In [1]:
```
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import seaborn as sns
import datetime as dt
import mysql.connector
```

In [2]:
```
mydb=mysql.connector.connect(host="localhost",user="root",password="gigaberosql",database="soccer")
```

In [3]:
```
pd.set_option("display.max_columns",100)
pd.options.mode.chained_assignment = None  # default='warn'
```

In [4]:
```
country=pd.read_sql("select * from country",mydb)
league=pd.read_sql("select * from league",mydb)
matches=pd.read_sql("select * from matches",mydb)
player=pd.read_sql("select * from player",mydb)
playerattributes=pd.read_sql("select * from player_attributes",mydb)
team=pd.read_sql("select * from team",mydb)
teamattributes=pd.read_sql("select * from team_attributes",mydb)
```

create view of matches

In [5]:
```
merged=matches.merge(country,left_on="country_id",right_on="id")\
.merge(league,left_on="country_id",right_on="country_id")[["name_x","name_y","season","date","home_team_api_id","home_team_goal","away_team_goal","away_team_api_id"]]\
.merge(team,left_on="home_team_api_id",right_on="team_api_id")\
.merge(team,left_on="away_team_api_id",right_on="team_api_id")\
[["name_x","name_y","season","date","home_team_api_id","away_team_api_id","team_long_name_x","home_team_goal","away_team_goal","team_long_name_y"]]

merged.rename(columns={"name_x":"country","name_y":"league","team_long_name_x":"home_team","team_long_name_y":"away_team"},inplace=True)
merged["date"]=pd.to_datetime(merged.date).dt.date
viewmatches=merged[~merged.league.isin(["Portugal Liga ZON Sagres","Belgium Jupiler League","Poland Ekstraklasa","Scotland Premier League","Switzerland Super League"])]
#viewmatches
viewmatches["goals"]=viewmatches.home_team_goal+viewmatches.away_team_goal
viewmatches
```

Out[5]:

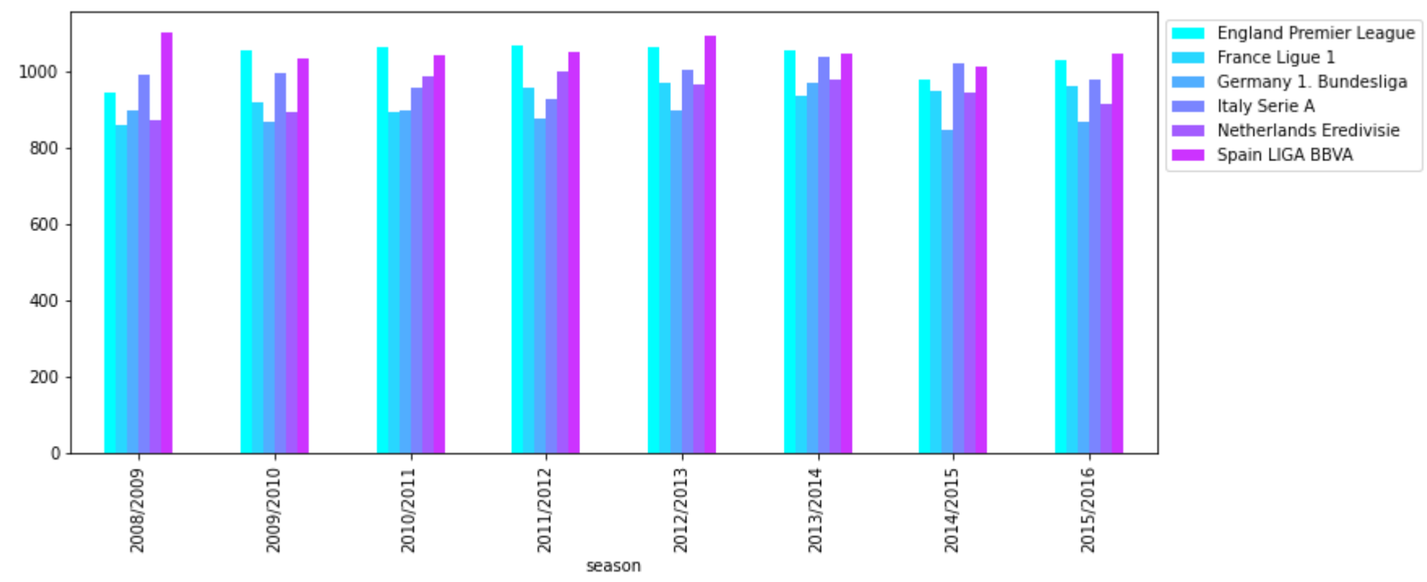
	country	league	season	date	home_team_api_id	away_team_api_id	home_team	home_team_goal	away_team_goal	away_team	goals
1728	England	England Premier League	2008/2009	2008-08-17	10260	10261	Manchester United	1	1	Newcastle United	2
1729	England	England Premier League	2010/2011	2010-08-16	10260	10261	Manchester United	3	0	Newcastle United	3
1730	England	England Premier League	2011/2012	2011-11-26	10260	10261	Manchester United	1	1	Newcastle United	2
1731	England	England Premier League	2012/2013	2012-12-26	10260	10261	Manchester United	4	3	Newcastle United	7
1732	England	England Premier League	2013/2014	2013-12-07	10260	10261	Manchester United	0	1	Newcastle United	1
...	...	...	...	...	...	...	...	...	...	...	...
24552	Spain	Spain LIGA BBVA	2014/2015	2015-03-20	10268	10267	Elche CF	0	4	Valencia CF	4
24553	Spain	Spain LIGA BBVA	2014/2015	2014-12-20	8372	10267	SD Eibar	0	1	Valencia CF	1
24554	Spain	Spain LIGA BBVA	2015/2016	2015-12-13	8372	10267	SD Eibar	1	1	Valencia CF	2
24555	Spain	Spain LIGA BBVA	2014/2015	2015-02-21	7869	10267	Córdoba CF	1	2	Valencia CF	3
24556	Spain	Spain LIGA BBVA	2015/2016	2016-04-02	8306	10267	UD Las Palmas	2	1	Valencia CF	3

17033 rows × 11 columns

find the leagues with the most scored goals in each season

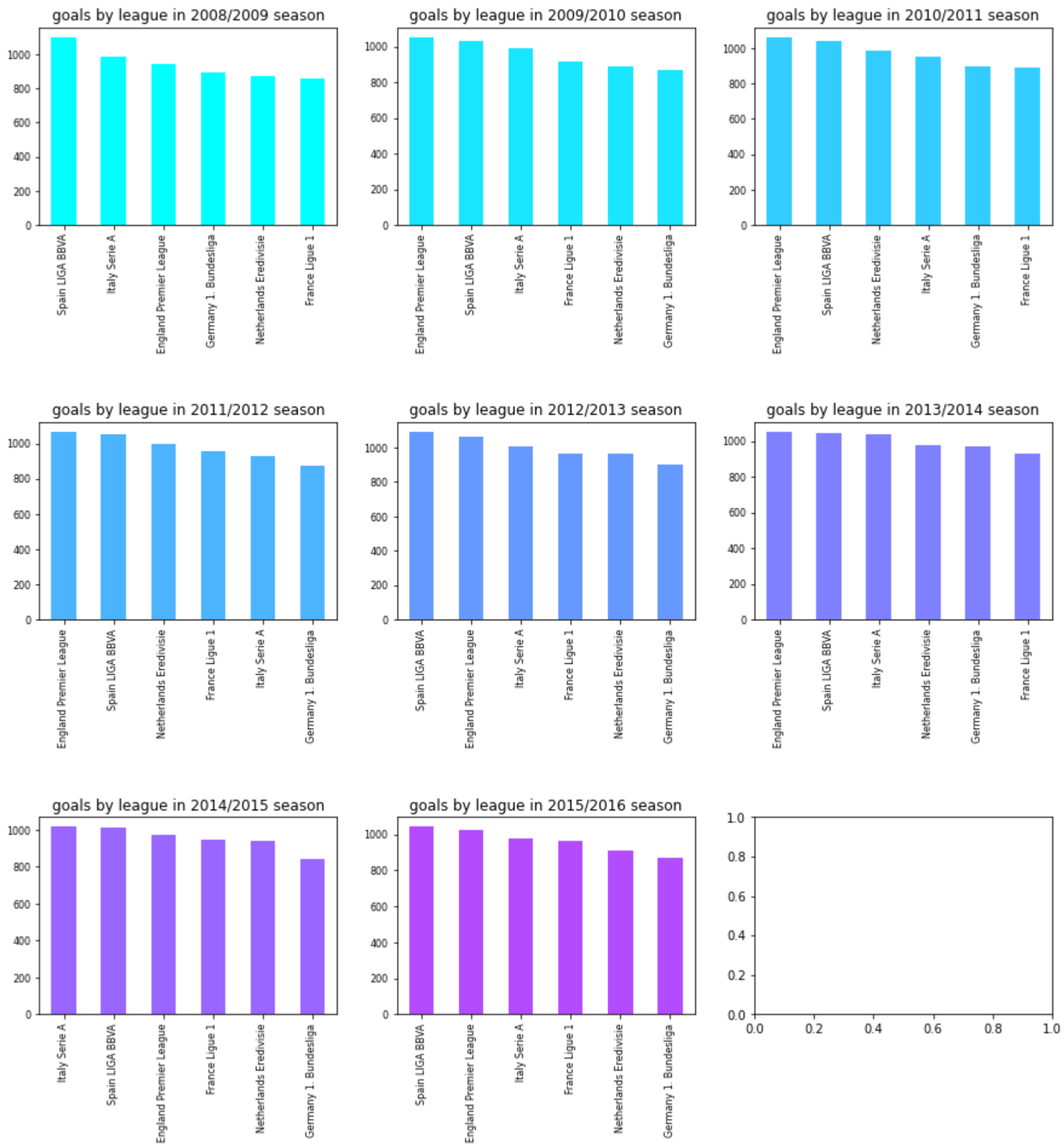
In [122]:
```
grouped=viewmatches.groupby(["season","league"])["goals"].sum().reset_index().sort_values(["season","league"])
pivoted=grouped.pivot("season","league","goals").reset_index()

pivoted.plot(kind="bar",x="season",figsize=(12,5),color=list(plt.get_cmap("cool")(np.linspace(0,0.8,6))),fontsize=10)
plt.legend(bbox_to_anchor=(1, 1),fontsize=10)
plt.show()
```



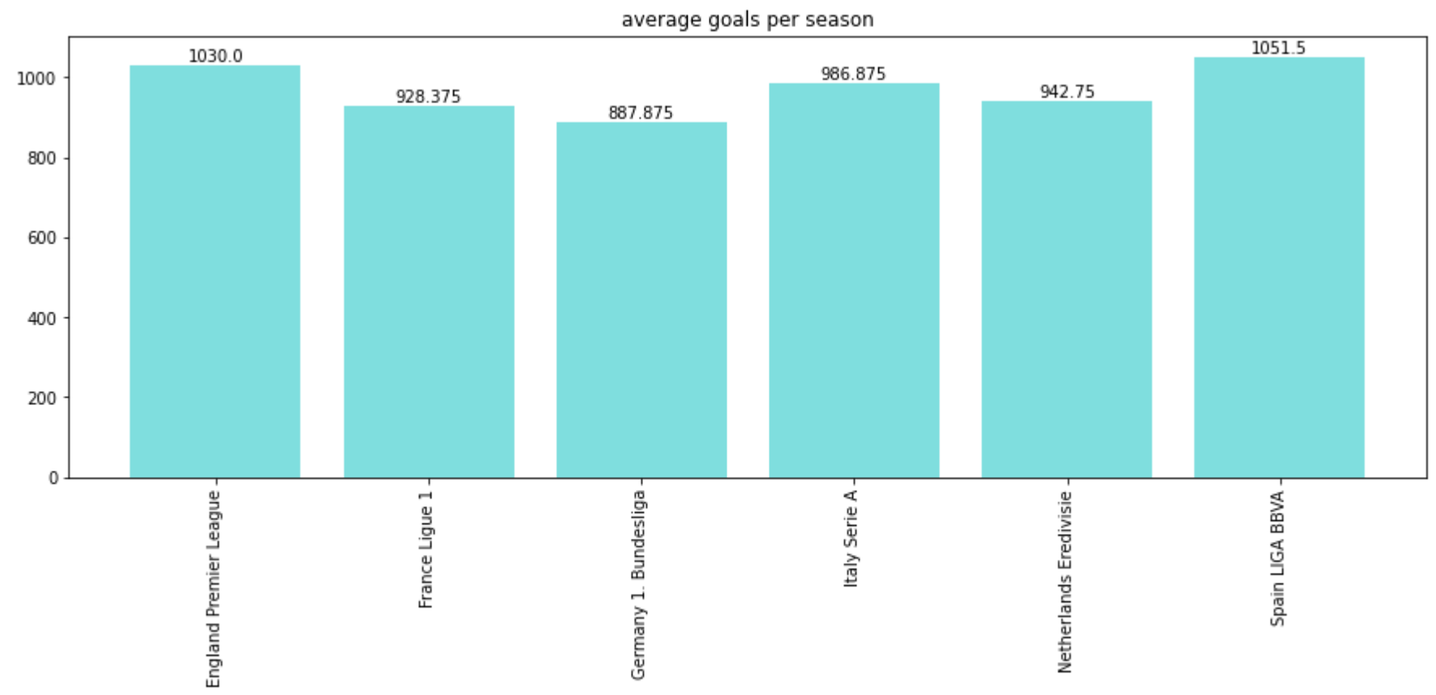
In [123]:
```
fig,axes=plt.subplots(3,3,figsize=(15,15))
cmap=plt.get_cmap("cool")
colors=list(cmap(np.linspace(0,0.7,len(viewmatches.season.unique()))))
for ax,s,c in zip(axes.ravel(),sorted(viewmatches.season.unique()),colors):
    filtered=viewmatches[viewmatches.season==s]
    filtered["goals"]=filtered.home_team_goal+filtered.away_team_goal
    grouped=filtered.groupby("league")["goals"].sum().reset_index().sort_values("goals",ascending=False)

    grouped.plot(kind="bar",x="league",y="goals",ax=ax,title="goals by league in "+s+" season",fontsize=8,xlabel="",color=c,legend=False)
    plt.subplots_adjust(hspace=1)
plt.show()
```



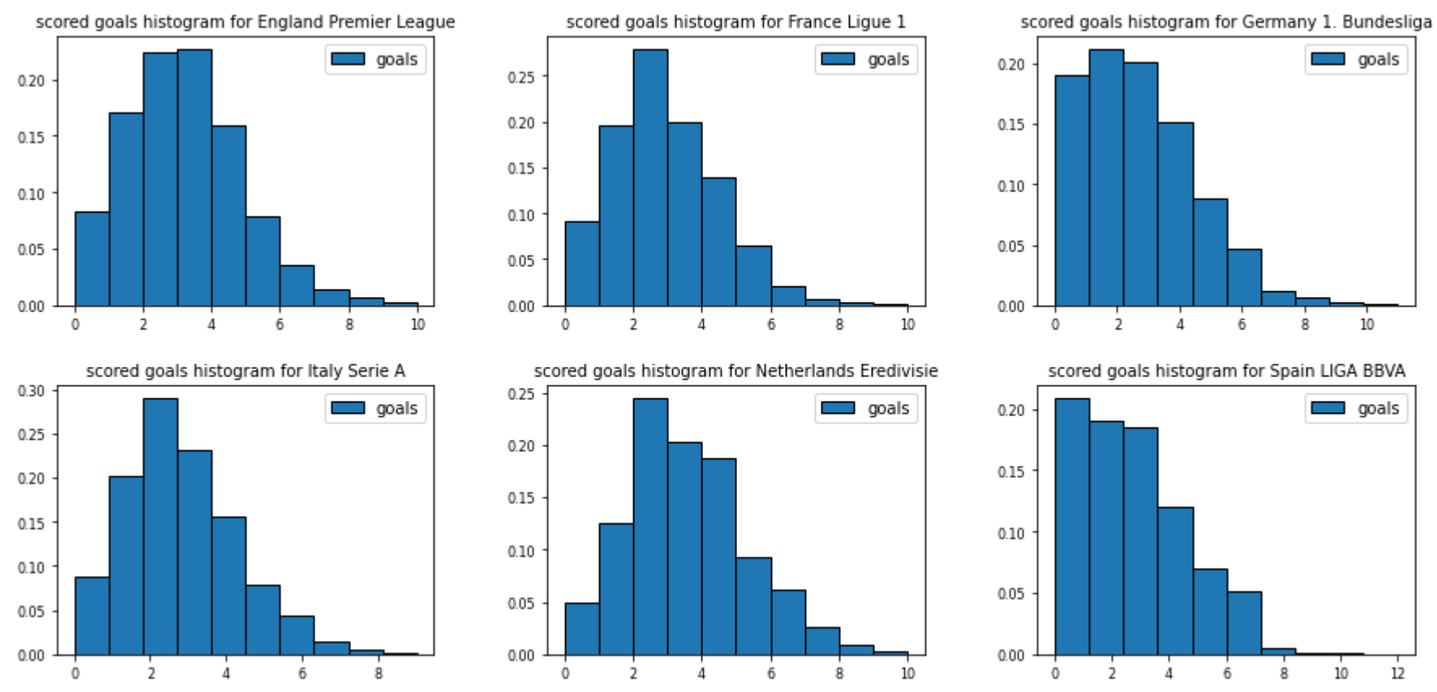
In [6]:
```
grouped=viewmatches.groupby(["season","league"])["goals"].sum().reset_index().sort_values(["season","league"])
grouped2=grouped.groupby("league")["goals"].mean().reset_index().sort_values("league")

plt.figure(figsize=(15,5))
plt.bar(grouped2.league,grouped2.goals,color="c",alpha=0.5)
plt.title("average goals per season")
plt.xticks(grouped2.league,rotation=90)
def value_label(x,y):
    for i in range(len(x)):
        plt.text(i,(y.iloc[i]),(y.iloc[i]),size=10,ha="center",va="bottom")
value_label(grouped2.league,grouped2.goals)
plt.show()
```

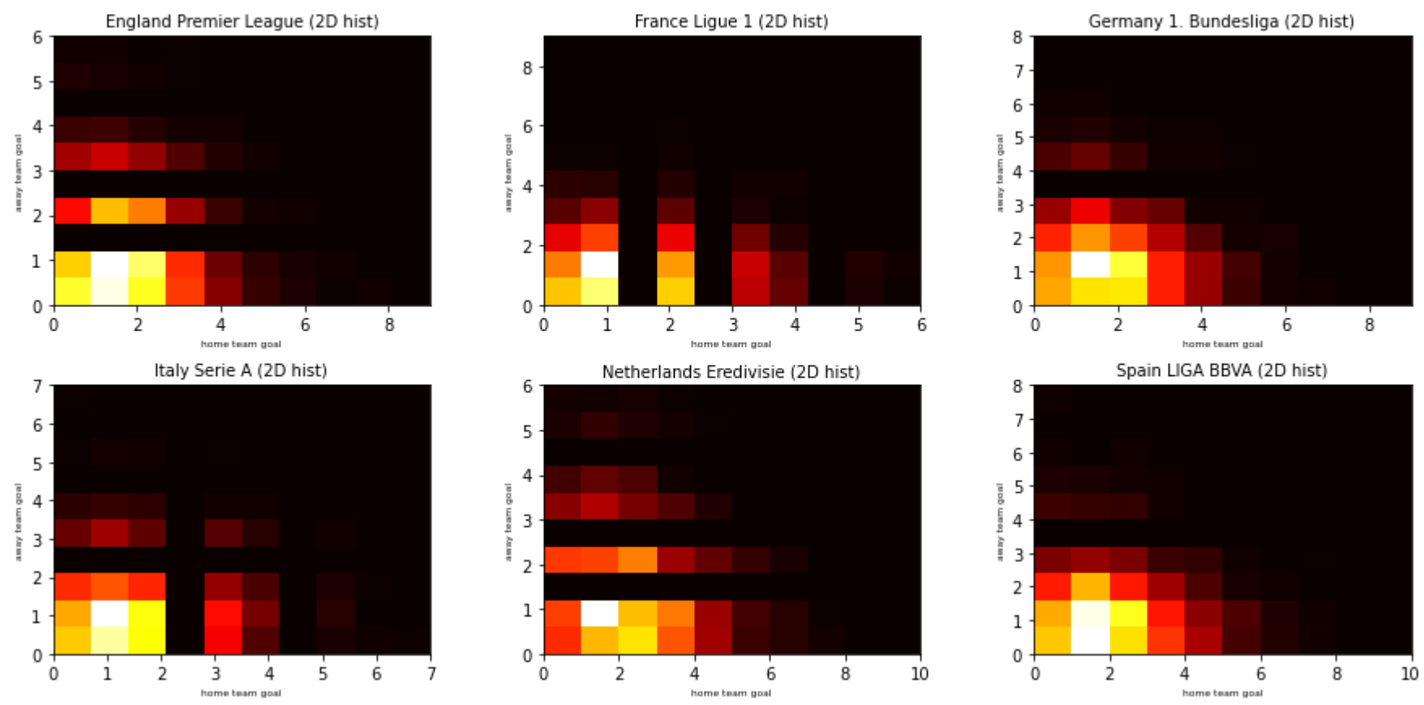


goals distribution for every league

In [55]:
```
fig,axes=plt.subplots(2,3,figsize=(15,7))
for ax,l in zip(axes.ravel(),sorted(viewmatches.league.unique())):
    filtered=viewmatches[viewmatches.league==l]
    filtered.plot(kind="hist",ax=ax,y="goals",ec="k",density=True,fontsize=8)
    ax.set_title("scored goals histogram for "+l,size=10)
    ax.set_ylabel("")
    plt.subplots_adjust(hspace=0.3,wspace=0.3)
plt.show()
```

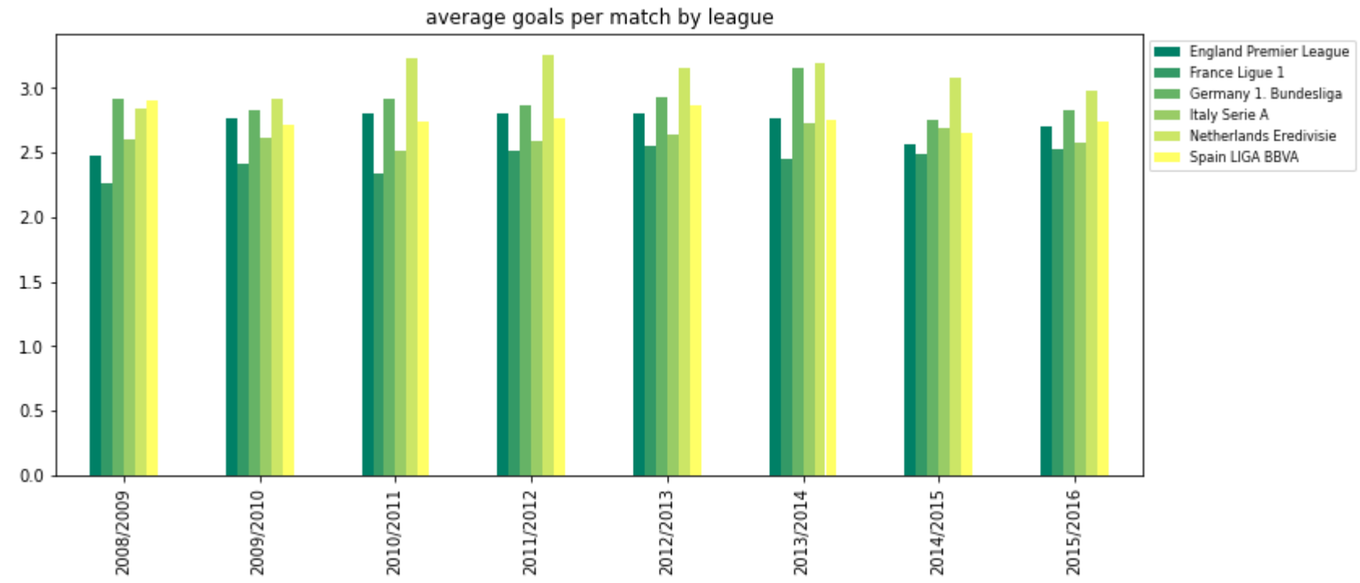


In [72]:
```
fig,axes=plt.subplots(2,3,figsize=(15,7))
for ax,l in zip(axes.ravel(),sorted(viewmatches.league.unique())):
    filtered=viewmatches[viewmatches.league==l]
    ax.hist2d(filtered.home_team_goal,filtered.away_team_goal,cmap="hot")
    ax.set_xlabel("home team goal",size=6)
    ax.set_ylabel("away team goal",size=6)
    ax.set_title(l+" (2D hist)",size=10)
    plt.subplots_adjust(hspace=0.3,wspace=0.3)
plt.show()
```



plot avg goals per match for every league in each season

In [178]:
```
grouped=viewmatches.groupby(["season","league"])["goals"].mean().reset_index().sort_values(["season","goals"],ascending=[True,False]).groupby("season").head(6)
pivoted=grouped.pivot("season","league","goals").reset_index()
pivoted.plot(kind="bar",x="season",y=pivoted.columns[1:],figsize=(12,5),cmap="summer")
plt.title("average goals per match by league")
plt.legend(bbox_to_anchor=(1, 1),fontsize=8)
plt.xlabel(None)
plt.show()
```



find teams which scored less goals than accepted in a season

In [26]:
```
h_grouped=viewmatches.groupby(["season","home_team"]).agg({"home_team_goal":"sum","away_team_goal":"sum"}).reset_index()
a_grouped=viewmatches.groupby(["season","away_team"]).agg({"home_team_goal":"sum","away_team_goal":"sum"}).reset_index()
merged=h_grouped.merge(a_grouped,left_on=["season","home_team"],right_on=["season","away_team"])\
[["season","home_team","home_team_goal_x","away_team_goal_x","home_team_goal_y","away_team_goal_y"]].sort_values(["season","home_team"])
merged.rename(columns={"home_team":"team"},inplace=True)

merged["scored"]=merged.home_team_goal_x+merged.away_team_goal_y
merged["accepted"]=merged.away_team_goal_x+merged.home_team_goal_y
merged[["season","team","scored","accepted"]]
```

Out[26]:

	season	team	scored	accepted
0	2008/2009	1. FC Köln	35	50
1	2008/2009	ADO Den Haag	41	58
2	2008/2009	AJ Auxerre	35	35
3	2008/2009	AS Monaco	41	45
4	2008/2009	AS Nancy-Lorraine	38	47
...	...	...	...	...
923	2015/2016	Vitesse	55	38
924	2015/2016	Watford	40	50
925	2015/2016	West Bromwich Albion	34	48
926	2015/2016	West Ham United	65	51
927	2015/2016	Willem II	35	53

928 rows × 4 columns

find teams with the most goals scored in 2012/2013 season

In [36]:
```
filtered=viewmatches[viewmatches.season=="2012/2013"]
home_scored=filtered.groupby("home_team")["home_team_goal"].sum().reset_index()
away_scored=filtered.groupby("away_team")["away_team_goal"].sum().reset_index()
merged=home_scored.merge(away_scored,left_on="home_team",right_on="away_team")
merged.rename(columns={"home_team":"team"},inplace=True)
merged=merged[["team","home_team_goal","away_team_goal"]]
merged["scored"]=merged.home_team_goal+merged.away_team_goal
merged.sort_values("scored",ascending=False)
```

Out[36]:

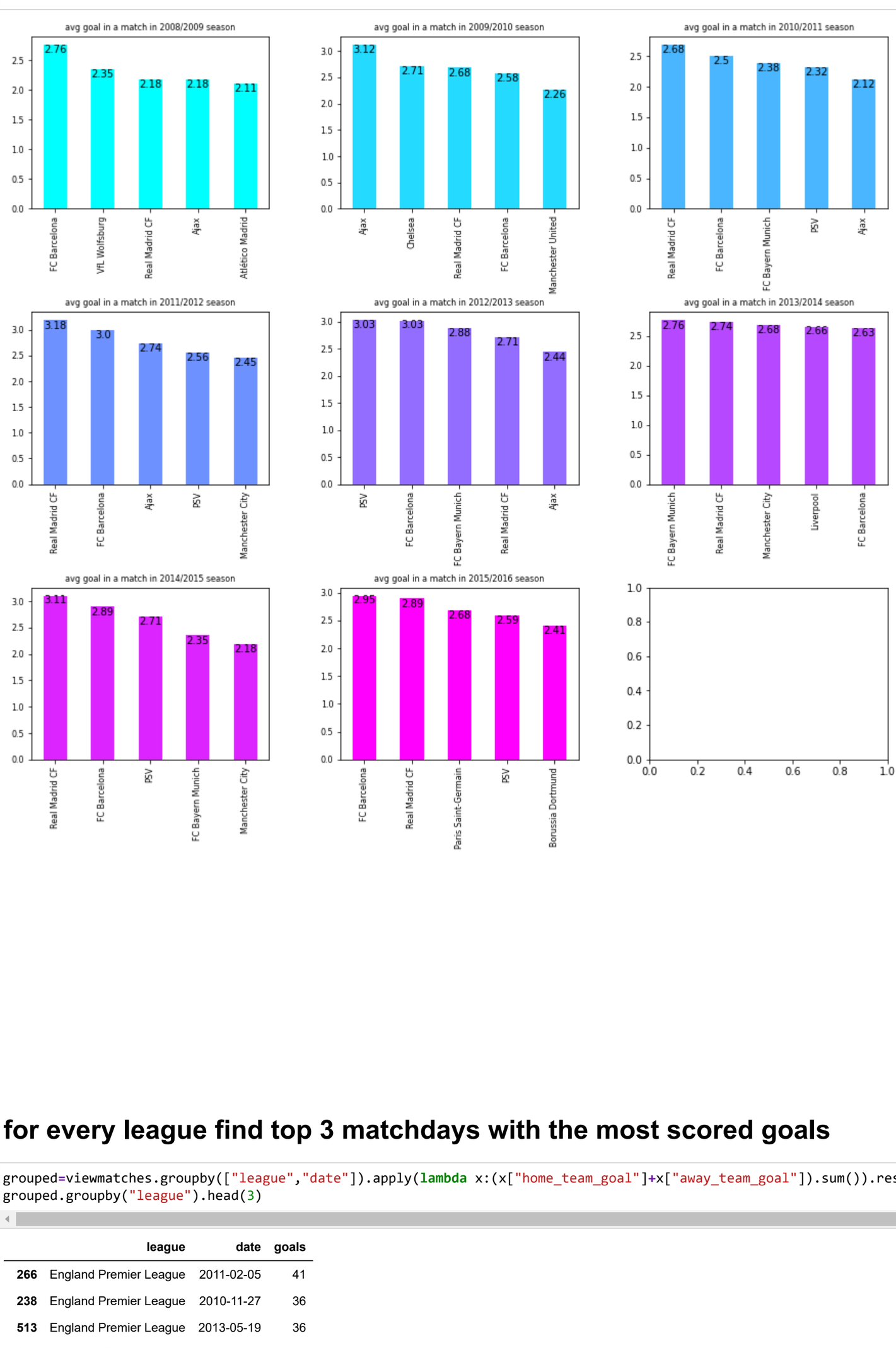
	team	home_team_goal	away_team_goal	scored
26	FC Barcelona	63	52	115
79	Real Madrid CF	67	36	103
65	PSV	58	45	103
27	FC Bayern Munich	56	42	98
52	Manchester United	45	41	86
...	...	...	...	...
96	Stade de Reims	20	13	33
94	Stade Brestois 29	17	15	32
70	Queens Park Rangers	13	17	30
69	Pescara	15	12	27
93	SpVgg Greuther Fürth	10	16	26

116 rows × 4 columns

for every season find top 5 teams with the most average goals in a match

In [115]:
```
home_avg=viewmatches.groupby(["season","home_team"])["home_team_goal"].mean().reset_index()
away_avg=viewmatches.groupby(["season","away_team"])["away_team_goal"].mean().reset_index()
merged=home_avg.merge(away_avg,left_on=["season","home_team"],right_on=["season","away_team"])
merged.rename(columns={"home_team":"team"},inplace=True)
merged=merged[["season","team","home_team_goal","away_team_goal"]]
merged["avg_scored"]=(merged.home_team_goal+merged.away_team_goal)/2
merged=merged.sort_values(["season","avg_scored"],ascending=[True,False])
final=merged.groupby(["season"]).head(5)  # get top 5 result from every group(must be sorted in advance)


fig,axes=plt.subplots(3,3,figsize=(15,13))
cmap=plt.get_cmap("cool")
colors=list(cmap(np.linspace(0,1,len(final.season.unique()))))
for ax,s,c in zip(axes.ravel(),sorted(final.season.unique()),colors):
    filtered=final[final.season==s]
    filtered.plot(kind="bar",ax=ax,x="team",y="avg_scored",fontsize=8,xlabel="",legend=False,color=c)
    ax.set_title("avg goals in a match in "+s+" season",size=8)
    plt.subplots_adjust(hspace=0.6,wspace=0.3)
    def value_label(x,y):
        for i in range(len(x)):
            ax.text(i,round(y.iloc[i],2),round(y.iloc[i],2),size=10,ha="center",va="top")
    value_label(filtered.team,filtered.avg_scored)
plt.show()
```



for every league find top 3 matchdays with the most scored goals

In [183]:
```
grouped=viewmatches.groupby(["league","date"]).apply(lambda x:(x["home_team_goal"]+x["away_team_goal"]).sum()).reset_index(name="goals").sort_values(["league","goals"],ascending=[Tr
grouped.groupby("league").head(3)
```

Out[183]:

	league	date	goals
266	England Premier League	2011-02-05	41
238	England Premier League	2010-11-27	36
513	England Premier League	2013-05-19	36
1131	France Ligue 1	2012-05-20	36
1469	France Ligue 1	2015-05-23	32
1048	France Ligue 1	2011-05-29	31
1960	Germany 1. Bundesliga	2012-05-05	35
2052	Germany 1. Bundesliga	2013-05-11	35
1678	Germany 1. Bundesliga	2009-05-23	34
2409	Italy Serie A	2009-05-31	42
2574	Italy Serie A	2011-05-22	37
2443	Italy Serie A	2010-01-06	33
3431	Netherlands Eredivisie	2012-05-06	40
3244	Netherlands Eredivisie	2010-05-02	39
3335	Netherlands Eredivisie	2011-05-01	39
4564	Spain LIGA BBVA	2015-05-23	42
4298	Spain LIGA BBVA	2013-06-01	38
4070	Spain LIGA BBVA	2011-05-21	36

which club (and when) scored the most goals in an entire year?

find most goal scoring team for each season

In [54]:
```
h_grouped=viewmatches.groupby(["season","home_team"])["home_team_goal"].sum().reset_index()
a_grouped=viewmatches.groupby(["season","away_team"])["away_team_goal"].sum().reset_index()
merged=h_grouped.merge(a_grouped,left_on=["home_team","season"],right_on=["away_team","season"])
merged.rename(columns={"home_team":"team"},inplace=True)
merged["scored"]=merged.home_team_goal+merged.away_team_goal
merged.sort_values("scored",ascending=False)[["season","team","scored"]] # answer for question1
```

Out[54]:

	season	team	scored
432	2011/2012	Real Madrid CF	121
777	2014/2015	Real Madrid CF	118
490	2012/2013	FC Barcelona	115
381	2011/2012	FC Barcelona	114
842	2015/2016	FC Barcelona	112
...	...	...	...
348	2011/2012	1. FC Kaiserslautern	24
26	2008/2009	De Graafschap	24
727	2014/2015	FC Dordrecht	24
717	2014/2015	Córdoba CF	22
236	2010/2011	AC Arles-Avignon	21

928 rows × 3 columns

In [46]:
```
merged.sort_values("scored",ascending=False).groupby("season").head(1).sort_values("season")  # answer for question2
```

Out[46]:

	season	team	home_team_goal	away_team	away_team_goal	scored
29	2008/2009	FC Barcelona	61	FC Barcelona	44	105
125	2009/2010	Ajax	64	Ajax	42	106
315	2010/2011	Real Madrid CF	61	Real Madrid CF	41	102
432	2011/2012	Real Madrid CF	70	Real Madrid CF	51	121
490	2012/2013	FC Barcelona	63	FC Barcelona	52	115
662	2013/2014	Real Madrid CF	63	Real Madrid CF	41	104
777	2014/2015	Real Madrid CF	65	Real Madrid CF	53	118
842	2015/2016	FC Barcelona	67	FC Barcelona	45	112

how many matches has bayern won against dortmund from 2008 to 2016?

In [8]:
```
home=viewmatches[(viewmatches.home_team=="FC Bayern Munich")&(viewmatches.away_team=="Borussia Dortmund")]
away=viewmatches[(viewmatches.away_team=="FC Bayern Munich")&(viewmatches.home_team=="Borussia Dortmund")]
home[home.home_team_goal>home.away_team_goal].shape[0]+away[away.home_team_goal<away.away_team_goal].shape[0]
```

Out[8]: 7

what was the biggest win?

In [51]:
```
unioned=pd.concat([home,away])
def balance(home_team,home_team_goal,away_team_goal):
    if home_team=="FC Bayern Munich":
        return home_team_goal-away_team_goal
    else:
        return away_team_goal-home_team_goal
unioned["balance"]=unioned.apply(lambda x:balance(x["home_team"],x["home_team_goal"],x["away_team_goal"]),axis=1)
x=unioned["balance"].max()
unioned[unioned["balance"].isin([x])]
```

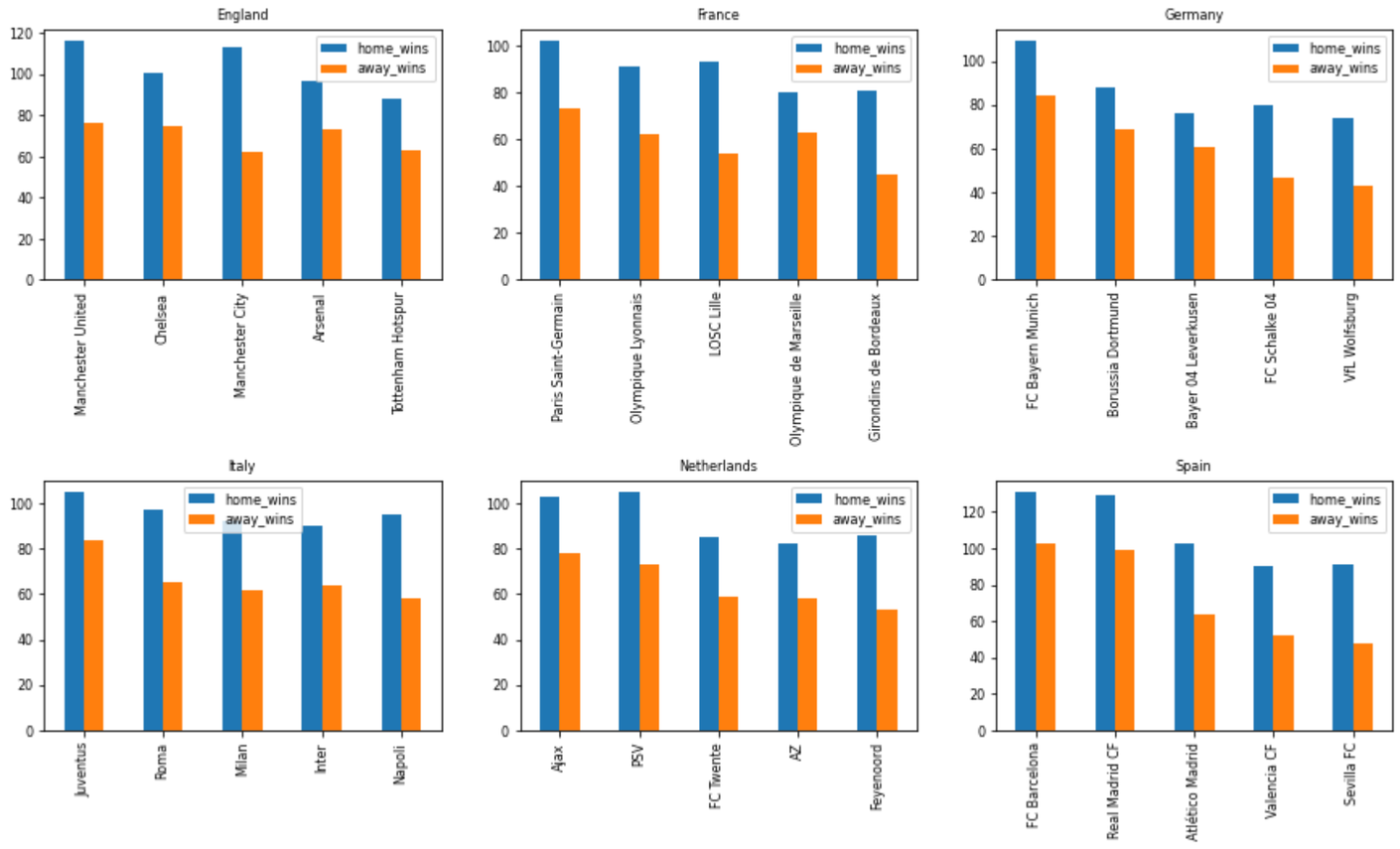
Out[51]:

	country	league	season	date	home_team_api_id	away_team_api_id	home_team	home_team_goal	away_team_goal	away_team	goals	balance
8121	Germany	Germany 1. Bundesliga	2015/2016	2015-10-04	9823	9789	FC Bayern Munich	5	1	Borussia Dortmund	6	4
10193	Germany	Germany 1. Bundesliga	2009/2010	2009-09-12	9789	9823	Borussia Dortmund	1	5	FC Bayern Munich	6	4

for every championship find top 5 team which has won the most matches from 2008 to 2016

In [187]:
```
fig,axes=plt.subplots(2,3, figsize=(15,8))
for ax,country in zip(axes.ravel(),sorted(viewmatches.country.unique())):
    filtered=viewmatches[viewmatches.country==country]
    h_wins=filtered[filtered.home_team_goal>filtered.away_team_goal].groupby("home_team")["home_team"].count().reset_index(name="home_wins")
    a_wins=filtered[filtered.away_team_goal>filtered.home_team_goal].groupby("away_team")["away_team"].count().reset_index(name="away_wins")
    merged=h_wins.merge(a_wins,left_on="home_team",right_on="away_team")[["home_team","home_wins","away_wins"]]
    merged.rename(columns={"home_team":"team"},inplace=True)
    merged["wins"]=merged.home_wins+merged.away_wins
    merged=merged.sort_values("wins",ascending=False).head(5)


    merged.plot(kind="bar",ax=ax,x="team",y=["home_wins","away_wins"],fontsize=8)
    plt.subplots_adjust(hspace=0.8)
    ax.legend(fontsize=8)
    ax.set_title(country,fontsize=8)
    ax.set_xlabel("")
plt.show()
```



find teams that has won more than 80% of matches in a season

In [70]:
```
hm=viewmatches.groupby(["season","home_team"])["home_team"].count().reset_index(name="home_matches")
hw=viewmatches[viewmatches.home_team_goal>viewmatches.away_team_goal].groupby(["season","home_team"])["home_team"].count().reset_index(name="home_wins")
home_final=hw.merge(hm, on=["season","home_team"])

am=viewmatches.groupby(["season","away_team"])["away_team"].count().reset_index(name="away_matches")
aw=viewmatches[viewmatches.away_team_goal>viewmatches.home_team_goal].groupby(["season","away_team"])["away_team"].count().reset_index(name="away_wins")
away_final=aw.merge(am, on=["season","away_team"])

merged=home_final.merge(away_final,left_on=["season","home_team"],right_on=["season","away_team"])

merged["wins"]=merged.home_wins+merged.away_wins
merged["matches"]=merged.home_matches+merged.away_matches
merged=merged[["season","home_team","wins","matches"]]
merged["win_percentage"]=(merged.wins/merged.matches*100).round(1)
merged[merged.win_percentage>80].sort_values(["season","win_percentage"],ascending=[True,False])
```

Out[70]:

	season	home_team	wins	matches	win_percentage
147	2009/2010	FC Barcelona	31	38	81.6
195	2009/2010	Real Madrid CF	31	38	81.6
428	2011/2012	Real Madrid CF	32	38	84.2
487	2012/2013	FC Bayern Munich	29	34	85.3
486	2012/2013	FC Barcelona	32	38	84.2
628	2013/2014	Juventus	33	38	86.8
605	2013/2014	FC Bayern Munich	29	34	85.3
760	2014/2015	PSV	29	34	85.3
836	2015/2016	FC Bayern Munich	28	34	82.4

In [113]:
```
viewmatches["new"]=viewmatches.apply(lambda x:x["home_team_goal"]-x["away_team_goal"] if x["home_team"]=="Manchester United"
                                     else(-x["home_team_goal"]+x["away_team_goal"] if x["away_team"]=="Manchester United" else None),axis=1)
viewmatches[viewmatches.new.isna()==False]
```

Out[113]:

	country	league	season	date	home_team_api_id	away_team_api_id	home_team	home_team_goal	away_team_goal	away_team	goals	new
1728	England	England Premier League	2008/2009	2008-08-17	10260	10261	Manchester United	1	1	Newcastle United	2	0.0
1729	England	England Premier League	2010/2011	2010-08-16	10260	10261	Manchester United	3	0	Newcastle United	3	3.0
1730	England	England Premier League	2011/2012	2011-11-26	10260	10261	Manchester United	1	1	Newcastle United	2	0.0
1731	England	England Premier League	2012/2013	2012-12-26	10260	10261	Manchester United	4	3	Newcastle United	7	1.0
1732	England	England Premier League	2013/2014	2013-12-07	10260	10261	Manchester United	0	1	Newcastle United	1	-1.0
...	...	...	...	...	...	...	...	...	...	...	...	...
4763	England	England Premier League	2013/2014	2013-11-24	8344	10260	Cardiff City	2	2	Manchester United	4	0.0
4764	England	England Premier League	2014/2015	2014-09-21	8197	10260	Leicester City	5	3	Manchester United	8	-2.0
4765	England	England Premier League	2015/2016	2015-11-28	8197	10260	Leicester City	1	1	Manchester United	2	0.0
4766	England	England Premier League	2015/2016	2015-12-12	8678	10260	Bournemouth	2	1	Manchester United	3	-1.0
4767	England	England Premier League	2015/2016	2015-11-21	9817	10260	Watford	1	2	Manchester United	3	1.0

304 rows × 12 columns

In [132]:
```
viewmatches.groupby(["season","home_team"]).apply(lambda x:x[x["home_team_goal"]>x["away_team_goal"]]["home_team"].count()).reset_index(name="home_wins")
viewmatches.groupby(["season","home_team"]).apply(lambda x:x["home_team"].count()).reset_index(name="home_matches")
```

Out[132]:

	season	home_team	home_matches
0	2008/2009	1. FC Köln	17
1	2008/2009	ADO Den Haag	17
2	2008/2009	AJ Auxerre	19
3	2008/2009	AS Monaco	19
4	2008/2009	AS Nancy-Lorraine	19
...	...	...	...
923	2015/2016	Vitesse	17
924	2015/2016	Watford	19
925	2015/2016	West Bromwich Albion	19
926	2015/2016	West Ham United	19
927	2015/2016	Willem II	17

928 rows × 3 columns

In [184]:
```
viewmatches.groupby(["season","home_team"]).apply(lambda x:x[x["home_team_goal"]>x["away_team_goal"]]["home_team"].count())
```

Out[184]:
```
season     home_team
2008/2009  1. FC Köln              4
           ADO Den Haag            5
           AJ Auxerre              8
           AS Monaco               7
           AS Nancy-Lorraine       5
                                  ..
2015/2016  Vitesse                 7
           Watford                 6
           West Bromwich Albion    6
           West Ham United         9
           Willem II               3
Length: 928, dtype: int64
```

In [ ]: