Exploratory Data Analysis on IPL Dataset

In [2]:

```python
## Importing Library

import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
%matplotlib inline
```

In [2]:

```python
pd.set_option('display.max_rows', 700)
pd.set_option('display.max_columns', 500)
pd.set_option('display.width', 1000)
```

In [7]:

```
## Importing Dataset
ipl = pd.read_csv('matches.csv')
```

In [8]:

```
## Checking All Information Related with Dataset
ipl.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 636 entries, 0 to 635
Data columns (total 18 columns):
 #   Column           Non-Null Count  Dtype  
---  ------           --------------  -----  
 0   id               636 non-null    int64  
 1   season           636 non-null    int64  
 2   city             629 non-null    object 
 3   date             636 non-null    object 
 4   team1            636 non-null    object 
 5   team2            636 non-null    object 
 6   toss_winner      636 non-null    object 
 7   toss_decision    636 non-null    object 
 8   result           636 non-null    object 
 9   dl_applied       636 non-null    int64  
 10  winner           633 non-null    object 
 11  win_by_runs      636 non-null    int64  
 12  win_by_wickets   636 non-null    int64  
 13  player_of_match  633 non-null    object 
 14  venue            636 non-null    object 
 15  umpire1          635 non-null    object 
 16  umpire2          635 non-null    object 
 17  umpire3          0 non-null      float64
dtypes: float64(1), int64(5), object(12)
memory usage: 89.6+ KB
```

In [5]:

```python
## Checking Top 5 Rows
ipl.head(5)
```

Out[5]:

am2	toss_winner	toss_decision	result	dl_applied	winner	win_by_runs
oyal jers lore	Royal Challengers Bangalore	field	normal	0	Sunrisers Hyderabad	35
sing 'une jiant	Rising Pune Supergiant	field	normal	0	Rising Pune Supergiant	0
kata ight ders	Kolkata Knight Riders	field	normal	0	Kolkata Knight Riders	0
s XI njab	Kings XI Punjab	field	normal	0	Kings XI Punjab	0
)elhi evils	Royal Challengers Bangalore	bat	normal	0	Royal Challengers Bangalore	15

In [9]:

```python
## Checking Rows and Columns
ipl.shape
```

Out[9]:

```
(636, 18)
```

In [7]:

```python
## Changing Datatype from Integer to Category
ipl['season']=ipl['season'].astype('category')
```

In [8]:

```
## Checking All Information Related with Dataset
ipl.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 636 entries, 0 to 635
Data columns (total 18 columns):
id                 636 non-null int64
season             636 non-null category
city               629 non-null object
date               636 non-null object
team1              636 non-null object
team2              636 non-null object
toss_winner        636 non-null object
toss_decision      636 non-null object
result             636 non-null object
dl_applied         636 non-null int64
winner             633 non-null object
win_by_runs        636 non-null int64
win_by_wickets     636 non-null int64
player_of_match    633 non-null object
venue              636 non-null object
umpire1            635 non-null object
umpire2            635 non-null object
umpire3            0 non-null float64
dtypes: category(1), float64(1), int64(4), object(12)
memory usage: 85.6+ KB
```

Q) find the venue in which highest number of matches were held

In [9]:

```
venue=ipl.groupby('venue')
venue.size().sort_values().reset_index().tail(1)
```

Out[9]:

	venue	0
34	M Chinnaswamy Stadium	66

Q) Find the team winning most number of matches since 2008

In [10]:

```python
ipl['winner'].value_counts().sort_values().tail(1)
```

Out[10]:

```
Mumbai Indians    92
Name: winner, dtype: int64
```

Q) Find the team winning least number of matches

In [11]:

```python
ipl['winner'].value_counts().sort_values().head(1).index[0]
```

Out[11]:

```
'Rising Pune Supergiants'
```

Q) Find the team who played most number of matches. note down winning doesnt matter

In [12]:

```python
(ipl['team2'].value_counts() + ipl['team1'].value_counts()).sort_values
```

Out[12]:

```
Mumbai Indians    157
dtype: int64
```

Q) List out all team names since 2008

In [13]:

```
(ipl['team2'].value_counts() + ipl['team1'].value_counts()).drop_duplic
```

Out[13]:

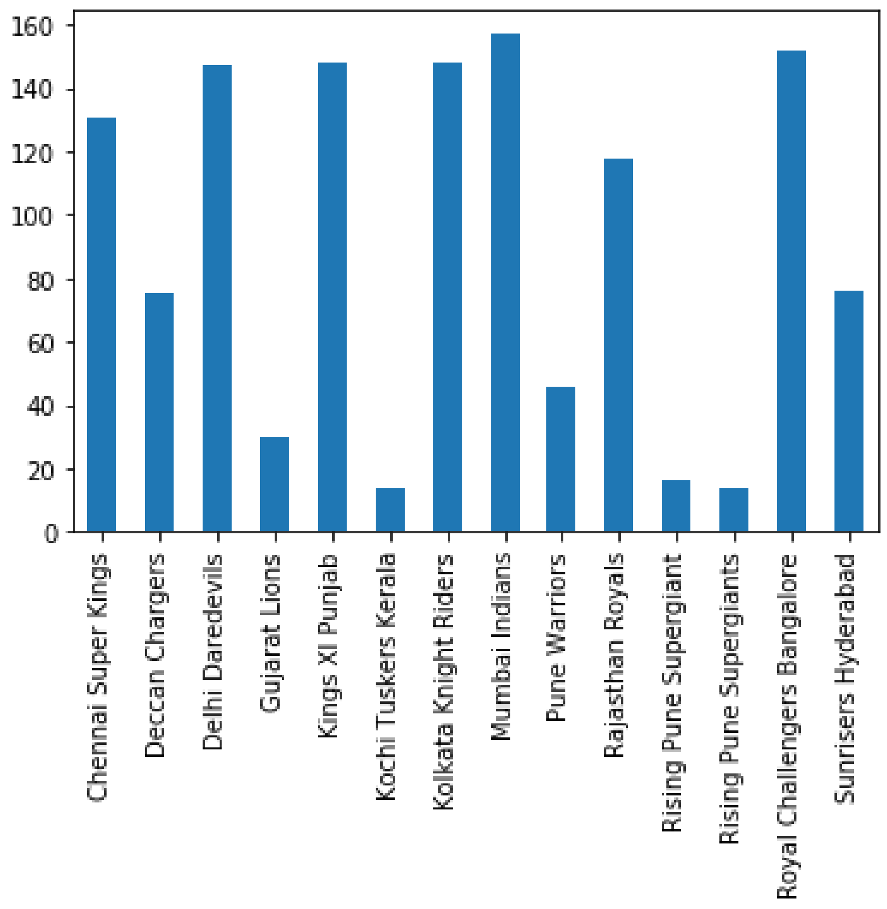
```
Index(['Chennai Super Kings', 'Deccan Chargers', 'Delhi Dared
evils', 'Gujarat Lions', 'Kings XI Punjab', 'Kochi Tuskers Ke
rala', 'Mumbai Indians', 'Pune Warriors', 'Rajasthan Royals',
'Rising Pune Supergiant', 'Royal Challengers Bangalore', 'Sun
risers Hyderabad'], dtype='object')
```

In [14]:

```
#plot bar graph for the teams and their number of matches played
(ipl['team2'].value_counts() + ipl['team1'].value_counts()).plot.bar()
```

Out[14]:

```
<matplotlib.axes._subplots.AxesSubplot at 0x7fc2d58585f8>
```



Q) List out each seasons winners.

logic is that each seasons last match is the final match and its winner is the seasons winner

In [15]:

```
x=ipl.drop_duplicates('season',keep='last')
```

In [16]:

```
x[['season','winner']].sort_values('season')
```

Out[16]:

	season	winner
116	2008	Rajasthan Royals
173	2009	Deccan Chargers
233	2010	Chennai Super Kings
306	2011	Chennai Super Kings
380	2012	Kolkata Knight Riders
456	2013	Mumbai Indians
516	2014	Kolkata Knight Riders
575	2015	Mumbai Indians
635	2016	Sunrisers Hyderabad
58	2017	Mumbai Indians

Q) how many times each team has won the finals

In [17]:

```
x['winner'].value_counts().reset_index()
```

Out[17]:

	index	winner
0	Mumbai Indians	3
1	Kolkata Knight Riders	2
2	Chennai Super Kings	2
3	Rajasthan Royals	1
4	Deccan Chargers	1
5	Sunrisers Hyderabad	1

In [18]:

```
ipl.head(10)
```

Out[18]:

	id	season	city	date	team1	team2	toss_winner	toss_
0	1	2017	Hyderabad	2017-04-05	Sunrisers Hyderabad	Royal Challengers Bangalore	Royal Challengers Bangalore	
1	2	2017	Pune	2017-04-06	Mumbai Indians	Rising Pune Supergiant	Rising Pune Supergiant	
2	3	2017	Rajkot	2017-04-07	Gujarat Lions	Kolkata Knight Riders	Kolkata Knight Riders	
3	4	2017	Indore	2017-04-08	Rising Pune Supergiant	Kings XI Punjab	Kings XI Punjab	
4	5	2017	Bangalore	2017-04-08	Royal Challengers Bangalore	Delhi Daredevils	Royal Challengers Bangalore	
5	6	2017	Hyderabad	2017-04-09	Gujarat Lions	Sunrisers Hyderabad	Sunrisers Hyderabad	
6	7	2017	Mumbai	2017-04-09	Kolkata Knight Riders	Mumbai Indians	Mumbai Indians	
7	8	2017	Indore	2017-04-10	Royal Challengers Bangalore	Kings XI Punjab	Royal Challengers Bangalore	
8	9	2017	Pune	2017-04-11	Delhi Daredevils	Rising Pune Supergiant	Rising Pune Supergiant	
9	10	2017	Mumbai	2017-04-12	Sunrisers Hyderabad	Mumbai Indians	Mumbai Indians	

Q)Find out whether the toss winner of the game has actually won

the game by his decision to bat or field first?

In [19]:

```
toss_data = ipl[['season','city','venue','toss_winner','toss_decision',
```

In [20]:

```
toss_data.head(10)
```

Out[20]:

	season	city	venue	toss_winner	toss_decision	winner
0	2017	Hyderabad	Rajiv Gandhi International Stadium, Uppal	Royal Challengers Bangalore	field	Sunrisers Hyderabad
1	2017	Pune	Maharashtra Cricket Association Stadium	Rising Pune Supergiant	field	Rising Pune Supergiant
2	2017	Rajkot	Saurashtra Cricket Association Stadium	Kolkata Knight Riders	field	Kolkata Knight Riders
3	2017	Indore	Holkar Cricket Stadium	Kings XI Punjab	field	Kings XI Punjab
4	2017	Bangalore	M Chinnaswamy Stadium	Royal Challengers Bangalore	bat	Royal Challengers Bangalore
5	2017	Hyderabad	Rajiv Gandhi International Stadium, Uppal	Sunrisers Hyderabad	field	Sunrisers Hyderabad
6	2017	Mumbai	Wankhede Stadium	Mumbai Indians	field	Mumbai Indians
7	2017	Indore	Holkar Cricket Stadium	Royal Challengers Bangalore	bat	Kings XI Punjab
8	2017	Pune	Maharashtra Cricket Association Stadium	Rising Pune Supergiant	field	Delhi Daredevils
9	2017	Mumbai	Wankhede Stadium	Mumbai Indians	field	Mumbai Indians

In [21]:

```
toss_data['toss_with_bat']=""
toss_data['toss_with_field']=""
```

In [22]:

```
d1 = toss_data['toss_winner']==toss_data['winner']
```

In [23]:

```
toss_data = toss_data[d1].sort_values('toss_winner')
```

In [24]:

```
def findValues_for_bat(toss_decision):
    if toss_decision=='bat':
        return 'yes'
    else:
        return 'no'
def findValues_for_field(toss_decision):
    if toss_decision=='field':
        return 'yes'
    else:
        return 'no'
```

In [25]:

```
toss_data['toss_with_bat']=toss_data['toss_decision'].apply(findValues_
toss_data['toss_with_field']=toss_data['toss_decision'].apply(findValue
```

In [26]:

```
toss_data.head(10)
```

Out[26]:

	season	city	venue	toss_winner	toss_decision	winner
520	2015	Chennai	MA Chidambaram Stadium, Chepauk	Chennai Super Kings	bat	Chennai Super Kings
181	2010	Kolkata	Eden Gardens	Chennai Super Kings	bat	Chennai Super Kings
445	2013	Chennai	MA Chidambaram Stadium, Chepauk	Chennai Super Kings	bat	Chennai Super Kings
60	2008	Chandigarh	Punjab Cricket Association Stadium, Mohali	Chennai Super Kings	bat	Chennai Super Kings
303	2011	Mumbai	Wankhede Stadium	Chennai Super Kings	field	Chennai Super Kings
424	2013	Chennai	MA Chidambaram Stadium, Chepauk	Chennai Super Kings	bat	Chennai Super Kings
306	2011	Chennai	MA Chidambaram Stadium, Chepauk	Chennai Super Kings	bat	Chennai Super Kings
421	2013	Pune	Subrata Roy Sahara Stadium	Chennai Super Kings	bat	Chennai Super Kings
86	2008	Delhi	Feroz Shah Kotla	Chennai Super Kings	field	Chennai Super Kings
541	2015	Chennai	MA Chidambaram Stadium, Chepauk	Chennai Super Kings	bat	Chennai Super Kings

In [27]:

```
toss_data=toss_data.rename(columns={'toss_with_bat':'bat first','toss_w
toss_data.head(10)
```

Out[27]:

	season	city	venue	toss_winner	toss_decision	winner
520	2015	Chennai	MA Chidambaram Stadium, Chepauk	Chennai Super Kings	bat	Chennai Super Kings
181	2010	Kolkata	Eden Gardens	Chennai Super Kings	bat	Chennai Super Kings
445	2013	Chennai	MA Chidambaram Stadium, Chepauk	Chennai Super Kings	bat	Chennai Super Kings
60	2008	Chandigarh	Punjab Cricket Association Stadium, Mohali	Chennai Super Kings	bat	Chennai Super Kings
303	2011	Mumbai	Wankhede Stadium	Chennai Super Kings	field	Chennai Super Kings
424	2013	Chennai	MA Chidambaram Stadium, Chepauk	Chennai Super Kings	bat	Chennai Super Kings
306	2011	Chennai	MA Chidambaram Stadium, Chepauk	Chennai Super Kings	bat	Chennai Super Kings
421	2013	Pune	Subrata Roy Sahara Stadium	Chennai Super Kings	bat	Chennai Super Kings
86	2008	Delhi	Feroz Shah Kotla	Chennai Super Kings	field	Chennai Super Kings
541	2015	Chennai	MA Chidambaram Stadium, Chepauk	Chennai Super Kings	bat	Chennai Super Kings

In [28]:

```
#toss_data = toss_data.drop(['venue','city','winner'],axis=1)
```

In [29]:

```
t = toss_data.groupby(['season','toss_winner','bat first'],sort=True)
#t = toss_data.groupby(['season','toss_winner','toss_decision'],sort=Tr
```

In [30]:

```
t.size().head(15)
```

Out[30]:

```
season  toss_winner                  bat first
2008    Chennai Super Kings          no            1
                                     yes           2
        Deccan Chargers              no            2
        Delhi Daredevils             no            2
        Kings XI Punjab              no            3
                                     yes           1
        Kolkata Knight Riders        yes           3
        Mumbai Indians               no            4
        Rajasthan Royals             no            7
                                     yes           2
        Royal Challengers Bangalore  yes           1
2009    Chennai Super Kings          yes           4
        Deccan Chargers              no            3
                                     yes           4
        Delhi Daredevils             no            4
dtype: int64
```

Q)Does the below thing have any real meaning? like is the below result useful?

In [31]:

```
t.describe()
```

Out[31]:

			city						
			count	unique	top	freq	count	unique	to
season	toss_winner	bat first							
		no	1	1	Delhi	1	1	1	Feroz Sha Kot
	Chennai Super Kings	yes	2	2	Bangalore	1	2	2	Punja Crick Associatio Stadiur Moha
	Deccan Chargers	no	2	2	Mumbai	1	2	2	Dr DY Pa Spor Academ

In [ ]:

```

```

In [11]:

```
## Importing Dataset
delivery = pd.read_csv('deliveries.csv')
```

In [12]:

```
## Checking All Information Related with Dataset
delivery.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 150460 entries, 0 to 150459
Data columns (total 21 columns):
 #   Column            Non-Null Count   Dtype 
---  ------            --------------   ----- 
 0   match_id          150460 non-null  int64 
 1   inning            150460 non-null  int64 
 2   batting_team      150460 non-null  object
 3   bowling_team      150460 non-null  object
 4   over              150460 non-null  int64 
 5   ball              150460 non-null  int64 
 6   batsman           150460 non-null  object
 7   non_striker       150460 non-null  object
 8   bowler            150460 non-null  object
 9   is_super_over     150460 non-null  int64 
 10  wide_runs         150460 non-null  int64 
 11  bye_runs          150460 non-null  int64 
 12  legbye_runs       150460 non-null  int64 
 13  noball_runs       150460 non-null  int64 
 14  penalty_runs      150460 non-null  int64 
 15  batsman_runs      150460 non-null  int64 
 16  extra_runs        150460 non-null  int64 
 17  total_runs        150460 non-null  int64 
 18  player_dismissed  7438 non-null    object
 19  dismissal_kind    7438 non-null    object
 20  fielder           5369 non-null    object
dtypes: int64(13), object(8)
memory usage: 24.1+ MB
```

In [13]:

```
## Checking Rows and Column
delivery.shape
```

Out[13]:

```
(150460, 21)
```

In [14]:

```
## Checking all Columns Available
delivery.columns
```

Out[14]:

```
Index(['match_id', 'inning', 'batting_team', 'bowling_team',
'over', 'ball',
       'batsman', 'non_striker', 'bowler', 'is_super_over',
'wide_runs',
       'bye_runs', 'legbye_runs', 'noball_runs', 'penalty_run
s',
       'batsman_runs', 'extra_runs', 'total_runs', 'player_di
smissed',
       'dismissal_kind', 'fielder'],
      dtype='object')
```

In [36]:

```python
delivery.head(10)
```

Out[36]:

	match_id	inning	batting_team	bowling_team	over	ball	batsman	non_s
0	1	1	Sunrisers Hyderabad	Royal Challengers Bangalore	1	1	DA Warner	S Dł
1	1	1	Sunrisers Hyderabad	Royal Challengers Bangalore	1	2	DA Warner	S Dł
2	1	1	Sunrisers Hyderabad	Royal Challengers Bangalore	1	3	DA Warner	S Dł
3	1	1	Sunrisers Hyderabad	Royal Challengers Bangalore	1	4	DA Warner	S Dł
4	1	1	Sunrisers Hyderabad	Royal Challengers Bangalore	1	5	DA Warner	S Dł
5	1	1	Sunrisers Hyderabad	Royal Challengers Bangalore	1	6	S Dhawan	DA V
6	1	1	Sunrisers Hyderabad	Royal Challengers Bangalore	1	7	S Dhawan	DA V
7	1	1	Sunrisers Hyderabad	Royal Challengers Bangalore	2	1	S Dhawan	DA V
8	1	1	Sunrisers Hyderabad	Royal Challengers Bangalore	2	2	DA Warner	S Dł
9	1	1	Sunrisers Hyderabad	Royal Challengers Bangalore	2	3	DA Warner	S Dł

Q) top 5 batsman in ipl according to most number of runs?

In [37]:

```
t=delivery.groupby(['batsman'])['batsman_runs'].sum()
```

In [38]:

```
t.sort_values(ascending=False).head(5)
```

Out[38]:

```
batsman
SK Raina     4548
V Kohli      4423
RG Sharma    4207
G Gambhir    4132
DA Warner    4014
Name: batsman_runs, dtype: int64
```

Q) which batsman has played most number of balls

In [39]:

```
t=delivery.groupby(['batsman'])
```

In [40]:

```
t['batsman_runs'].count().sort_values(ascending=False).head(5)
# logic is each row is one ball
```

Out[40]:

```
batsman
V Kohli      3494
G Gambhir    3433
SK Raina     3369
RG Sharma    3274
S Dhawan     3005
Name: batsman_runs, dtype: int64
```

Q) which batsman has hit highest number of 4s

In [41]:

```
mask=delivery['batsman_runs']==4
```

In [42]:

```
delivery_fours = delivery[mask].groupby('batsman')['batsman_runs'].coun
# count() instead of sum() because we need to count the number of 4s in
```

In [43]:

```
delivery_fours.head(5)
```

Out[43]:

```
batsman
G Gambhir    484
SK Raina     402
DA Warner    401
S Dhawan     401
V Kohli      384
Name: batsman_runs, dtype: int64
```

Q) how many total fours in ipl till now

In [44]:

```
len(delivery[mask])
```

Out[44]:

```
17033
```

Q) which batsman has hit highest number of 6's

In [45]:

```
mask=delivery['batsman_runs']==6
delivery_fours = delivery[mask].groupby('batsman')['batsman_runs'].coun
delivery_fours.head(5)
```

Out[45]:

```
batsman
CH Gayle      266
SK Raina      174
RG Sharma     173
DA Warner     160
V Kohli       160
Name: batsman_runs, dtype: int64
```

Q) which bowler has given most no. of dot balls

In [46]:

```
mask = delivery['total_runs']==0
delivery_dot = delivery[mask]
delivery_dot.groupby('bowler')['total_runs'].count().sort_values(ascend
```

Out[46]:

```
bowler
P Kumar            1075
Harbhajan Singh    1062
SL Malinga         1060
DW Steyn            978
A Mishra            953
Name: total_runs, dtype: int64
```

Q) batsman which when on non-striker end, there has been most dismissals

Case 1: Only the striker is dismissed everytime

Case 2: The striker and non-striker both can be dismissed

Sir's version runs for case 1 and 2 both and my version runs only for case 1.

In [47]:

```
#My version - only works for case 1
delivery_dismissal1 = delivery.dropna(subset=['player_dismissed'])
mask=delivery_dismissal1['batsman']==delivery_dismissal1['player_dismis
delivery_dismissal1 = delivery_dismissal1[mask]
ans=delivery_dismissal1.groupby('non_striker')['player_dismissed'].coun
#delivery_dismissal1.shape
ans
```

Out[47]:

	non_striker	player_dismissed
0	RG Sharma	170
1	V Kohli	150
2	SK Raina	138
3	G Gambhir	135
4	RV Uthappa	134

In [48]:

```
#Sirs version - works for both the cases but actually the question aske
delivery_dismissal2 = delivery.fillna({'player_dismissed':'Not'})
mask=delivery_dismissal2['player_dismissed']!='Not'
#mask1=delivery_dismissal2['player_dismissed']!=delivery_dismissal2['no
#delivery_dismissal2 = delivery_dismissal2[mask & mask1]
delivery_dismissal2 = delivery_dismissal2[mask]
ans1=delivery_dismissal2.groupby('non_striker')['player_dismissed'].cou
#delivery_dismissal2.shape
ans1
```

Out[48]:

	non_striker	player_dismissed
0	RG Sharma	171
1	V Kohli	151
2	SK Raina	145
3	G Gambhir	142
4	RV Uthappa	138
5	KD Karthik	125
6	MS Dhoni	120
7	AB de Villiers	120
8	S Dhawan	116
9	DA Warner	112

Below cell is the proof by showing that RG Sharma has been out being on non_strikers end just one time

Comparing sir's and my version and according to the question that is:- count the number of times batsman on strikers end got out while a particular batsman was on the non-strikers end.

My version seems to be correct

In [49]:

```
#Finding the cases when the non-striker was the player_dismissed
dell = delivery.dropna(subset=['player_dismissed'])
mask = dell['non_striker']==dell['player_dismissed']
mask1 = dell['non_striker']=='RG Sharma'
dell = dell[mask & mask1]
dell.groupby('non_striker')['player_dismissed'].count().sort_values(asc
```

Out[49]:

	non_striker	player_dismissed
0	RG Sharma	1

In [50]:

```
7084+354 # means sirs version din take into account that non-striker ca
```

Out[50]:

```
7438
```

Q) make a function with one argument:- batsman name and return the name of the team that batsman has hit most runs against

In [51]:

```
# Finding the batsmans and the team they have hit most number of runs ag
hit_runs = delivery.groupby(['bowling_team','batsman'])['batsman_runs']
hit_runs
```

Out[51]:

	bowling_team	batsman	batsman_runs
0	Kings XI Punjab	CH Gayle	797
1	Kolkata Knight Riders	RG Sharma	710
2	Mumbai Indians	SK Raina	708
3	Chennai Super Kings	V Kohli	706
8	Delhi Daredevils	RG Sharma	670
11	Royal Challengers Bangalore	G Gambhir	644
31	Rajasthan Royals	AB de Villiers	485
50	Sunrisers Hyderabad	V Kohli	439
76	Pune Warriors	CH Gayle	383
99	Deccan Chargers	R Dravid	339
103	Gujarat Lions	DA Warner	336
288	Rising Pune Supergiants	V Kohli	188
503	Rising Pune Supergiant	PA Patel	108
540	Kochi Tuskers Kerala	SR Tendulkar	100

In [52]:

```
# Finding virat has hit most runs against which team
mask=delivery['batsman']=='V Kohli'
bats = delivery[mask]
bats.groupby('bowling_team')['batsman_runs'].sum().sort_values(ascendin
```

Out[52]:

```
'Chennai Super Kings'
```

In [53]:

```
def opp_team_most_runs(batsman_name):
    mask=delivery['batsman']==batsman_name
    bats = delivery[mask]
    ans=bats.groupby('bowling_team')['batsman_runs'].sum().sort_values(
    return ans
```

In [54]:

```
opp_team_most_runs('RG Sharma')
```

Out[54]:

```
'Kolkata Knight Riders'
```

Q) make a function which takes one argument:- batsman and return which bowler has givn highest number of runs to that batsman

In [55]:

```
mask=delivery['batsman']=='V Kohli'
bats = delivery[mask]
bats.groupby('bowler')['batsman_runs'].sum().sort_values(ascending=Fals
```

Out[55]:

```
bowler
A Mishra     149
UT Yadav     141
DJ Bravo     130
R Ashwin     127
RA Jadeja    104
Name: batsman_runs, dtype: int64
```

In [56]:

```
def most_runs_taken_from_bowler(batsman_name):
    mask=delivery['batsman']==batsman_name
    bats = delivery[mask]
    return bats.groupby('bowler')['batsman_runs'].sum().sort_values(asc
```

In [57]:

```
most_runs_taken_from_bowler('V Kohli')
```

Out[57]:

```
'A Mishra'
```

Q)in each over which team has hit how many sixes

In [58]:

```python
# Pivot_table method
sixes = delivery[delivery['batsman_runs']==6]
y=sixes.pivot_table(index=['batting_team'],columns=['over'],values='bat
print(y)
```

```
over                          1     2     3     4     5    
6     7     8     9     10    11    12    13    14    15    1
6    17    18    19    20
batting_team                                                
Chennai Super Kings          5.0  17.0  37.0  34.0  41.0  4
3.0  22.0  25.0  23.0  23.0  36.0  36.0  35.0  45.0  43.0  4
6.0  51.0  58.0  54.0  68.0
Deccan Chargers              3.0  21.0  11.0  17.0  27.0  2
2.0  11.0  13.0  17.0  14.0  15.0  26.0  23.0  22.0  20.0  2
1.0  38.0  37.0  23.0  19.0
Delhi Daredevils            14.0  19.0  30.0  41.0  29.0  2
7.0  20.0  26.0  32.0  24.0  34.0  38.0  37.0  35.0  28.0  4
3.0  56.0  44.0  59.0  50.0
Gujarat Lions                4.0   6.0  14.0   9.0  11.0  1
2.0  10.0   6.0  11.0   8.0   5.0   7.0   5.0   8.0   5.0   
5.0   7.0   9.0   9.0   4.0
Kings XI Punjab             10.0  19.0  27.0  36.0  30.0  3
9.0  19.0  35.0  36.0  29.0  37.0  38.0  47.0  41.0  51.0  5
9.0  39.0  57.0  53.0  60.0
Kochi Tuskers Kerala         2.0   4.0   3.0   3.0   3.0   
3.0   2.0   2.0   1.0   3.0   1.0   3.0   2.0   3.0   4.0   N
aN   3.0   4.0   5.0   2.0
Kolkata Knight Riders       10.0  13.0  28.0  35.0  25.0  3
4.0  26.0  25.0  27.0  21.0  34.0  32.0  42.0  31.0  40.0  5
0.0  55.0  52.0  45.0  34.0
Mumbai Indians               9.0  17.0  22.0  28.0  43.0  5
0.0  18.0  23.0  35.0  22.0  33.0  49.0  51.0  50.0  53.0  6
6.0  60.0  86.0  72.0  89.0
Pune Warriors                5.0   6.0   6.0   7.0   7.0   
3.0   5.0  10.0   9.0   6.0  13.0   5.0  10.0  13.0  13.0  1
6.0  13.0  12.0  18.0  19.0
Rajasthan Royals            12.0   7.0  13.0  21.0  23.0  2
4.0  15.0  24.0  20.0  26.0  30.0  33.0  39.0  38.0  34.0  3
7.0  45.0  34.0  37.0  26.0
Rising Pune Supergiant       1.0   NaN   2.0   5.0   8.0   
6.0   1.0   NaN   3.0   8.0   3.0   2.0   7.0   4.0   5.0   
5.0   2.0   2.0  14.0  11.0
Rising Pune Supergiants      NaN   2.0   1.0   1.0   5.0   
5.0   4.0   3.0   1.0   1.0   2.0   2.0   1.0   1.0   7.0   
6.0   6.0   9.0   2.0   9.0
Royal Challengers Bangalore 20.0  28.0  40.0  43.0  40.0  2
9.0  18.0  34.0  47.0  36.0  47.0  36.0  51.0  53.0  54.0  7
1.0  61.0  82.0  74.0  71.0
Sunrisers Hyderabad          3.0  12.0  16.0   8.0  17.0  1
0.0  13.0  19.0  15.0  12.0  11.0  11.0  19.0  18.0  33.0  2
2.0  18.0  37.0  42.0  28.0
```

In [59]:

```
# Groupby method
sixes.groupby(['batting_team','over'])['batsman_runs'].count().head(10)
```

Out[59]:

```
batting_team         over
Chennai Super Kings  1        5
                     2       17
                     3       37
                     4       34
                     5       41
                     6       43
                     7       22
                     8       25
                     9       23
                     10      23
Name: batsman_runs, dtype: int64
```

In [60]:

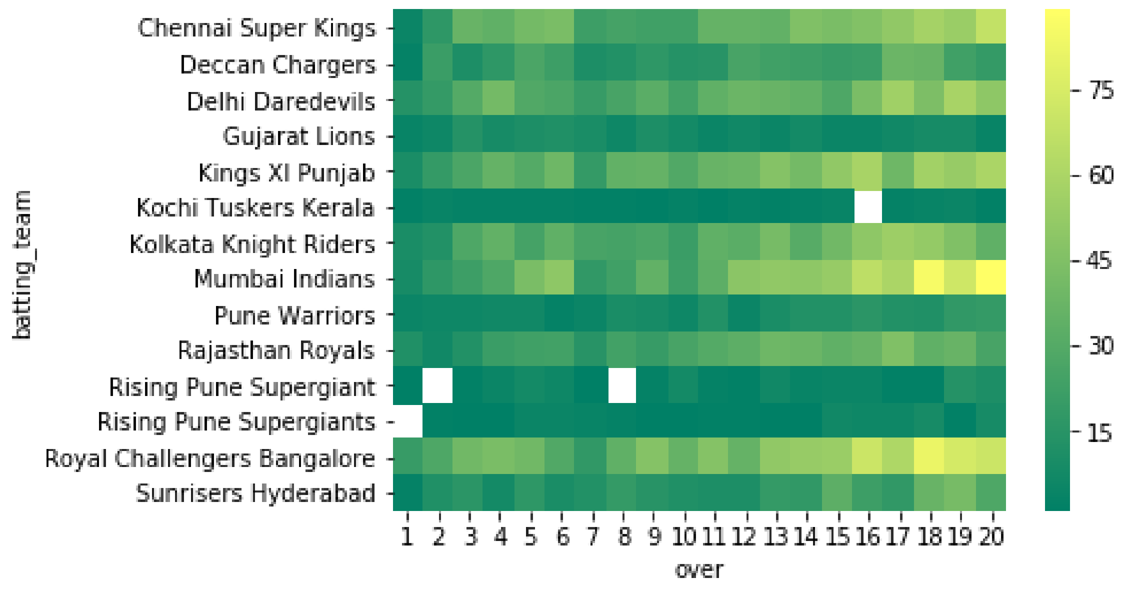
```
import seaborn as sns
```

In [61]:

```
sns.heatmap(y,cmap='summer')
```

Out[61]:

```
<matplotlib.axes._subplots.AxesSubplot at 0x7fc2c8be1128>
```



Q) find the orange cap holders of each season

In [62]:

```
merged_data = ipl.merge(delivery,left_on='id',right_on='match_id')
```

In [63]:

```
merged_data.head()
```

Out[63]:

	id	season	city	date	team1	team2	toss_winner	toss_d
0	1	2017	Hyderabad	2017-04-05	Sunrisers Hyderabad	Royal Challengers Bangalore	Royal Challengers Bangalore	
1	1	2017	Hyderabad	2017-04-05	Sunrisers Hyderabad	Royal Challengers Bangalore	Royal Challengers Bangalore	
2	1	2017	Hyderabad	2017-04-05	Sunrisers Hyderabad	Royal Challengers Bangalore	Royal Challengers Bangalore	
3	1	2017	Hyderabad	2017-04-05	Sunrisers Hyderabad	Royal Challengers Bangalore	Royal Challengers Bangalore	
4	1	2017	Hyderabad	2017-04-05	Sunrisers Hyderabad	Royal Challengers Bangalore	Royal Challengers Bangalore	

In [64]:

```
df = merged_data.groupby(['season','batsman'])['batsman_runs'].sum().re
```

In [65]:

```
df.sort_values('batsman_runs').drop_duplicates(subset=['season'],keep='
```

Out[65]:

	season	batsman	batsman_runs
115	2008	SE Marsh	616
229	2009	ML Hayden	572
446	2010	SR Tendulkar	618
502	2011	CH Gayle	608
684	2012	CH Gayle	733
910	2013	MEK Hussey	733
1088	2014	RV Uthappa	660
1148	2015	DA Warner	562
1383	2016	V Kohli	973
1422	2017	DA Warner	641

Q1) last 5 overs (death overs) mein sabse dangerous batsman, strike rate (no. of runs divided by number of balls)*100.

base criteria is player has played 200 balls, (between 16 and 20 overs he has completed 200 balls)

In [66]:

```
mask = merged_data['over']>15
```

In [67]:

```
# Only for death overs that is from 16-20 both inclusive
danger = merged_data[mask]
danger.head(10)
```

Out[67]:

	id	season	city	date	team1	team2	toss_winner	toss
93	1	2017	Hyderabad	2017-04-05	Sunrisers Hyderabad	Royal Challengers Bangalore	Royal Challengers Bangalore	
94	1	2017	Hyderabad	2017-04-05	Sunrisers Hyderabad	Royal Challengers Bangalore	Royal Challengers Bangalore	
95	1	2017	Hyderabad	2017-04-05	Sunrisers Hyderabad	Royal Challengers Bangalore	Royal Challengers Bangalore	
96	1	2017	Hyderabad	2017-04-05	Sunrisers Hyderabad	Royal Challengers Bangalore	Royal Challengers Bangalore	
97	1	2017	Hyderabad	2017-04-05	Sunrisers Hyderabad	Royal Challengers Bangalore	Royal Challengers Bangalore	
98	1	2017	Hyderabad	2017-04-05	Sunrisers Hyderabad	Royal Challengers Bangalore	Royal Challengers Bangalore	
99	1	2017	Hyderabad	2017-04-05	Sunrisers Hyderabad	Royal Challengers Bangalore	Royal Challengers Bangalore	
100	1	2017	Hyderabad	2017-04-05	Sunrisers Hyderabad	Royal Challengers Bangalore	Royal Challengers Bangalore	
101	1	2017	Hyderabad	2017-04-05	Sunrisers Hyderabad	Royal Challengers Bangalore	Royal Challengers Bangalore	

	id	season	city	date	team1	team2	toss_winner	toss
102	1	2017	Hyderabad	2017-04-05	Sunrisers Hyderabad	Royal Challengers Bangalore	Royal Challengers Bangalore	

In [68]:

```
# Finding each batsmans total runs in history in death overs
runs = danger.groupby('batsman')['batsman_runs'].sum().sort_values(asce
runs.head(10)
```

Out[68]:

	batsman	batsman_runs
0	MS Dhoni	2076
1	KA Pollard	1352
2	RG Sharma	1314
3	AB de Villiers	1203
4	V Kohli	993
5	YK Pathan	930
6	Yuvraj Singh	883
7	JP Duminy	869
8	SK Raina	767
9	RA Jadeja	753

In [69]:

```
# Finding number of balls played by each batsman in death overs
balls = danger.groupby('batsman')['ball'].count().sort_values(ascending
balls.head(10)
```

Out[69]:

	batsman	ball
0	MS Dhoni	1224
1	KA Pollard	838
2	RG Sharma	748
3	YK Pathan	584
4	RA Jadeja	576
5	AB de Villiers	570
6	V Kohli	546
7	JP Duminy	518
8	Yuvraj Singh	516
9	IK Pathan	465

In [70]:

```
# Merging runs and ball values in a single dataframe for simplicity
balls_and_runs = balls.merge(runs,left_on='batsman',right_on='batsman')
```

In [71]:

```
balls_and_runs = balls_and_runs[balls_and_runs['ball']>=200]
len(balls_and_runs)
```

Out[71]:

```
44
```

In [72]:

```
balls_and_runs['strike']=0
```

In [73]:

```
balls_and_runs['strike']=(balls_and_runs['batsman_runs']/balls_and_runs
balls_and_runs.sort_values('strike',ascending=False).head(2)
```

Out[73]:

	batsman	ball	batsman_runs	strike
5	AB de Villiers	570	1203	211.052632
38	DA Warner	228	432	189.473684

Q2) top 10 batsman, and top 10 bowlers with max number of wickets and combine them and make a heatmap which tells which top batsman has hitten most runs against a top bowler

In [74]:

```
top_bowlers=delivery.dropna(subset=['player_dismissed']).copy()
top_bowlers[top_bowlers['bowler']==top_bowlers['fielder']].reset_index(
```

Out[74]:

	index	match_id	inning	batting_team	bowling_team	over	ball	batsma
0	557	3	1	Gujarat Lions	Kolkata Knight Riders	11	2	AJ Finc
1	2700	12	1	Royal Challengers Bangalore	Mumbai Indians	18	7	P Neg
2	5632	24	1	Mumbai Indians	Delhi Daredevils	19	7	HH Pandy
3	5966	25	2	Rising Pune Supergiant	Sunrisers Hyderabad	14	1	MS Dhor
4	6129	26	1	Kings XI Punjab	Gujarat Lions	20	6	WP Sah
5	6680	28	2	Mumbai Indians	Rising Pune Supergiant	20	5	Harbhaja Sing
6	7766	33	2	Royal Challengers Bangalore	Rising Pune Supergiant	8	4	KM Jadha
7	7963	34	1	Gujarat Lions	Mumbai Indians	19	7	J Faulkne
8	8386	36	1	Sunrisers Hyderabad	Kolkata Knight Riders	20	6	Yuvra Sing
9	12427	53	1	Mumbai Indians	Kolkata Knight Riders	16	6	A Rayud

In [75]:

```
l=list()
for i,row in top_bowlers.iterrows():
    if row['dismissal_kind']=='run out' or row['dismissal_kind']=='reti
        l.append(i)
for i in l:
    top_bowlers.drop(i,inplace=True)
```

In [76]:

```
top_bowlers.shape
```

Out[76]:

```
(6673, 21)
```

In [77]:

```
top_bowlers=top_bowlers.groupby('bowler')['player_dismissed'].count().s
#top_bowlers.groupby('bowler')['dismissal_kind'].count().sort_values(as
```

In [78]:

```
top_batsman=delivery.groupby('batsman')['batsman_runs'].sum().sort_valu
```

In [79]:

```
#mask1=top_bowlers['bowler']==delivery['bowler']
#mask2=top_batsman['batsman']==delivery['batsman']
#bat_and_bowl = delivery.mask(top_bowlers['bowler']==delivery['bowler']
top_batsman.head()
```

Out[79]:

	batsman	batsman_runs
0	SK Raina	4548
1	V Kohli	4423
2	RG Sharma	4207
3	G Gambhir	4132
4	DA Warner	4014

In [80]:

```
top_bowlers
```

Out[80]:

	bowler	player_dismissed
0	SL Malinga	154
1	A Mishra	134
2	Harbhajan Singh	127
3	PP Chawla	126
4	DJ Bravo	122
5	B Kumar	111
6	A Nehra	106
7	R Vinay Kumar	103
8	Z Khan	102
9	R Ashwin	100

In [81]:

```python
ex=delivery.copy()
ex['top_batsmans']=0.0
ex['top_bowlers']=0.0
ex.head(10)
```

Out[81]:

	match_id	inning	batting_team	bowling_team	over	ball	batsman	non_s
0	1	1	Sunrisers Hyderabad	Royal Challengers Bangalore	1	1	DA Warner	S Dl
1	1	1	Sunrisers Hyderabad	Royal Challengers Bangalore	1	2	DA Warner	S Dl
2	1	1	Sunrisers Hyderabad	Royal Challengers Bangalore	1	3	DA Warner	S Dl
3	1	1	Sunrisers Hyderabad	Royal Challengers Bangalore	1	4	DA Warner	S Dl
4	1	1	Sunrisers Hyderabad	Royal Challengers Bangalore	1	5	DA Warner	S Dl
5	1	1	Sunrisers Hyderabad	Royal Challengers Bangalore	1	6	S Dhawan	DA V
6	1	1	Sunrisers Hyderabad	Royal Challengers Bangalore	1	7	S Dhawan	DA V
7	1	1	Sunrisers Hyderabad	Royal Challengers Bangalore	2	1	S Dhawan	DA V
8	1	1	Sunrisers Hyderabad	Royal Challengers Bangalore	2	2	DA Warner	S Dl
9	1	1	Sunrisers Hyderabad	Royal Challengers Bangalore	2	3	DA Warner	S Dl

In [82]:

```
for i,row in top_batsman.iterrows():
    e=str(row['batsman'])
    for j,r in ex.iterrows():
        if str(r['batsman'])==e:
            result=1
            ex.at[j,'top_batsmans']=result
    print('done with ',e)
print('done with batsman')
```

```
done with  SK Raina
done with  V Kohli
done with  RG Sharma
done with  G Gambhir
done with  DA Warner
done with  RV Uthappa
done with  CH Gayle
done with  S Dhawan
done with  MS Dhoni
done with  AB de Villiers
done with batsman
```

In [83]:

```
for i,row in top_bowlers.iterrows():
    e=row['bowler']
    for j,r in ex.iterrows():
        if r['bowler']==e:
            ex.at[j,'top_bowlers']=1
    print('done with ',e)
```

```
done with  SL Malinga
done with  A Mishra
done with  Harbhajan Singh
done with  PP Chawla
done with  DJ Bravo
done with  B Kumar
done with  A Nehra
done with  R Vinay Kumar
done with  Z Khan
done with  R Ashwin
```

In [84]:

```
mask1=ex['top_batsmans']==1
mask2=ex['top_bowlers']==1
y=ex[mask1 & mask2].pivot_table(index='batsman',columns='bowler',values
y
```

Out[84]:

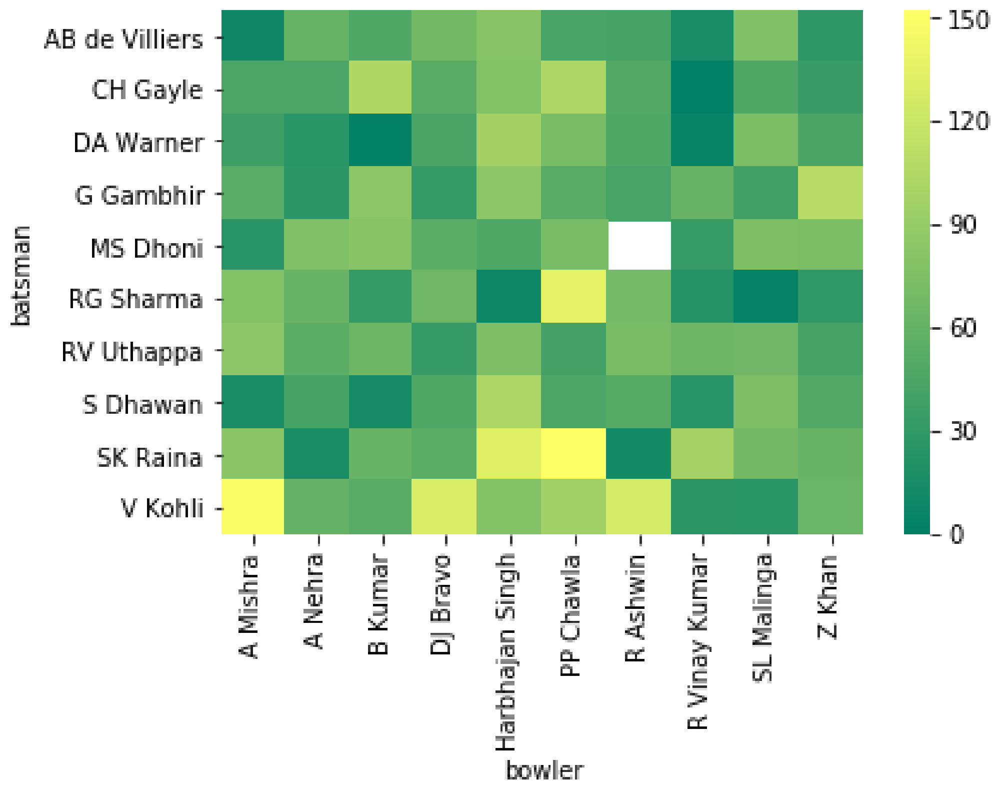
bowler	A Mishra	A Nehra	B Kumar	DJ Bravo	Harbhajan Singh	PP Chawla	R Ashwin	R Vinay Kumar
batsman								
AB de Villiers	9.0	61.0	48.0	69.0	80.0	43.0	42.0	16.0
CH Gayle	45.0	45.0	104.0	53.0	78.0	103.0	49.0	0.0
DA Warner	37.0	25.0	2.0	44.0	97.0	72.0	48.0	5.0
G Gambhir	54.0	27.0	84.0	32.0	84.0	53.0	43.0	62.0
MS Dhoni	24.0	76.0	81.0	55.0	47.0	72.0	NaN	33.0
RG Sharma	78.0	62.0	31.0	66.0	8.0	136.0	70.0	22.0
RV Uthappa	84.0	55.0	65.0	32.0	75.0	41.0	72.0	65.0
S Dhawan	16.0	42.0	14.0	48.0	103.0	46.0	51.0	24.0
SK Raina	83.0	15.0	62.0	55.0	132.0	152.0	12.0	98.0
V Kohli	149.0	60.0	53.0	130.0	78.0	95.0	127.0	26.0

In [85]:

```python
import seaborn as sns
sns.heatmap(y,cmap='summer')
```

Out[85]:

```
<matplotlib.axes._subplots.AxesSubplot at 0x7fc2c8be10f0>
```



In [86]:

```python
mask1=ex['batsman']=='CH Gayle'
mask2=ex['bowler']=='A Mishra'
ex[mask1 & mask2].groupby('batsman')['batsman_runs'].sum()
```

Out[86]:

```
batsman
CH Gayle    45
Name: batsman_runs, dtype: int64
```

Q3) most economical bowler in death overs

Economy rate = runs conceeded / overs bowled
Example if a bowler has given 35 runs in 3.1 overs
so his overs bowled will be calculated as 3+1/6 = 3.1666
and Economy rate would be 35/3.166 = 11.054

In [87]:

```python
danger=delivery[delivery['over']>15].copy()
```

In [88]:

```python
def over_conversion(over,ball):
    o=str(over-15)
    b=str(ball)
    return float(o+"."+b)
def econ_rate(runs,ball):
    return float(float(runs)/float(ball/6))
```

In [89]:

```python
over_conversion(16,1)
```

Out[89]:

```
1.1
```

In [90]:

```python
danger['o']=0.0
```

In [91]:

```python
# useful knowledge to update values
for i,row in danger.iterrows():
    result = over_conversion(row['over'],row['ball'])
    danger.at[i,'o']=result #way to update data in row
```

Make sure u run either of the below two cells

In [92]:

```
#Finding out each team's most economical bowler in death overs
danger=danger[['bowling_team','over','ball','o','bowler','total_runs']]
total_runs_given=danger.groupby(['bowling_team','bowler'])['total_runs'
total_balls_bowled=danger.groupby(['bowling_team','bowler'])['ball'].co
runs_and_balls=total_runs_given.merge(total_balls_bowled,left_on=['bowl
```

In [ ]:

```
# Just finding the most economical bowler without consideration which t
danger=danger[['bowling_team','over','ball','o','bowler','total_runs']]
total_runs_given=danger.groupby('bowler')['total_runs'].sum().sort_valu
total_balls_bowled=danger.groupby('bowler')['ball'].count().sort_values
runs_and_balls=total_runs_given.merge(total_balls_bowled,left_on=['bowl
```

In [93]:

```
runs_and_balls['econ_rate']=0.0
#runs_and_balls['econ_rate']=runs_and_balls['total_runs']/(runs_and_bal
```

In [94]:

```
for i,row in runs_and_balls.iterrows():
    result = econ_rate(row['total_runs'],row['ball'])
    runs_and_balls.at[i,'econ_rate']=result
```

In [95]:

```
runs_and_balls[runs_and_balls['ball']>100].sort_values('econ_rate').hea
```

Out[95]:

	bowling_team	bowler	total_runs	ball	econ_rate
74	Chennai Super Kings	M Muralitharan	208	192	6.500000
132	Rajasthan Royals	Sohail Tanvir	122	107	6.841121
81	Royal Challengers Bangalore	DW Steyn	189	165	6.872727
3	Kolkata Knight Riders	SP Narine	790	664	7.138554
46	Chennai Super Kings	DE Bollinger	297	242	7.363636
0	Mumbai Indians	SL Malinga	1300	1050	7.428571
67	Royal Challengers Bangalore	A Kumble	217	174	7.482759
64	Delhi Daredevils	CH Morris	222	177	7.525424
69	Sunrisers Hyderabad	Mustafizur Rahman	212	168	7.571429
49	Royal Challengers Bangalore	MA Starc	265	210	7.571429

In [96]:

```
runs_and_balls[runs_and_balls['ball']>=100].sort_values('econ_rate',asc
```

Out[96]:

	index	bowling_team	bowler	total_runs	ball	econ_rate
0	74	Chennai Super Kings	M Muralitharan	208	192	6.500000
1	132	Rajasthan Royals	Sohail Tanvir	122	107	6.841121
2	81	Royal Challengers Bangalore	DW Steyn	189	165	6.872727
3	3	Kolkata Knight Riders	SP Narine	790	664	7.138554
4	0	Mumbai Indians	SL Malinga	1300	1050	7.428571
5	64	Delhi Daredevils	CH Morris	222	177	7.525424
6	69	Sunrisers Hyderabad	Mustafizur Rahman	212	168	7.571429
7	73	Pune Warriors	B Kumar	209	159	7.886792
8	51	Deccan Chargers	DW Steyn	255	188	8.138298
9	112	Kings XI Punjab	B Lee	143	105	8.171429
10	99	Rising Pune Supergiant	JD Unadkat	158	115	8.243478
11	82	Gujarat Lions	Basil Thampi	188	108	10.444444

In [ ]:

```

```

Sirs methods for the 3 above questions

Q1) last 5 overs (death overs) mein sabse dangerous batsman, strike rate (no. of runs divided by number of balls)*100.

base criteria is player has played 200 balls, (between 16 and 20 overs he has completed 200 balls)

In [97]:

```
df = delivery[delivery['over']>15] #only need to use data from 16 to 20
```

In [98]:

```
a=df.groupby('batsman')['batsman_runs'].count() #counting number of bal
```

In [99]:

```
b=df.groupby('batsman')['batsman_runs'].count()>200 # only need to take
```

In [100]:

```
c=a[b].index.tolist()
```

In [101]:

```
c
```

```
Out[101]:
```

```
['A Mishra',
 'AB de Villiers',
 'AD Mathews',
 'AM Rahane',
 'AR Patel',
 'AT Rayudu',
 'BJ Hodge',
 'DA Miller',
 'DA Warner',
 'DJ Bravo',
 'DJ Hussey',
 'DPMD Jayawardene',
 'Harbhajan Singh',
 'IK Pathan',
 'JA Morkel',
 'JH Kallis',
 'JP Duminy',
 'JP Faulkner',
 'KA Pollard',
 'KD Karthik',
 'KM Jadhav',
 'LRPL Taylor',
 'MK Pandey',
 'MK Tiwary',
 'MS Dhoni',
 'NV Ojha',
 'P Kumar',
 'PP Chawla',
 'R Vinay Kumar',
 'RA Jadeja',
 'RG Sharma',
 'RV Uthappa',
 'S Badrinath',
 'S Dhawan',
 'SK Raina',
 'SPD Smith',
 'SS Tiwary',
 'STR Binny',
 'V Kohli',
 'WP Saha',
 'Y Venugopal Rao',
 'YK Pathan',
 'Yuvraj Singh']
```

In [102]:

```python
df.head(10)
```

Out[102]:

	match_id	inning	batting_team	bowling_team	over	ball	batsman	no
93	1	1	Sunrisers Hyderabad	Royal Challengers Bangalore	16	1	MC Henriques	
94	1	1	Sunrisers Hyderabad	Royal Challengers Bangalore	16	2	MC Henriques	
95	1	1	Sunrisers Hyderabad	Royal Challengers Bangalore	16	3	Yuvraj Singh	I
96	1	1	Sunrisers Hyderabad	Royal Challengers Bangalore	16	4	DJ Hooda	
97	1	1	Sunrisers Hyderabad	Royal Challengers Bangalore	16	5	Yuvraj Singh	I
98	1	1	Sunrisers Hyderabad	Royal Challengers Bangalore	16	6	DJ Hooda	
99	1	1	Sunrisers Hyderabad	Royal Challengers Bangalore	17	1	DJ Hooda	
100	1	1	Sunrisers Hyderabad	Royal Challengers Bangalore	17	2	Yuvraj Singh	I
101	1	1	Sunrisers Hyderabad	Royal Challengers Bangalore	17	3	Yuvraj Singh	I
102	1	1	Sunrisers Hyderabad	Royal Challengers Bangalore	17	4	Yuvraj Singh	I

In [103]:

```
d=df[df['batsman'].isin(c)] #isin() function is used to find only those
# stored in a list in c, this
```

In [104]:

```
runs=d.groupby('batsman')['batsman_runs'].sum()
```

In [105]:

```
balls=d.groupby('batsman')['batsman_runs'].count()
```

In [106]:

```
(runs/balls*100).sort_values(ascending=False)
```

Out[106]:

```
batsman
AB de Villiers      211.052632
DA Warner           189.473684
DA Miller           186.666667
V Kohli             181.868132
RG Sharma           175.668449
DJ Hussey           175.213675
RV Uthappa          173.454545
Yuvraj Singh        171.124031
JH Kallis           170.562771
MS Dhoni            169.607843
SPD Smith           169.303797
JP Duminy           167.760618
DJ Bravo            167.726161
SK Raina            167.467249
AT Rayudu           165.411765
WP Saha             163.389831
KA Pollard          161.336516
YK Pathan           159.246575
S Dhawan            158.847737
BJ Hodge            157.402597
AM Rahane           152.985075
LRPL Taylor         152.941176
KD Karthik          152.051836
DPMD Jayawardene    152.032520
MK Pandey           151.785714
JA Morkel           149.882353
JP Faulkner         149.319728
S Badrinath         149.116608
Y Venugopal Rao     148.846154
Harbhajan Singh     147.607656
AD Mathews          147.058824
KM Jadhav           144.378698
STR Binny           144.036697
AR Patel            142.794760
IK Pathan           142.580645
MK Tiwary           140.189125
SS Tiwary           136.666667
NV Ojha             134.868421
RA Jadeja           130.729167
PP Chawla           120.257235
P Kumar             109.701493
R Vinay Kumar       108.936170
A Mishra            100.888889
Name: batsman_runs, dtype: float64
```

Q2) top 10 batsman, and top 10 bowlers with max number of wickets and combine them and make a heatmap which tells which top batsman has hitten most runs against a top bowler

In [107]:

```
top_batsman=delivery.groupby('batsman')['batsman_runs'].sum().sort_valu
#Finding the top 10 batsman and storing the names in a list using index
```

In [108]:

```
top_batsman
```

Out[108]:

```
['SK Raina',
 'V Kohli',
 'RG Sharma',
 'G Gambhir',
 'DA Warner',
 'RV Uthappa',
 'CH Gayle',
 'S Dhawan',
 'MS Dhoni',
 'AB de Villiers']
```

In [109]:

```
delivery['dismissal_kind'].value_counts()
```

Out[109]:

```
caught                     4373
bowled                     1382
run out                     755
lbw                         455
stumped                     243
caught and bowled           211
retired hurt                  9
hit wicket                    9
obstructing the field         1
Name: dismissal_kind, dtype: int64
```

In [110]:

```
dismissal=['caught','bowled','lbw','stumped','caught and bowled','hit w
#only in these cases the wicket credit is given to bowler
```

In [111]:

```
out=delivery[delivery['dismissal_kind'].isin(dismissal)]
#Filtering out batsman who got out by the above ways
```

In [112]:

```
bowler=out.groupby('bowler')['dismissal_kind'].count().sort_values(asce
#Taking out list of top 10 bowlers having most wickets
```

In [113]:

```
len(out)
```

Out[113]:

```
6673
```

In [114]:

```
batsmandf=delivery[delivery['batsman'].isin(top_batsman)]
# fitlering out top10 batsman and storing in new variable
```

In [115]:

```
finaldf=batsmandf[batsmandf['bowler'].isin(bowler)]
# filtering out batsmans who faced the top10 batsmans
```

In [116]:

```
finaldf.shape
```

Out[116]:

```
(4625, 21)
```

In [117]:

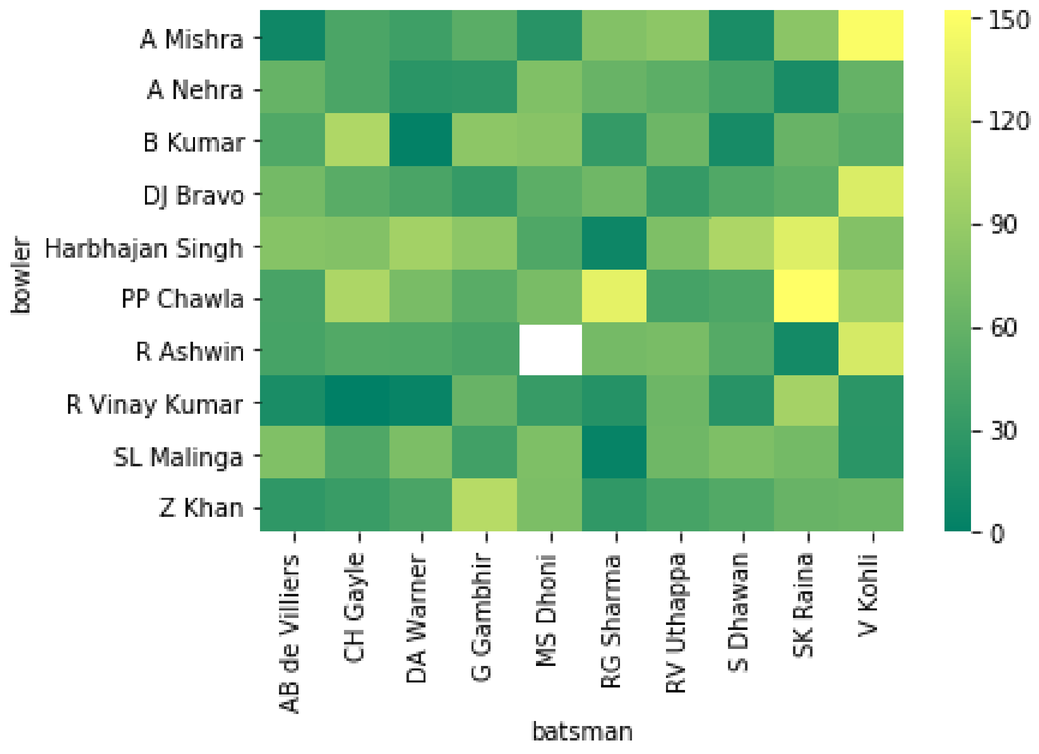
```
y=finaldf.pivot_table(index='bowler',columns='batsman',values='batsman_
```

In [118]:

```
sns.heatmap(y,cmap='summer')
```

Out[118]:

```
<matplotlib.axes._subplots.AxesSubplot at 0x7fc2c8aba748>
```



Q3) most economical bowler in death overs

Economy rate = runs conceeded / overs bowled
Example if a bowler has given 35 runs in 3.1 overs
so his overs bowled will be calculated as 3+1/6 = 3.1666
and Economy rate would be 35/3.166 = 11.054

In [119]:

```
do=delivery[delivery['over']>15]
#we only need overs between 16 to 20 overs
```

In [120]:

```
len(do)
```

Out[120]:

```
33737
```

In [121]:

```
a=do.groupby('bowler')['total_runs'].count() #Finding number of balls b
a.sort_values(ascending=False)
```

Out[121]:

```
bowler
SL Malinga          1050
DJ Bravo             885
B Kumar              715
R Vinay Kumar        673
SP Narine            664
UT Yadav             631
P Kumar              624
DW Steyn             624
Z Khan               620
SR Watson            611
RP Singh             556
A Nehra              546
L Balaji             523
IK Pathan            505
JP Faulkner          493
A Mishra             461
MM Sharma            454
```

In [122]:

```
b=do.groupby('bowler')['total_runs'].count()>100 #Only need bowlers who
```

In [123]:

```
bowler=a[b].index.tolist() # storing bowler names in a list
```

In [124]:

```
newdf=delivery[delivery['bowler'].isin(bowler)]
```

In [125]:

```
newdf.shape
```

Out[125]:

```
(110789, 21)
```

In [126]:

```
run=newdf.groupby('bowler')['total_runs'].sum()
```

In [127]:

```
balls=newdf.groupby('bowler')['total_runs'].count()
```

In [128]:

```
balls=balls/6
```

In [129]:

```
(run/balls).sort_values().head
```

```
Out[129]:
```

```
<bound method NDFrame.head of bowler
Sohail Tanvir        6.226415
SP Narine            6.395706
R Ashwin             6.490886
DW Steyn             6.600278
A Kumble             6.646999
M Muralitharan       6.698292
SL Malinga           6.757238
DL Vettori           6.833121
J Botha              6.922426
Harbhajan Singh      6.931415
S Nadeem             7.029024
Mustafizur Rahman    7.038168
B Kumar              7.039922
R Sharma             7.058824
DP Nannes            7.097242
MA Starc             7.107843
Shakib Al Hasan      7.115100
Iqbal Abdulla        7.158006
DE Bollinger         7.160000
SK Warne             7.187244
M Kartik             7.197970
MF Maharoof          7.238095
WD Parnell           7.297837
A Mishra             7.336293
SK Raina             7.357143
Yuvraj Singh         7.373993
B Lee                7.375546
PP Ojha              7.400514
AR Patel             7.425000
R Bhatia             7.437688
SK Trivedi           7.491329
SW Tait              7.505618
MM Patel             7.523878
CH Morris            7.525912
RJ Harris            7.526012
Z Khan               7.539543
M Morkel             7.543261
NM Coulter-Nile      7.566553
P Kumar              7.604096
SR Watson            7.618562
AC Thomas            7.633028
BW Hilfenhaus        7.646154
Sandeep Sharma       7.649647
PP Chawla            7.667695
DT Christian         7.678715
Azhar Mahmood        7.684783
```

Thank You

```
IK Pathan           7.698060
A Nehra             7.711246
S Sreesanth         7.736008
RP Singh            7.738527
DS Kulkarni         7.749495
RA Jadeja           7.767584
CH Gayle            7.772021
Harmeet Singh       7.792350
MG Johnson          7.818493
JH Kallis           7.831017
YS Chahal           7.875308
A Singh             7.888889
KK Cooper           7.890000
JJ Bumrah           7.931734
L Balaji            7.940280
J Theron            7.940426
AB Dinda            7.940843
```