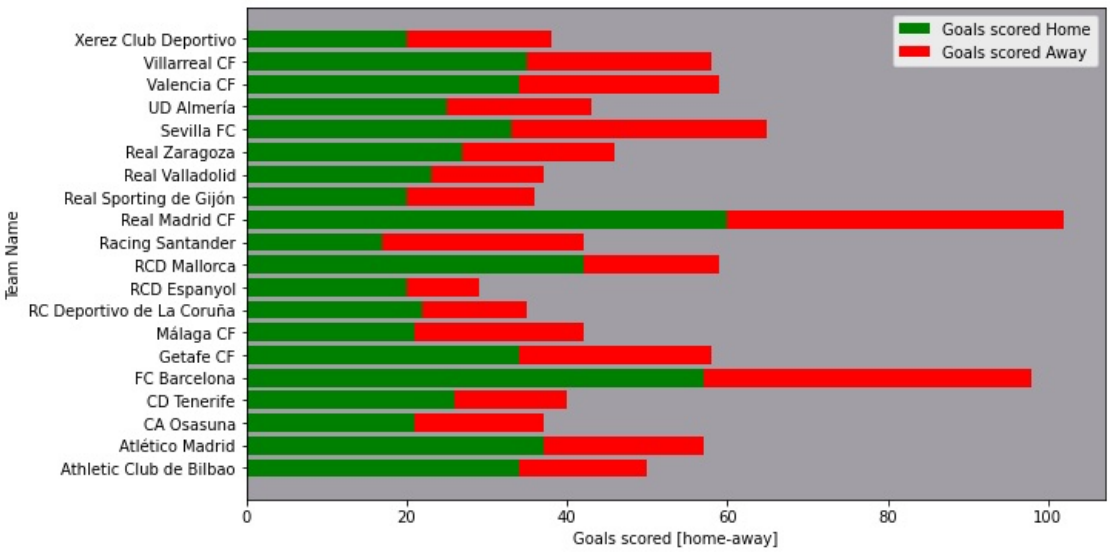
In [50]:

```
compare_goals('2009/2010','Spain LIGA BBVA',df_matches_spain)
```

comparison Between goals scored Away and Home
season : 2009/2010
Spain LIGA BBVA League







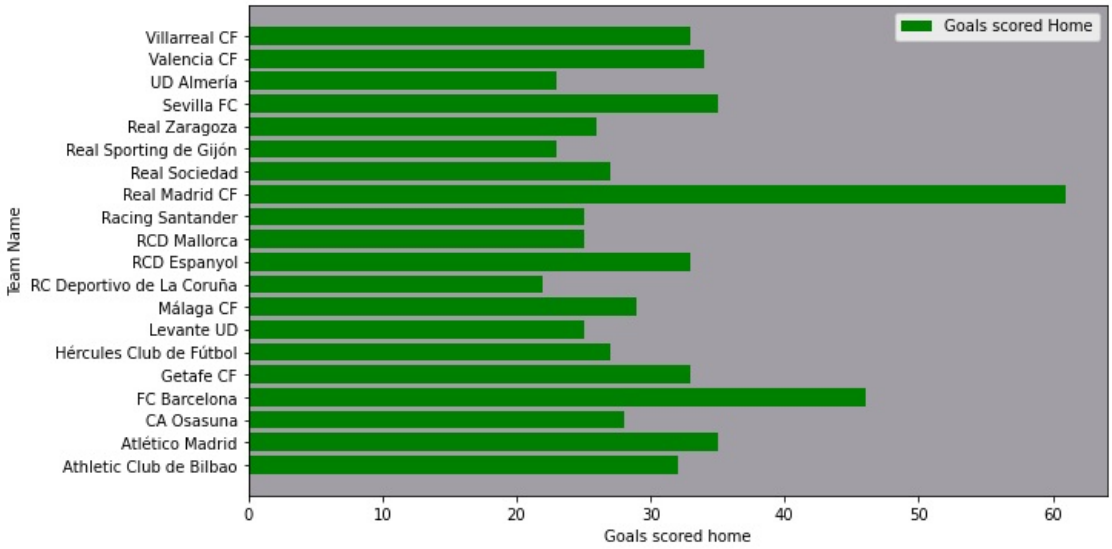
season 2009/2010 :

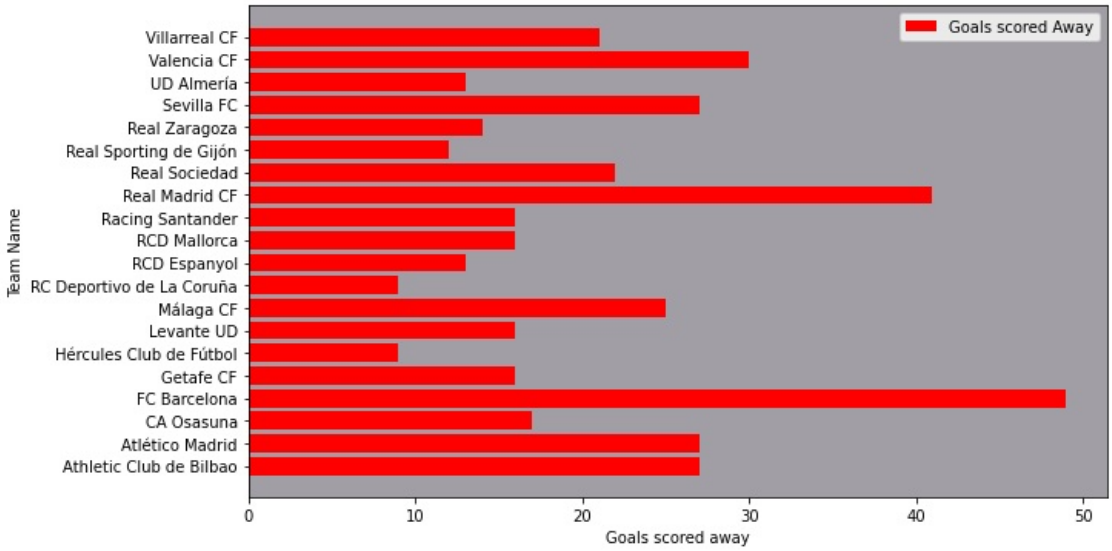
Real Madrid **has the heighest score with more than 100 goals most of them scored Home**
Real Madrid **has the second heighest score with 100 goals most of them scored Home**
Sevilla **has the third heighest score with 60 goals most of them scored Home**
Espanyol **has the lowest score with less than 40 goals**

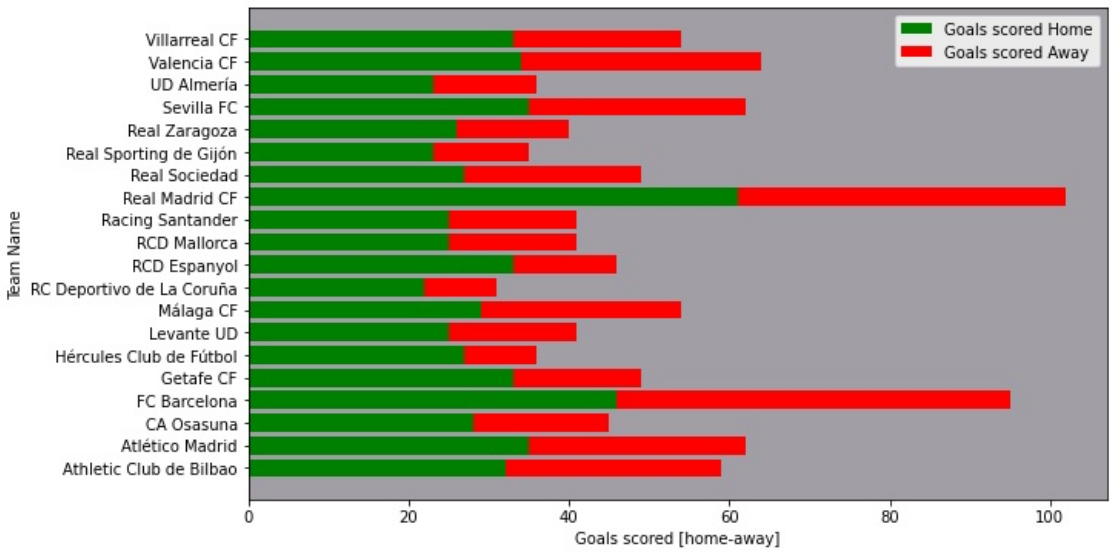
In [51]:

```
compare_goals('2010/2011','Spain LIGA BBVA',df_matches_spain)
```

comparison Between goals scored Away and Home
season : 2010/2011
Spain LIGA BBVA League







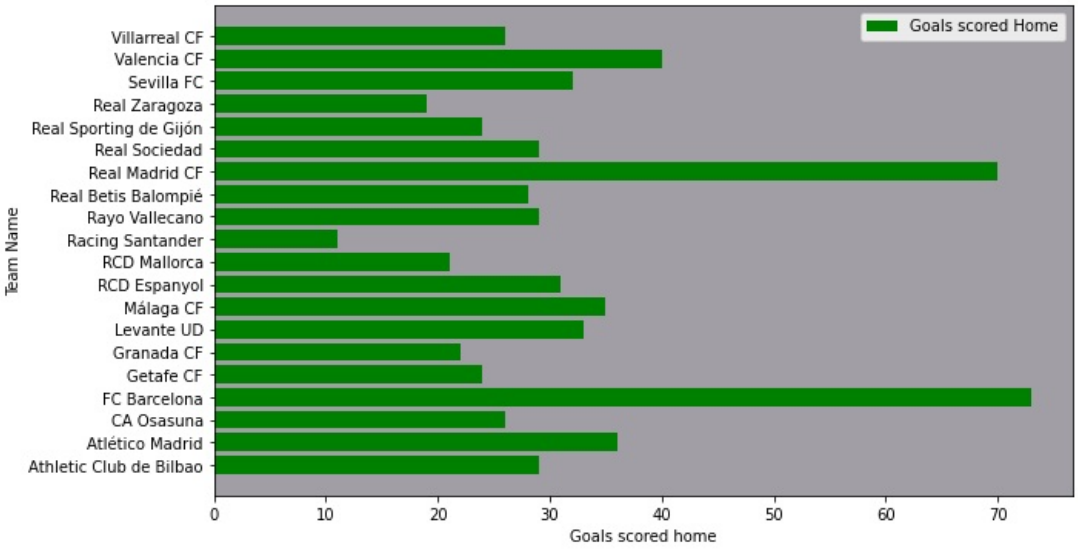
season 2010/2011 :

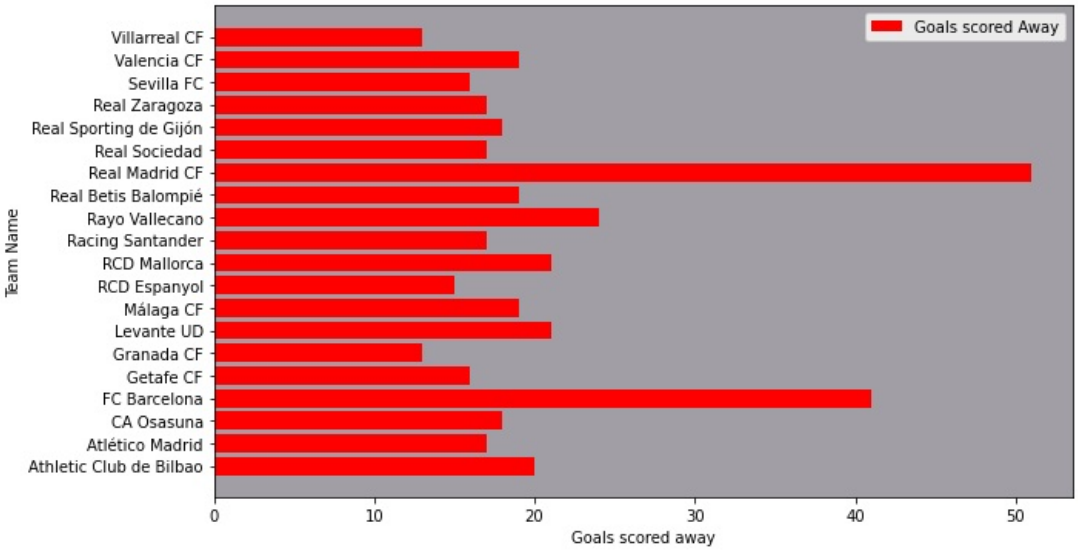
Real Madrid **has the heighest score with more than 100 goals most of them scored Home**
Barcelona **has the second heighest score with less than 100 goals most of them scored Away**
Valencia **has the third heighest score with 60 goals most of them scored Home**
Deportivo de la coruna **has the lowest score with less than 40 goals**

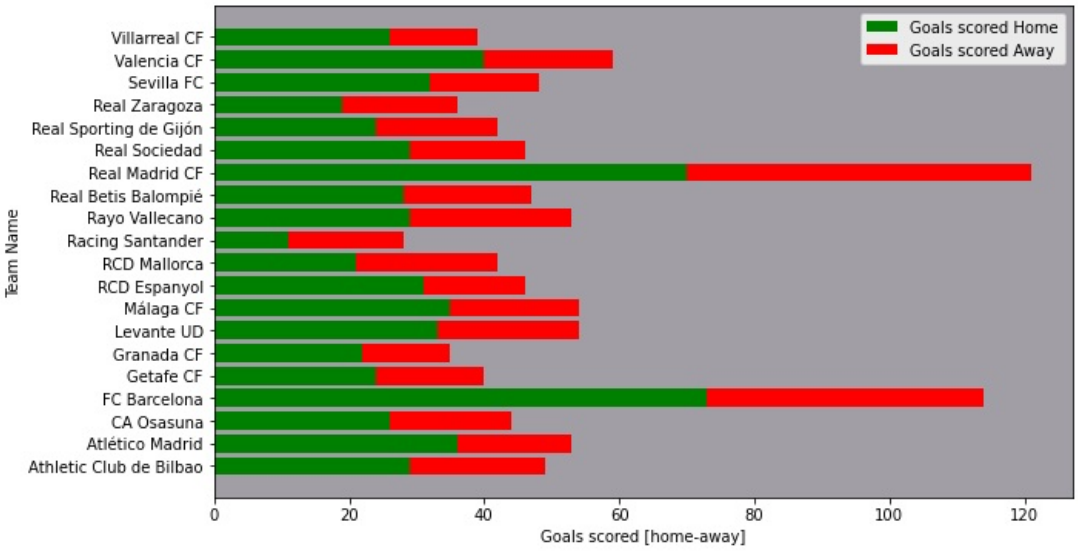
In [52]:

```
compare_goals('2011/2012','Spain LIGA BBVA',df_matches_spain)
```

comparison Between goals scored Away and Home
season : 2011/2012
Spain LIGA BBVA League







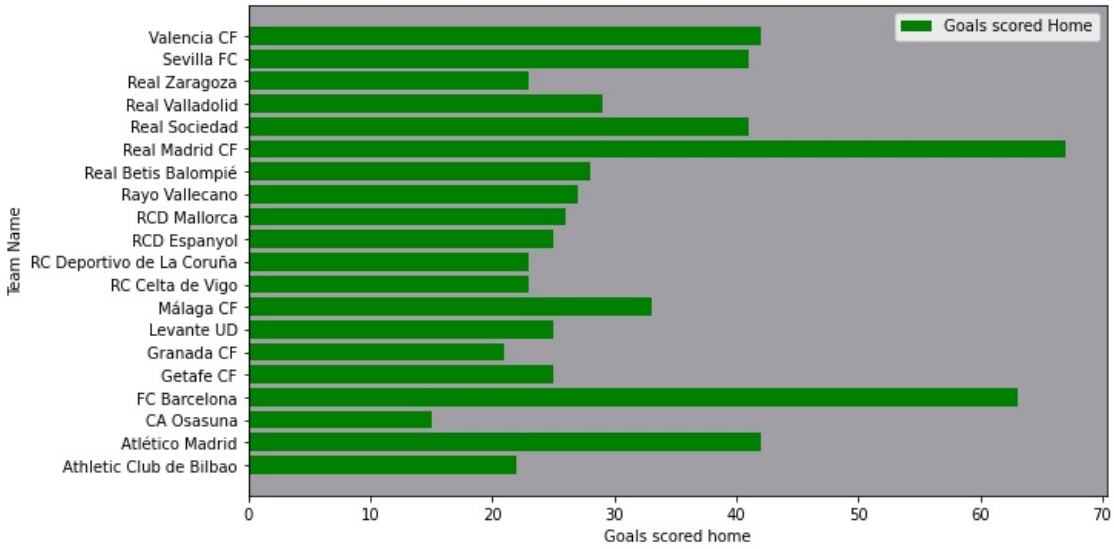
season 2011/2012 :

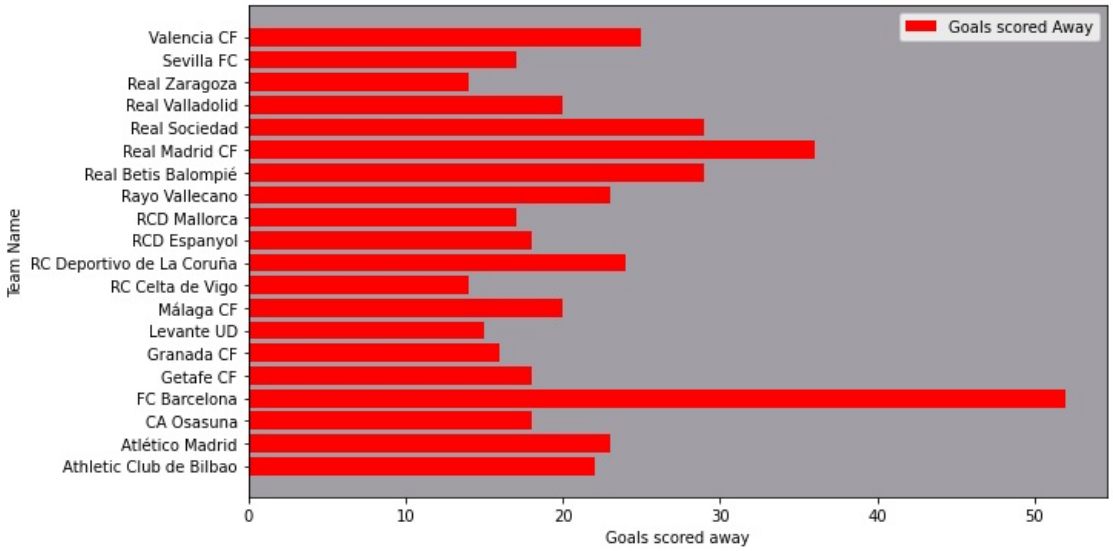
Real Madrid **has the heighest score with 120 goals most of them scored Home**
Barcelona **has the second heighest score with more than 100 goals most of them scored Home**
Valencia **has the third heighest score with 60 goals most of them scored Home**
Racing santander **has the lowest score with less than 40 goals**

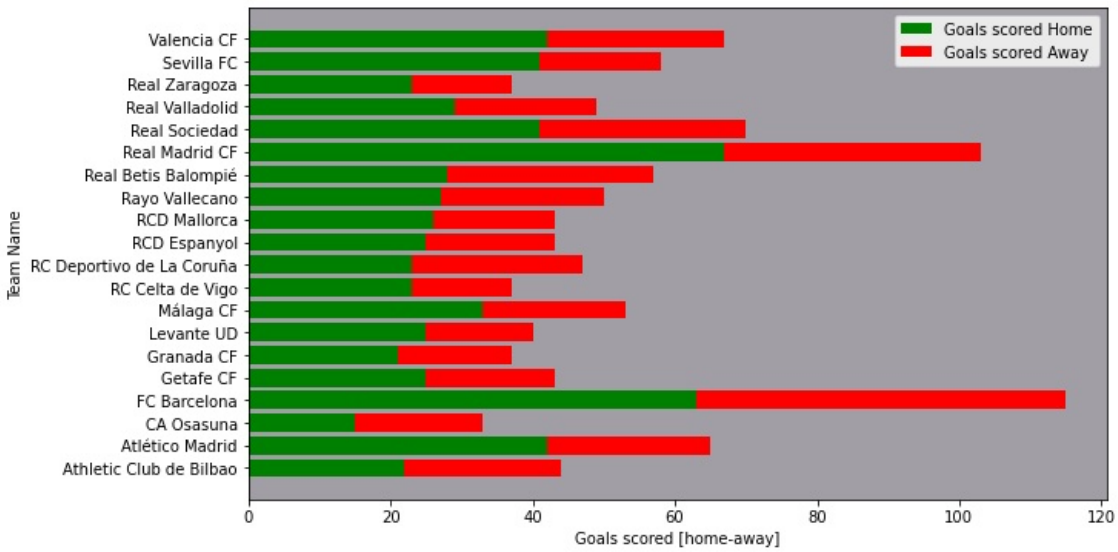
In [53]:

```
compare_goals('2012/2013','Spain LIGA BBVA',df_matches_spain)
```

comparison Between goals scored Away and Home
season : 2012/2013
Spain LIGA BBVA League







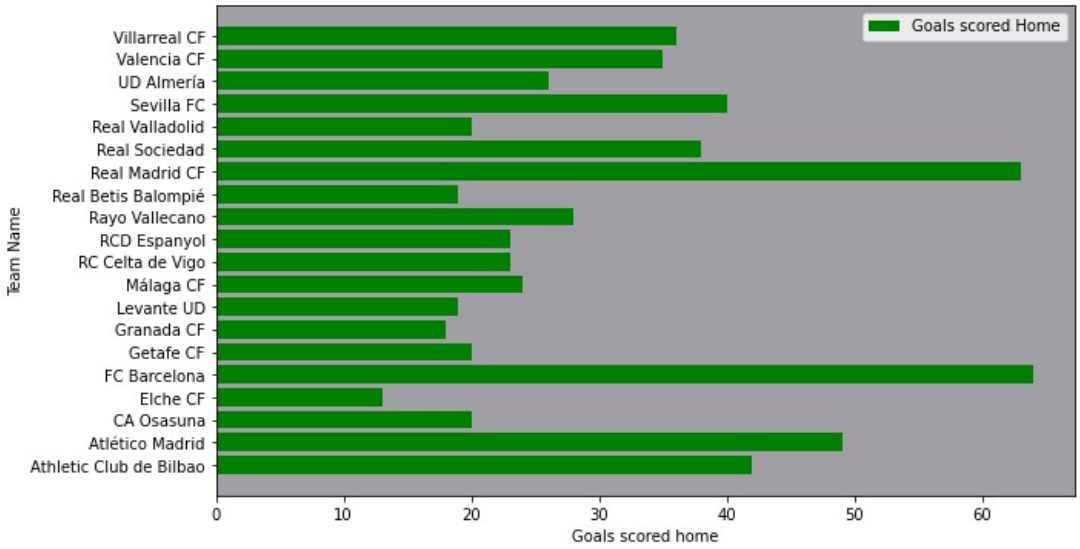
season 2012/2013 :

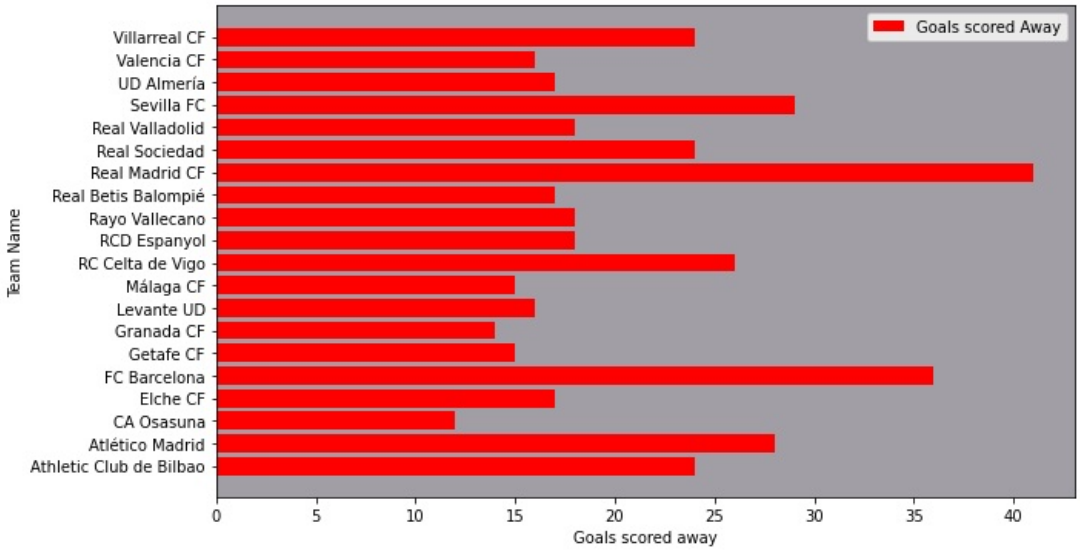
Barcelona **has the heighest score with more than 100 goals most of them scored Home**
Real Madrid **has the second heighest score with more than 100 goals most of them scored Home**
Real sociedad **has the third heighest score with more than 60 goals most of them scored Home**
Osasuna **has the lowest score with less than 40 goals**

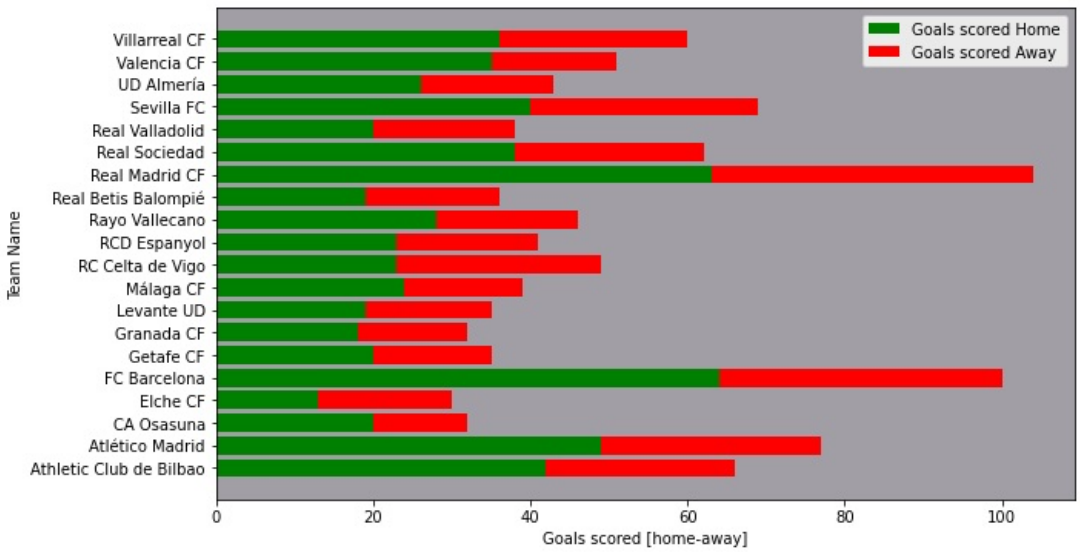
In [54]:

```
compare_goals('2013/2014','Spain LIGA BBVA',df_matches_spain)
```

comparison Between goals scored Away and Home
season : 2013/2014
Spain LIGA BBVA League







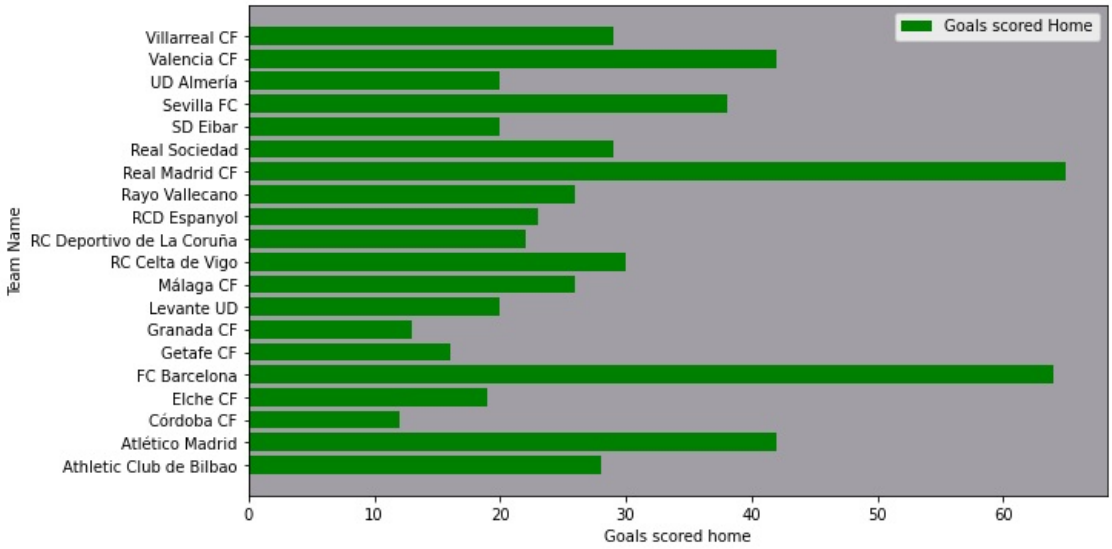
season 2013/2014 :

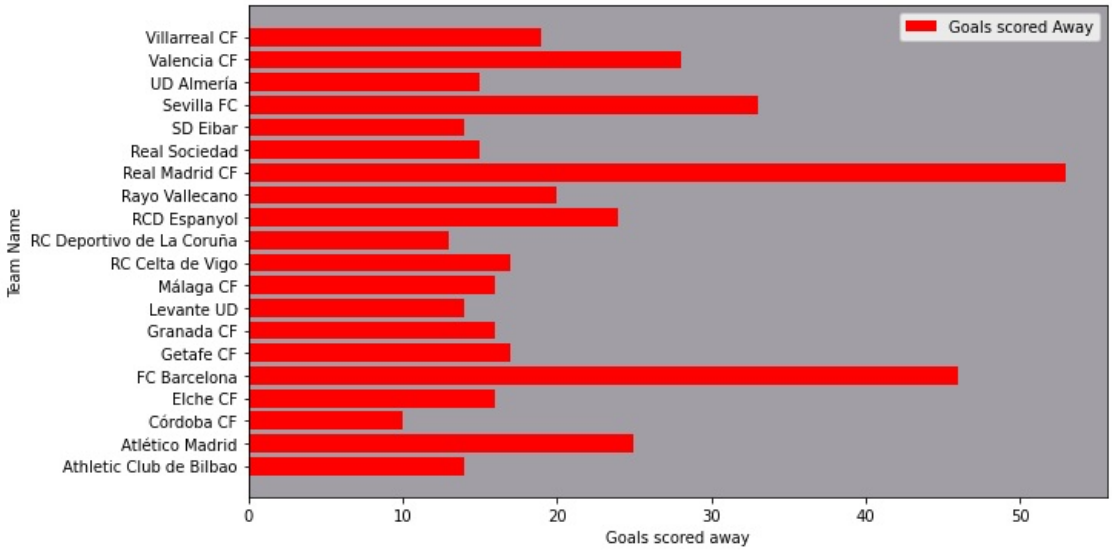
Real Madrid **has the heighest score with more than 100 goals most of them scored Home**
Barcelona **has the second heighest score with 100 goals most of them scored Home**
Atletico Madrid **has the third heighest score with 60 goals most of them scored Home**
Elche **has the lowest score with less than 40 goals**

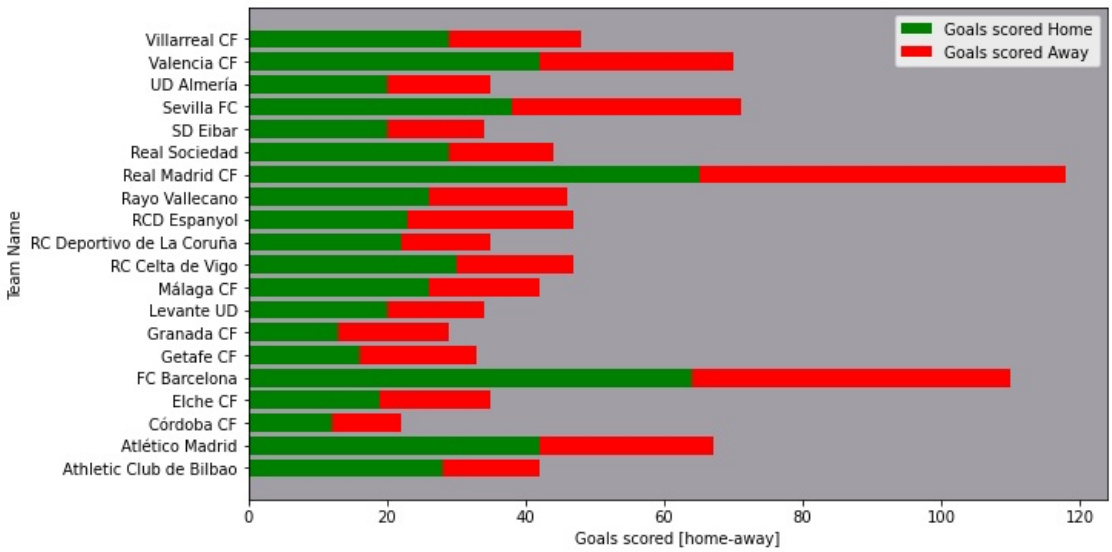
In [55]:

```
compare_goals('2014/2015','Spain LIGA BBVA',df_matches_spain)
```

comparison Between goals scored Away and Home
season : 2014/2015
Spain LIGA BBVA League







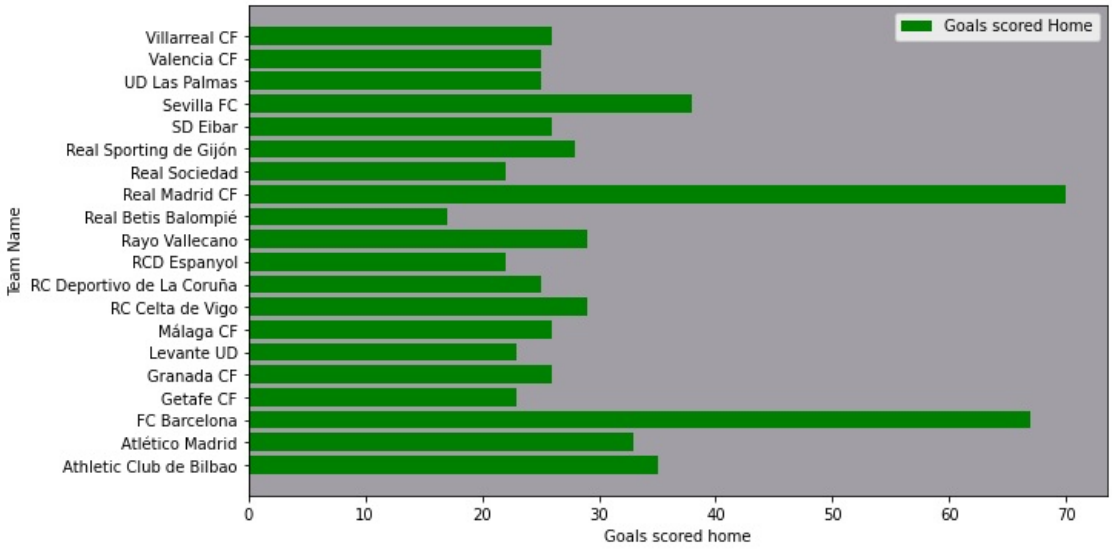
season 2014/2015 :

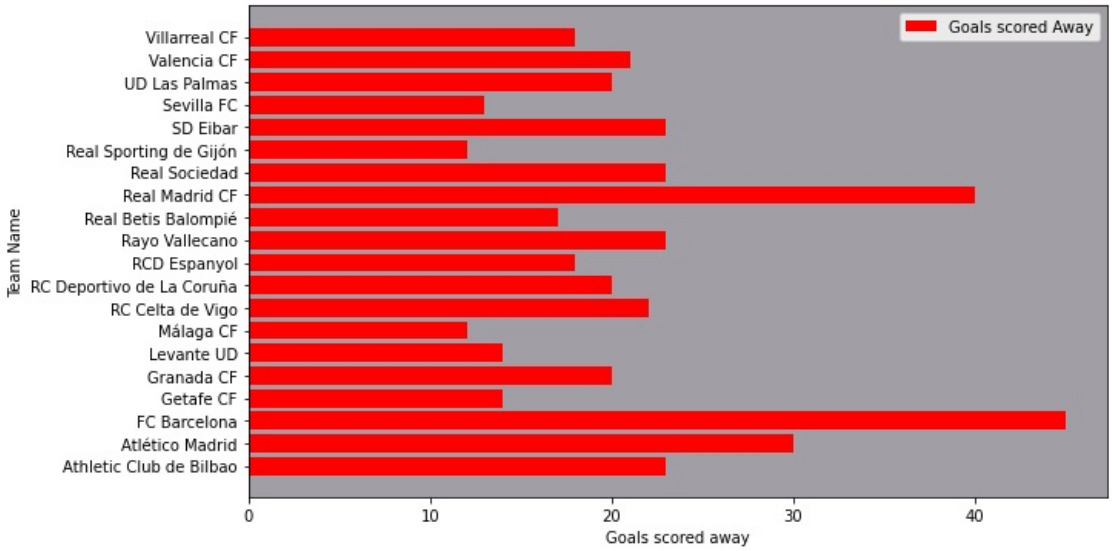
Real Madrid **has the heighest score with more than 100 goals most of them scored Home**
Barcelona **has the second heighest score with more than 100 goals most of them scored Home**
Sevilla **has the third heighest score with 60 goals most of them scored Home**
Cordoba **has the lowest score with 20 goals**

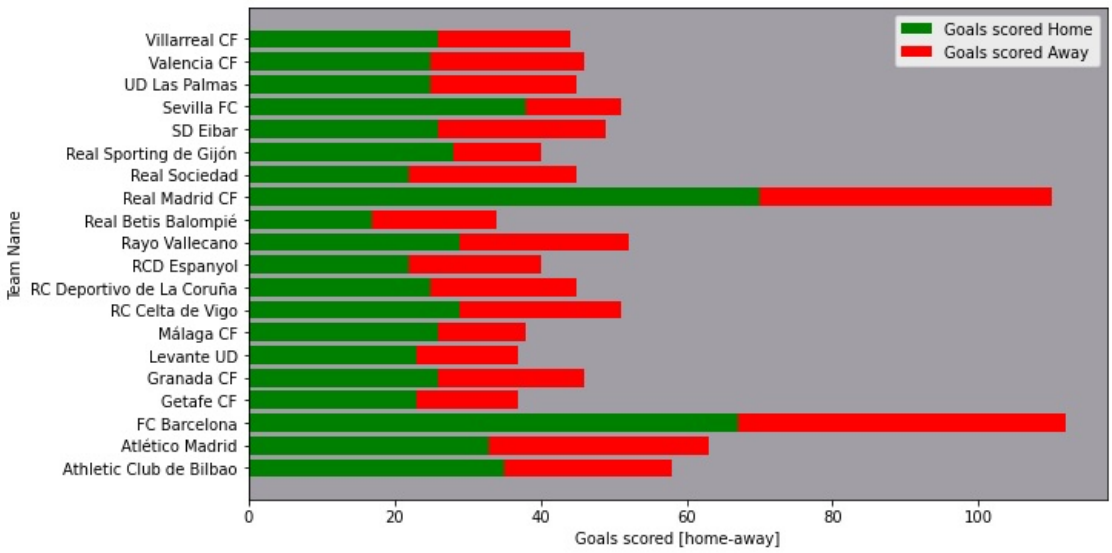
In [56]:

```
compare_goals('2015/2016','Spain LIGA BBVA',df_matches_spain)
```

comparison Between goals scored Away and Home
season : 2015/2016
Spain LIGA BBVA League







season 2015/2016 :

Barcelona **has the heighest score with more than 100 goals most of them scored Home**
Real Madrid **has the second heighest score with more than 100 goals most of them scored Home**
Atletico Madrid **has the third heighest score with 60 goals most of them scored Home**
Real betis balompie **has the lowest score with less than 40 goals**

Research Question 2 :

How is the player's physical power related to weight and height?

Main Points :

1. ***The physical power can be determined by some attributes like Acceleration, Agility, Balance, jumping, stamina and strength***
2. ***select specific date to deal with***
3. ***Find the distribution of weight***
4. ***Find the distribution of height***
5. ***Check if there any correlation between weight and height***
6. ***Check for the correaltion between weight and all the attributes***
7. ***Check for the correaltion between height and all the attributes***
   Note: use correlation value R^2 such that : $R^2 \approx \pm 0.4$ or higher

In [57]:

```
physical_attr = df_players_info[['player_name','date','acceleration','agility','balance','jumping','stamina','str
ength','reactions','weight','height']]
```

In [58]:

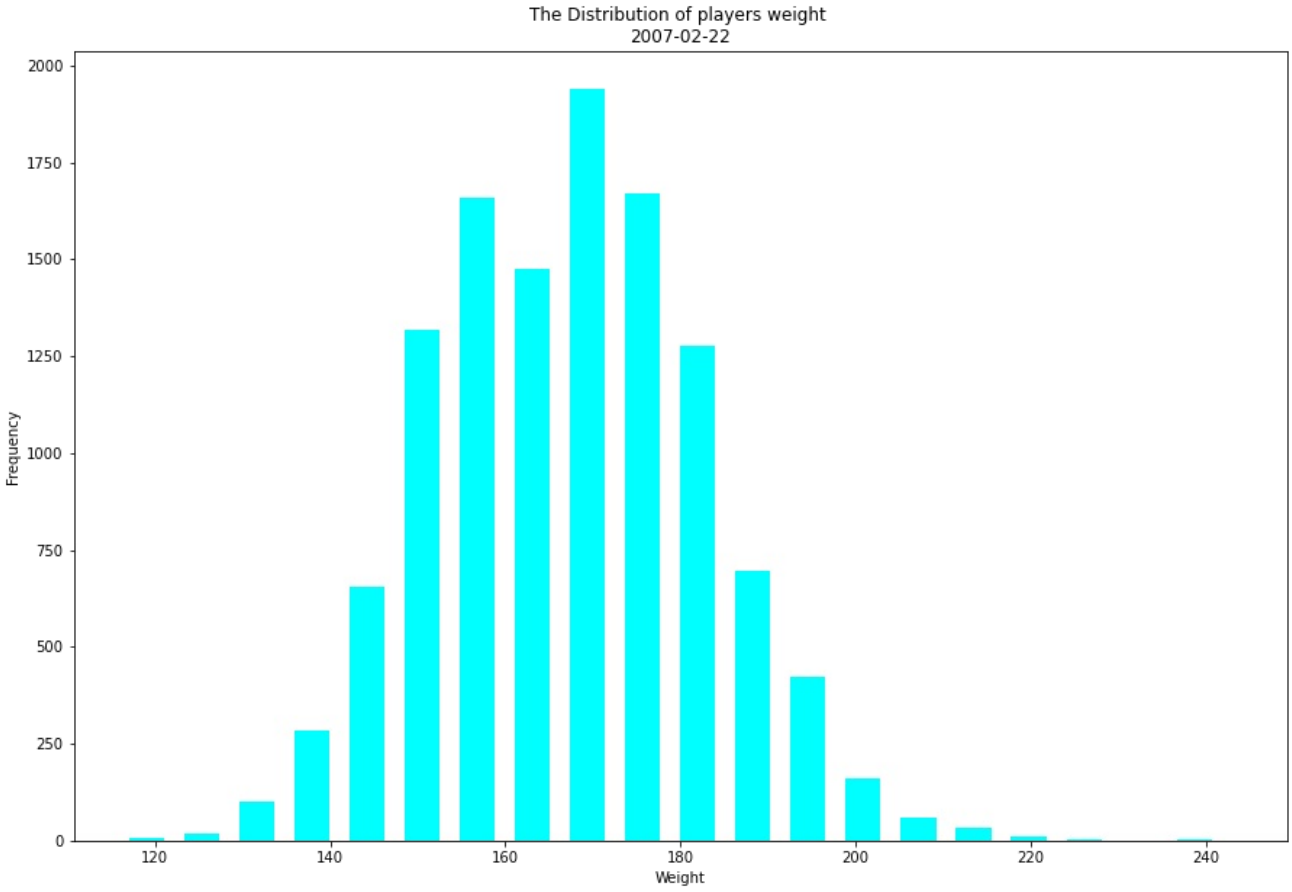
```
# select data within date 2007-02-22
# you can find unique dates in the previous phase Data Wrangling
physical_attr_227 = physical_attr.query('date == 20070222')
# make sure datatypes are consistent
physical_attr_227 = physical_attr_227.infer_objects()
```

.....View the distribution of Weight.....

In [59]:

```
# view the distribution of players weight in this date
weight = physical_attr_227['weight']
plt.figure(figsize=(15,10))
plt.title("The Distribution of players weight "+"\n2007-02-22")
plt.ylabel("Frequency")
plt.xlabel("Weight")
plt.hist( weight,bins = 20,color='cyan',width=4);
print("The mean value of weight is {}".format(np.mean(weight)))
```

The mean value of weight is 168.44942294636795



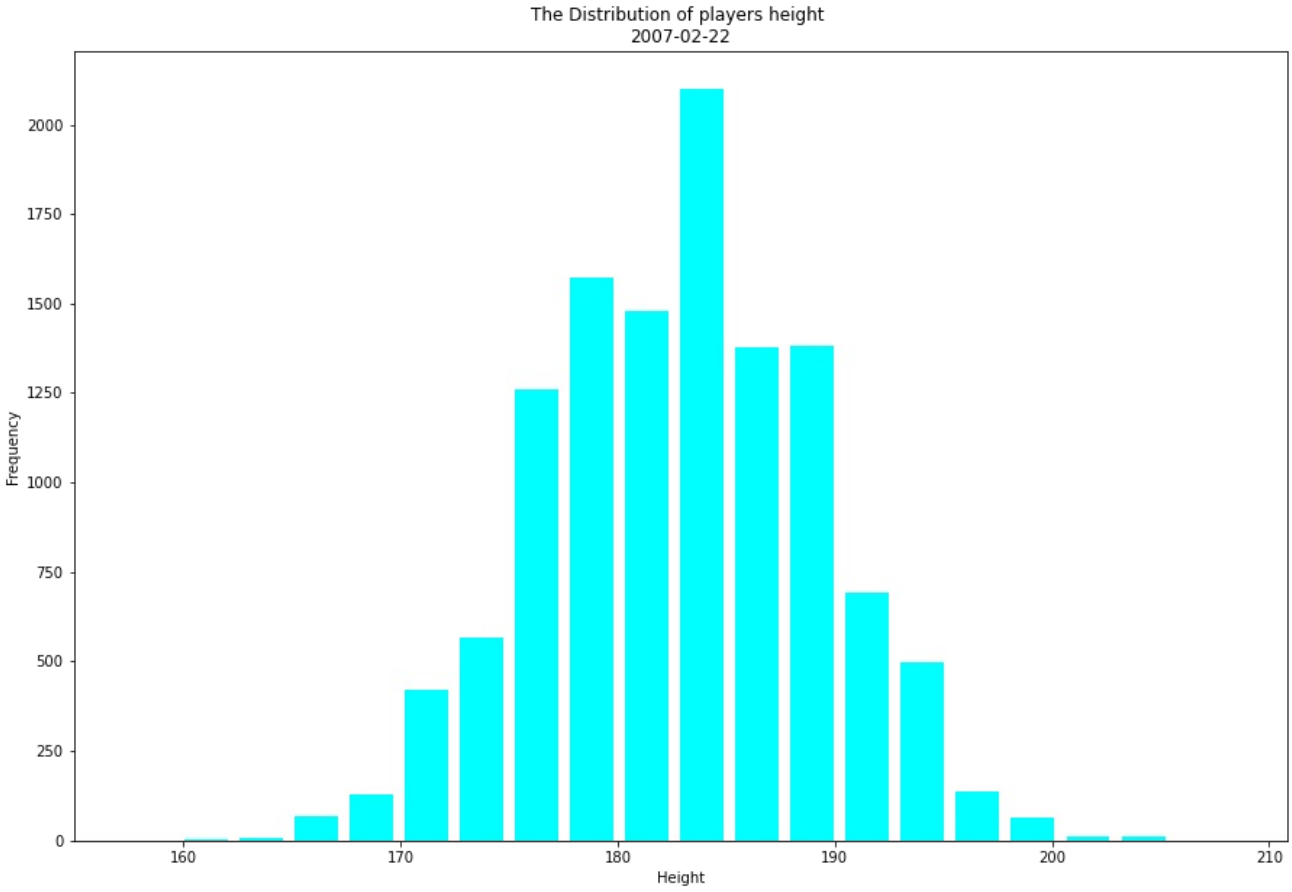
The players weight are normally distributed

.....View the distribution of Height.....

In [60]:

```
# view the distribution of players height in this date
height = physical_attr_227['height']
plt.figure(figsize=(15,10))
plt.title("The Distribution of players height "+"\n2007-02-22")
plt.ylabel("Frequency")
plt.xlabel("Height")
plt.hist( height,bins =20,color='cyan',width=2);
print("The mean value of height is {}".format(np.mean(height)))
```

The mean value of height is 181.86908689747958

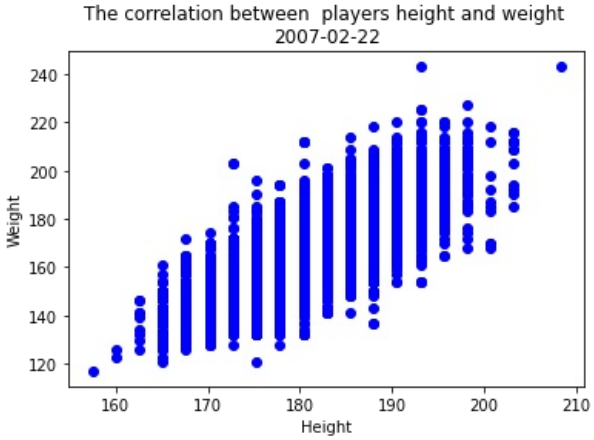


The same thing for players height

.....View the correlation between Height and Weight.....

In [61]:

```
# let's see if there any correlation between weight and height
height = physical_attr_227['height']
weight = physical_attr_227['weight']
plt.title("The correlation between  players height and weight "+"\n2007-02-22")
plt.ylabel("Weight")
plt.xlabel("Height")
plt.scatter( height, weight, color='blue');
```



There is a positive correlation between Hight and weight

.....View Which attribute has a correlation with Weight.....

In [62]:

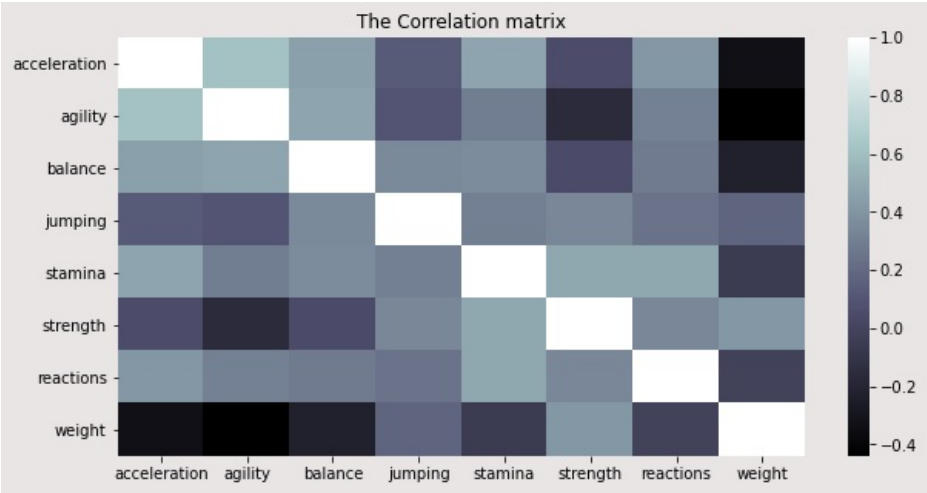
```
# build a correlation matrix between weight and all the other attributes
weight_correlation_matrix =physical_attr_227[['acceleration','agility','balance','jumping','stamina','strength','
reactions','weight']].corr()
weight_correlation_matrix
```

Out[62]:

	acceleration	agility	balance	jumping	stamina	strength	reactions	weight
acceleration	1.000000	0.613982	0.454475	0.130513	0.474922	0.052010	0.411562	-0.337811
agility	0.613982	1.000000	0.472631	0.099194	0.286786	-0.163240	0.310720	-0.439215
balance	0.454475	0.472631	1.000000	0.351952	0.359711	0.048557	0.282136	-0.220130
jumping	0.130513	0.099194	0.351952	1.000000	0.297487	0.338856	0.242815	0.175596
stamina	0.474922	0.286786	0.359711	0.297487	1.000000	0.483845	0.483094	-0.061764
strength	0.052010	-0.163240	0.048557	0.338856	0.483845	1.000000	0.337293	0.410662
reactions	0.411562	0.310720	0.282136	0.242815	0.483094	0.337293	1.000000	-0.016343
weight	-0.337811	-0.439215	-0.220130	0.175596	-0.061764	0.410662	-0.016343	1.000000

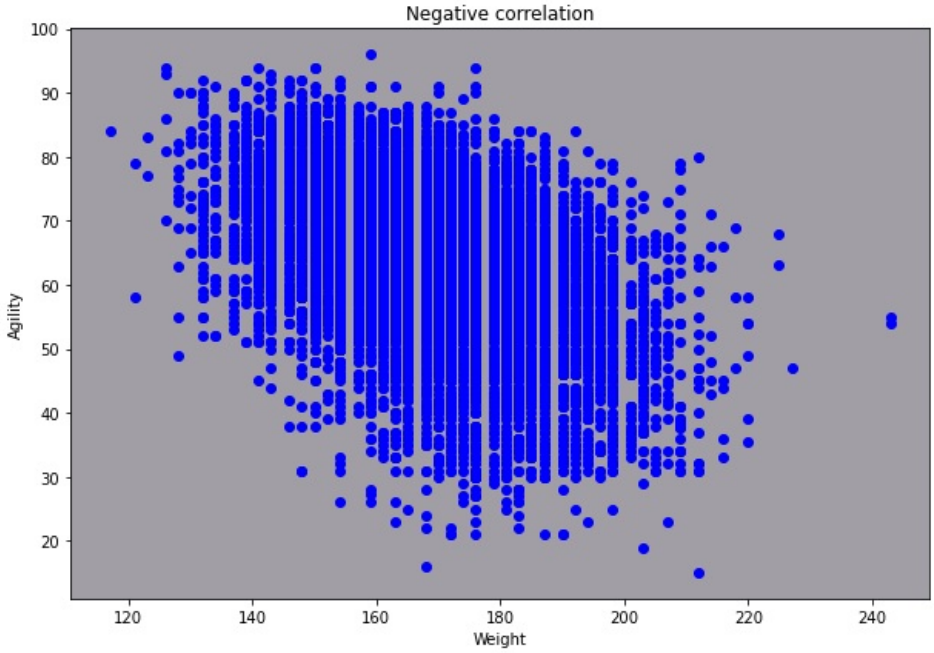
In [63]:

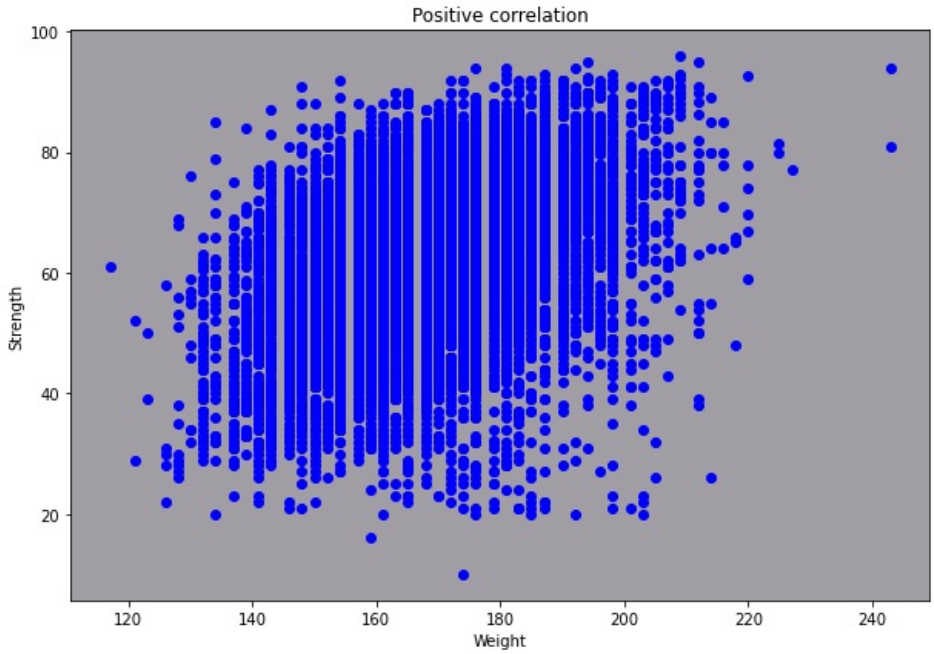
```
fig = plt.figure(figsize=(10,5))
plt.title("The Correlation matrix")
fig.patch.set_facecolor("#E9E5E5")
sns.heatmap(weight_correlation_matrix,cmap = 'bone');
```



In [64]:

```
# let's build a scatter plot for both correaltions
fig ,(ax1,ax2) = plt.subplots(2,figsize=(10,15))
fig.patch.set_facecolor("#FFFFFF")
weight = physical_attr_227['weight']
agility = physical_attr_227['agility']
strength = physical_attr_227['strength']
# scatter plot between weight and agility
ax1.set_facecolor('#A19FA5')
ax1.set_xlabel("Weight")
ax1.set_ylabel("Agility")
ax1.set_title("Negative correlation")
ax1.scatter(weight,agility,color ='blue');
# scatter plot between weight and strenght
ax2.set_facecolor('#A19FA5')
ax2.set_xlabel("Weight")
ax2.set_ylabel("Strength")
ax2.set_title("Positive correlation")
ax2.scatter(weight,strength,color ='blue');
```





- weight and agility has a negative correlation
- weight and strength has a positive correaltion

.....Repeat the same process to the Height.....

According to previous steps weight and Height has a positive correlation.Hence, we must find a correlation between height and agility and strength

In [65]:

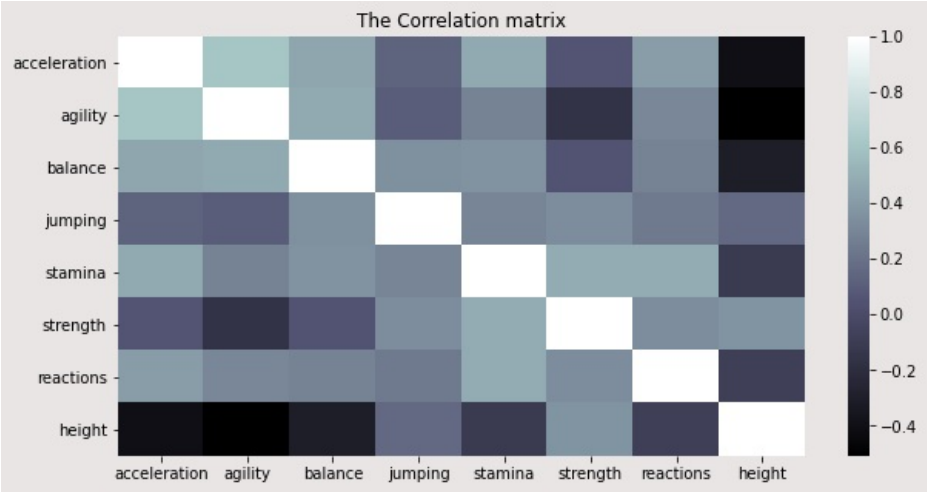
```
# build a correlation matrix between Height and all the other attributes
height_correlation_matrix = physical_attr_227[['acceleration','agility','balance','jumping','stamina','strength',
'reactions','height']].corr()
height_correlation_matrix
```

Out[65]:

	acceleration	agility	balance	jumping	stamina	strength	reactions	height
acceleration	1.000000	0.613982	0.454475	0.130513	0.474922	0.052010	0.411562	-0.405290
agility	0.613982	1.000000	0.472631	0.099194	0.286786	-0.163240	0.310720	-0.507899
balance	0.454475	0.472631	1.000000	0.351952	0.359711	0.048557	0.282136	-0.306263
jumping	0.130513	0.099194	0.351952	1.000000	0.297487	0.338856	0.242815	0.161593
stamina	0.474922	0.286786	0.359711	0.297487	1.000000	0.483845	0.483094	-0.117280
strength	0.052010	-0.163240	0.048557	0.338856	0.483845	1.000000	0.337293	0.368340
reactions	0.411562	0.310720	0.282136	0.242815	0.483094	0.337293	1.000000	-0.083399
height	-0.405290	-0.507899	-0.306263	0.161593	-0.117280	0.368340	-0.083399	1.000000

In [66]:

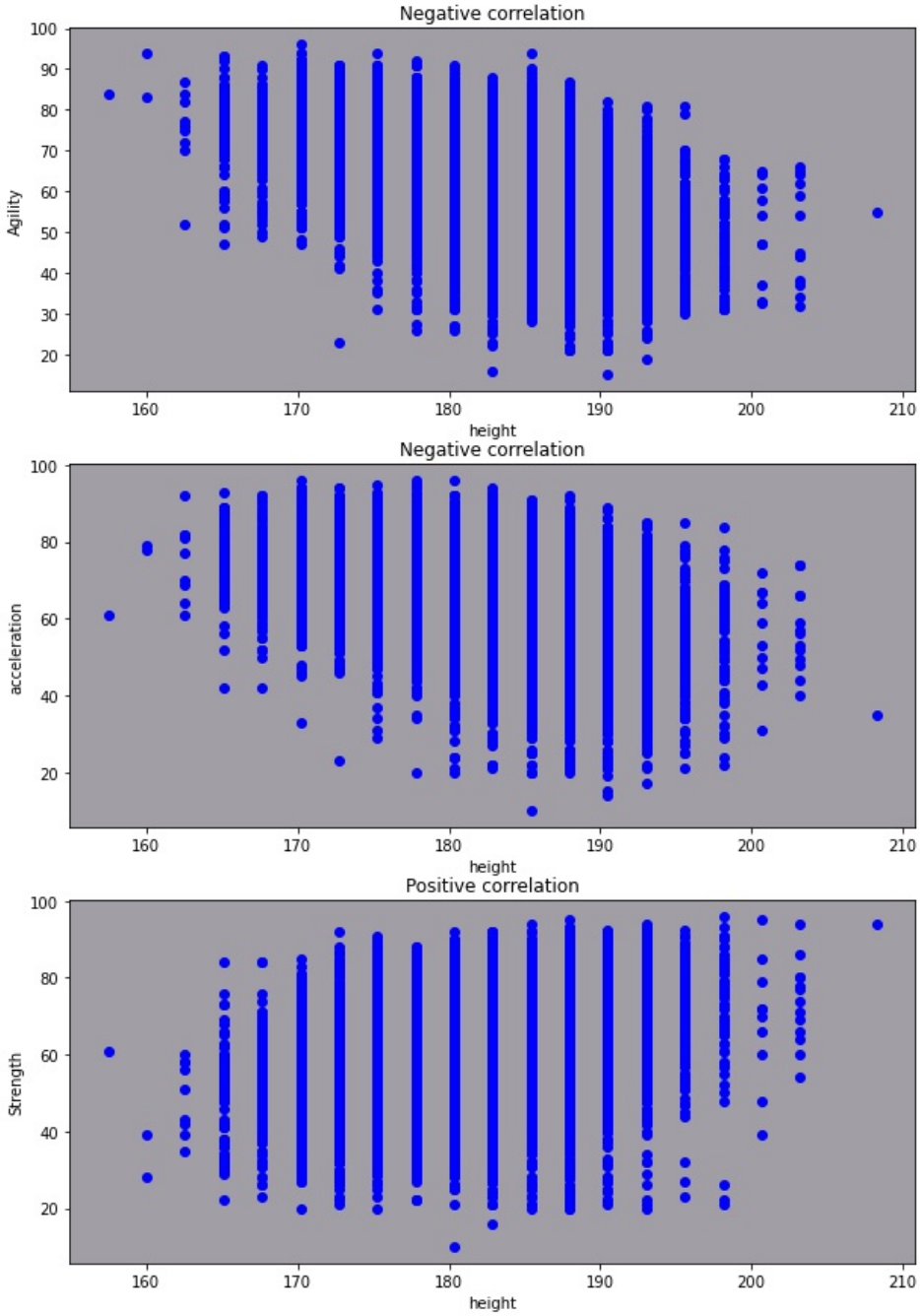
```
# let's make the correlation matrix clear by using a heatmap
fig = plt.figure(figsize=(10,5))
plt.title("The Correlation matrix")
fig.patch.set_facecolor("#E9E5E5")
sns.heatmap(height_correlation_matrix,cmap = 'bone');
```



The Height has a negative correlation with agility and acceleration
The Height has a positve correlation with strength

In [67]:

```
# let's build a scatter plot for both correaltions
fig ,(ax1,ax2,ax3) = plt.subplots(3,figsize=(10,15))
fig.patch.set_facecolor("#FFFFFF")
height = physical_attr_227['height']
agility = physical_attr_227['agility']
acceleration = physical_attr_227['acceleration']
strength = physical_attr_227['strength']
# scatter plot between weight and agility
ax1.set_facecolor('#A19FA5')
ax1.set_xlabel("height")
ax1.set_ylabel("Agility")
ax1.set_title("Negative correlation")
ax1.scatter(height,agility,color ='blue');
# scatter plot between weight and acceleration
ax2.set_facecolor('#A19FA5')
ax2.set_xlabel("height")
ax2.set_ylabel("acceleration")
ax2.set_title("Negative correlation")
ax2.scatter(height,acceleration,color ='blue');
# scatter plot between weight and strenght
ax3.set_facecolor('#A19FA5')
ax3.set_xlabel("height")
ax3.set_ylabel("Strength")
ax3.set_title("Positive correlation")
ax3.scatter(height,strength,color ='blue');
```



Research Question 3 :

How did the number of red cards change from 2008 to 2016?

> **Main Points :**
>
> 1. define a function to filter the cards_info data by card_tpe ,date and get the sum of red cards that a player got within this date
> 2. *call the function using different dates*
> 3. *show how the number of red cards has changed from one date to another*

----------define a function to filter the cards_info data----------

In [68]:

```
# view the range of date
cards_info['date'].describe()
```

```
<ipython-input-68-8ef54e11ace5>:2: FutureWarning: Treating datetime data as categorical rather than
numeric in `.describe` is deprecated and will be removed in a future version of pandas. Specify `dat
etime_is_numeric=True` to silence this warning and adopt the future behavior now.
  cards_info['date'].describe()
```

Out[68]:

```
count                   61767
unique                   1347
top       2015-04-04 00:00:00
freq                      184
first     2008-08-15 00:00:00
last      2016-05-25 00:00:00
Name: date, dtype: object
```

In [69]:

```
# will use this function multiple times with different date from 2008 to 2016
def invistigate_red_cards( df, table_name, start_date, end_date, card_type):
    """
    this function is to filter the cards_info data by date and sum over card_type then join it with players
    table using sql
    inputs :
    df --------------------> DataFrame----------> dataframe to store the result
    table_name -------------> String ------------> the name of the table
    start_date -------------> String ------------> the date to filter with in format yyyy0101
    end_date ---------------> String ------------> the date to filter with in format yyyy0101
    ouputs :
    df -------------------> DataFrame----------> dataframe after filtering and joining with players table
    """
    if card_type == 'y':
        card_type = '!='
    else :
        card_type = '=='
    # we have to filter players with red cards and within satrt_date to end_date
    query = 'card_type {} "r" and {}< date <{}'.format( card_type, start_date, end_date)
    df = cards_info.query(query)
    # we want to group the data by player id and count corresponding card type
    df = df.groupby(['player_id'])['card_type'].count().reset_index()
    # check if the table exist or not
    try :
        # save the dataframe into a table called red_card_2008 load it into the datebase
        load_table( df, table_name, False, {'player_id':Integer(),'card_type':Integer()})
    except ValueError:
        print("The table  already exists")
    # query the result of joining the two tables players and red_card_2008
    query = """
    SELECT p.player_name,r.card_type
    FROM (SELECT DISTINCT player_api_id,player_name  FROM Player) as p
    JOIN {} as r on(p.player_api_id = r.player_id);
    """.format(table_name)
    df = make_Query(query)
    return df
```

----------call the function using different dates----------

In [70]:

```
red_card_2008 = pd.DataFrame()
red_card_2008 = invistigate_red_cards( red_card_2008, 'red_card_2008', '20080101', '20090101','r')

yellow_card_2008 = pd.DataFrame()
yellow_card_2008 = invistigate_red_cards( yellow_card_2008, 'yellow_card_2008', '20080101', '20090101','y')
```

```
The table  already exists
The table  already exists
```

In [71]:

```
red_card_2009 = pd.DataFrame()
red_card_2009 = invistigate_red_cards( red_card_2009, 'red_card_2009', '20090101', '20100101','r')

yellow_card_2009 = pd.DataFrame()
yellow_card_2009 = invistigate_red_cards( yellow_card_2009, 'yellow_card_2009', '20090101', '20100101','y')
```

```
The table  already exists
The table  already exists
```

In [72]:

```
red_card_2010 = pd.DataFrame()
red_card_2010 = invistigate_red_cards( red_card_2010, 'red_card_2010', '20100101', '20110101','r')

yellow_card_2010 = pd.DataFrame()
yellow_card_2010 = invistigate_red_cards( yellow_card_2010, 'yellow_card_2010', '20100101', '20110101','y')
```

```
The table  already exists
The table  already exists
```

In [73]:

```
red_card_2011 = pd.DataFrame()
red_card_2011 = invistigate_red_cards( red_card_2011, 'red_card_2011', '20110101', '20120101','r')

yellow_card_2011 = pd.DataFrame()
yellow_card_2011 = invistigate_red_cards( yellow_card_2011, 'yellow_card_2011', '20110101', '20120101','y')
```

```
The table  already exists
The table  already exists
```

In [74]:

```
red_card_2012 = pd.DataFrame()
red_card_2012 = invistigate_red_cards( red_card_2012, 'red_card_2012', '20120101', '20130101','r')

yellow_card_2012 = pd.DataFrame()
yellow_card_2012 = invistigate_red_cards( yellow_card_2012, 'yellow_card_2012', '20120101', '20130101','y')
```

```
The table  already exists
The table  already exists
```

In [75]:

```
red_card_2013 = pd.DataFrame()
red_card_2013 = invistigate_red_cards( red_card_2013, 'red_card_2013', '20130101', '20140101','r')

yellow_card_2013 = pd.DataFrame()
yellow_card_2013 = invistigate_red_cards( yellow_card_2013, 'yellow_card_2013', '20130101', '20140101','y')
```

```
The table  already exists
The table  already exists
```

In [76]:

```
red_card_2014 = pd.DataFrame()
red_card_2014 = invistigate_red_cards( red_card_2014, 'red_card_2014', '20140101', '20150101','r')

yellow_card_2014 = pd.DataFrame()
yellow_card_2014 = invistigate_red_cards( yellow_card_2014, 'yellow_card_2014', '20140101', '20150101','y')
```

```
The table  already exists
The table  already exists
```

In [77]:

```
red_card_2015 = pd.DataFrame()
red_card_2015 = invistigate_red_cards( red_card_2015, 'red_card_2015', '20150101', '20160101','r')

yellow_card_2015 = pd.DataFrame()
yellow_card_2015 = invistigate_red_cards( yellow_card_2015, 'yellow_card_2015', '20150101', '20160101','y')
```

```
The table  already exists
The table  already exists
```

In [78]:

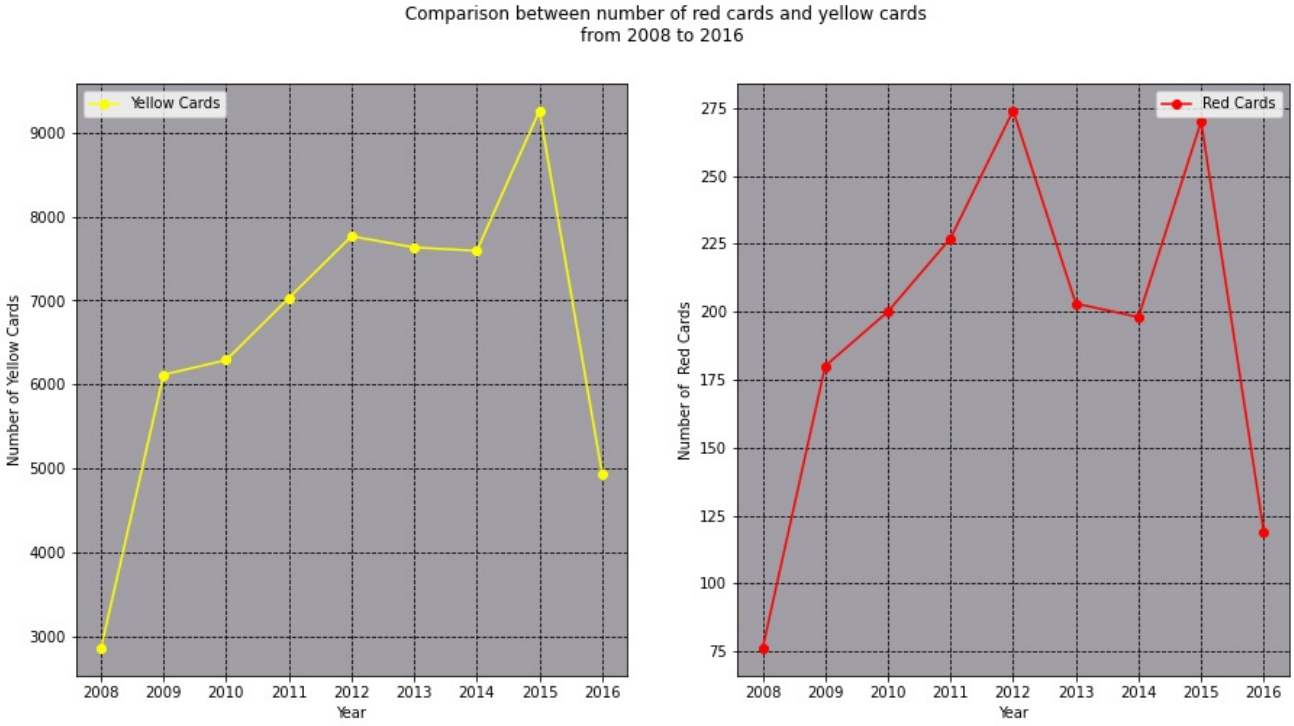
```
red_card_2016 = pd.DataFrame()
red_card_2016 = invistigate_red_cards( red_card_2016, 'red_card_2016', '20160101', '20170101','r')

yellow_card_2016 = pd.DataFrame()
yellow_card_2016 = invistigate_red_cards( yellow_card_2016, 'yellow_card_2016', '20160101', '20170101','y')
```

```
The table  already exists
The table  already exists
```

----------show how the number of red cards has changed----------

In [79]:

```
# let's store the sum of all red/yellow cards in each season
red_cards_full = [ red_card_2008, red_card_2009, red_card_2010, red_card_2011, red_card_2012, red_card_2013, red_
card_2014, red_card_2015, red_card_2016]
yellow_cards_full = [ yellow_card_2008, yellow_card_2009, yellow_card_2010, yellow_card_2011, yellow_card_2012, y
ellow_card_2013, yellow_card_2014, yellow_card_2015, yellow_card_2016]
x = ['2008','2009','2010','2011','2012','2013','2014','2015','2016']
y1 = []
y2 = []
for element in red_cards_full :
    y1.append(element.card_type.sum())
for element in yellow_cards_full :
    y2.append(element.card_type.sum())
fig , (ax1 , ax2) = plt.subplots(1,2,figsize=(15,7.5)) # we will plot two figures
fig.suptitle(" Comparison between number of red cards and yellow cards"+"\nfrom 2008 to 2016")
fig.patch.set_facecolor("#FFFFFF")
# plot first line chart for yellow cards
ax1.set_xlabel("Year")
ax1.set_ylabel("Number of Yellow Cards")
ax1.set_facecolor('#A19FA5')
ax1.grid(color='black',linestyle='dashed')
ax1.plot(x,y2,color= 'yellow',markersize = 12,marker='.',linewidth = 1.5,label="Yellow Cards");
ax1.legend();
# plot first line chart for yellow cards
ax2.set_xlabel("Year")
ax2.set_ylabel("Number of  Red Cards")
ax2.set_facecolor('#A19FA5')
ax2.grid(color='black',linestyle='dashed')
ax2.plot(x,y1,color= 'red',markersize = 12,marker='.',linewidth = 1.5,label="Red Cards");
ax2.legend();
```



Conclusions

- **Most Teams in Spain LIGA BBVA league score in the home stadium more than in the away stadium**
- **Real Madrid and Barcelona score more than 100 goals most of the time each season**
- **Villarreal and valencia are often close to each other when comparing the number of goals in each season**
- **The highest number of goals was made by Real Madrid in season 2011/2012**
- **The weight of the players are normally distributed around the mean which is 168 kg**
- **The height of the players are normally distributed around the mean which is 182 cm**
- **The height of the players are normally distributed around the mean which is 182 cm**
- **Once a player is tall and gains weight there is a high chance to have a low agility score and a high acceleration score**
- **In 2008 nearly 3000 yellow cards was recorded and increased by the double in 2009 and continue to increase to nearly 8000 cards till 2012 and decreased again to 7500 cards till 2014 and reached it's peak with more than 9000 cards and decreased again to 5000**
- **The red cards follow the same pattern as the yellow cards the maximum number of red cards was recorded is 275 cards in 2012 and the minumum number of red cards was recorded is 75 cards in 2008**

Limitations

Lacke of information is one of the limitations that I have encountered while dealing with this database *for example* there wasn't a foreign key team_api_id in the players' table that prevent us from relating the players' table with the teams' table.in addition to that,data inconsistency is another issue the database itself is consistent but some columns like card, goal, shot off,..etc written in XML format aren't consistent *for example :* in the card column, you might find a player_id but without specifying card_type or vice versa. other issue like different date ranges were used *for example :* in the players' table, you might find some players' date ranges from 2008 to 2012 and others from 2012 to 2014 that make it impossible to deal with all the players on the same date.

Resources

- **This website helped me a lot to understand the structure of xml file visit the site here (https://www.anyjson.in/xml-to-table)**
- **Kaggle website (https://www.kaggle.com/datasets/hugomathien/soccer/discussion?search=g) for soccer database**
- **This website taught me LaTeX mathematical symbols (https://oeis.org/wiki/List_of_LaTeX_mathematical_symbols)**