

## Matplotlib: Visualization with Python

Matplotlib is a comprehensive library for creating static, animated, and interactive visualizations in Python. Matplotlib makes easy things easy and hard things possible.



```
In [1]: # import the Library
```

```
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
import seaborn as sns

plt.style.use('default')
```

### Types of Data

- Numerical Data
- Categorical Data

Certainly! Here's a shorter version of data:

**Single column:** Univariate Analysis (Analyzing a single variable)

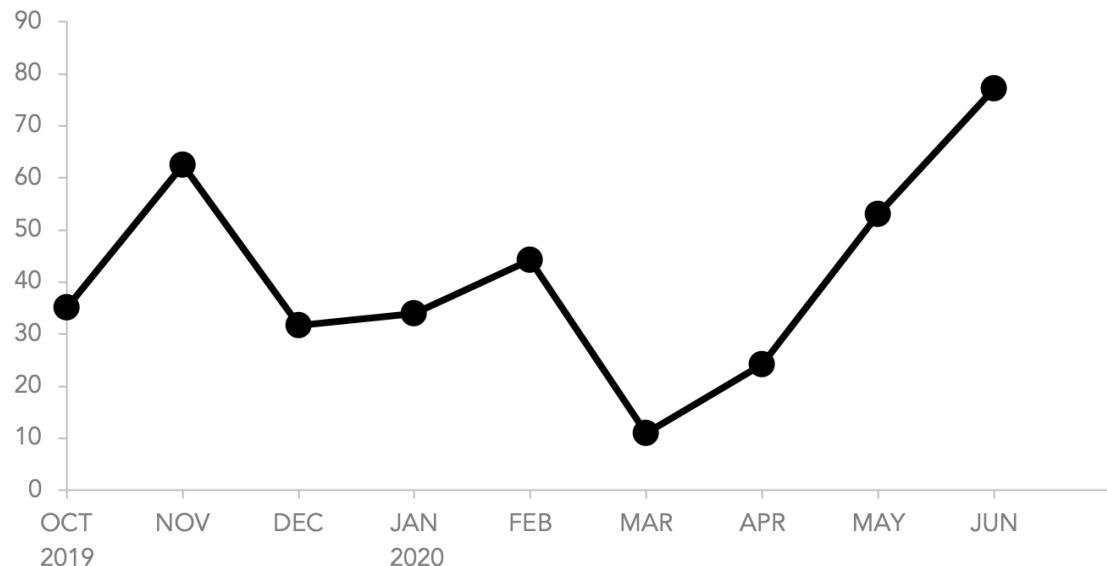
**Two columns:** Bivariate Analysis (Analyzing the relationship between two variables)

**Two or more columns:** Multivariate Analysis (Analyzing multiple variables simultaneously)

## \* 2D line Plot

A 2D line plot in matplotlib is a graphical representation of data points connected by **straight lines on a two-dimensional coordinate system**. It is a basic type of plot used to visualize the relationship between **two continuous variables**.

Produce sales  
IN THOUSANDS (USD)



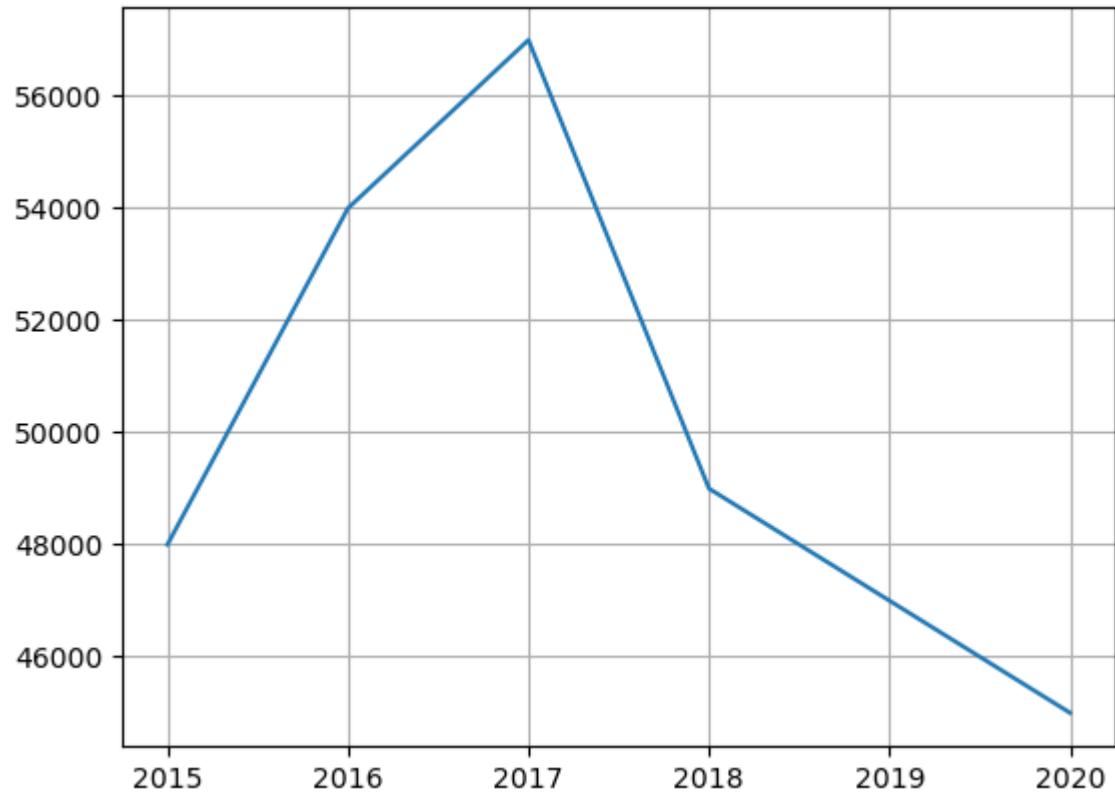
## 2D line PLot can be used on

- Bivariate Analysis
- categorical -> numerical and numerical -> numerical
- Use case - Time series data

```
In [2]: # plotting a simple function
```

```
price = [48000,54000,57000,49000,47000,45000]
year = [2015,2016,2017,2018,2019,2020]

plt.plot( year, price )
plt.grid()
```



```
In [3]: # from a pandas dataframe
```

```
batsman = pd.read_csv("sharma-kohli.csv")
```

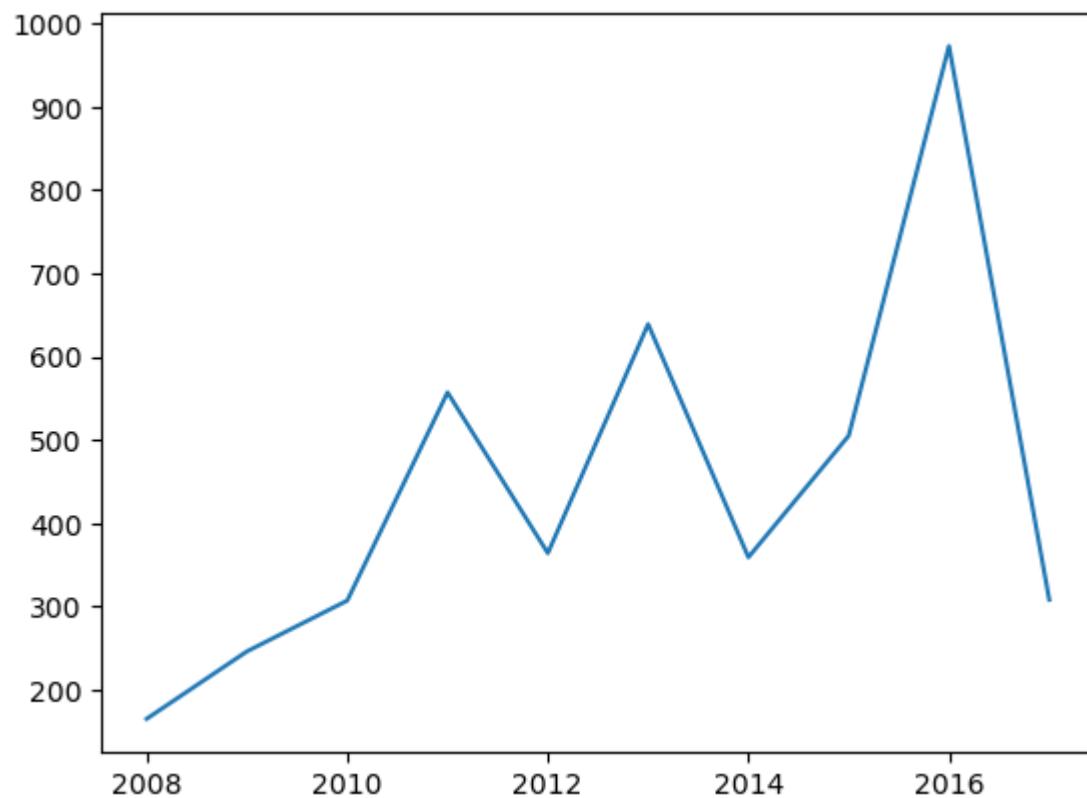
In [4]: batsman

Out[4]:

	index	RG Sharma	V Kohli
0	2008	404	165
1	2009	362	246
2	2010	404	307
3	2011	372	557
4	2012	433	364
5	2013	538	639
6	2014	390	359
7	2015	482	505
8	2016	489	973
9	2017	333	308

In [5]: plt.plot(batsman['index'],batsman['V Kohli'])

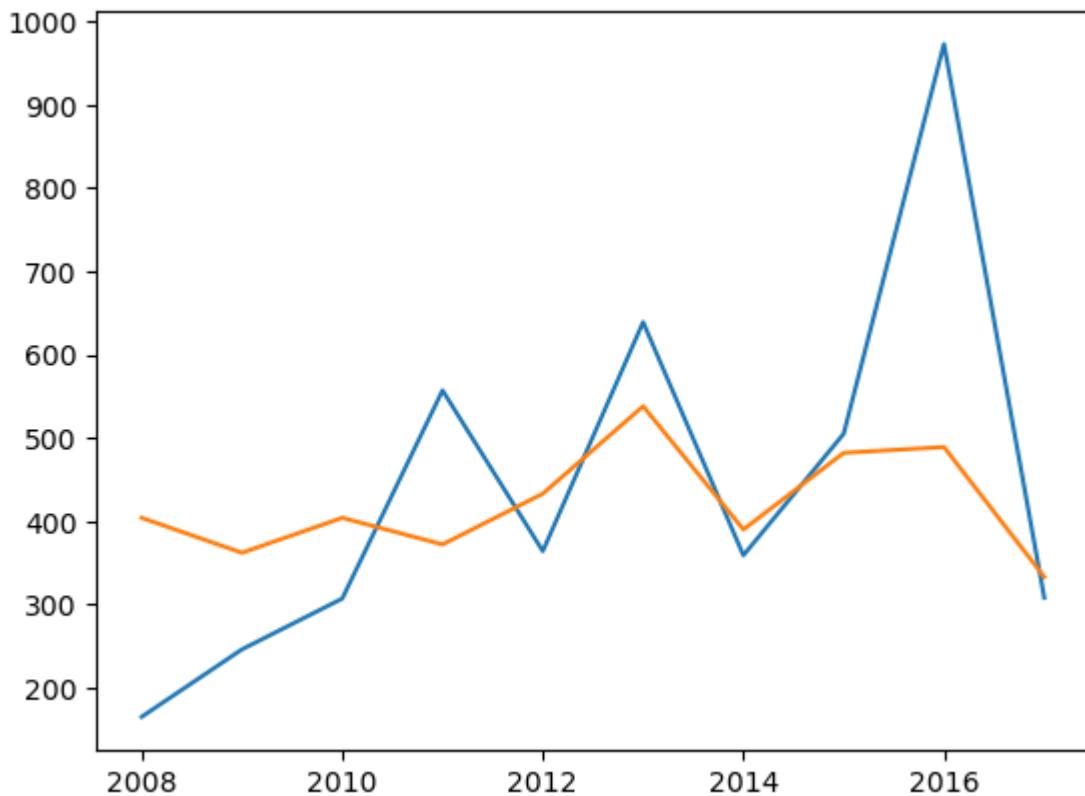
Out[5]: [`<matplotlib.lines.Line2D at 0x1ab0d70c790>`]



## plotting multiple plots

```
In [6]: plt.plot(batsman['index'],batsman['V Kohli'])  
plt.plot(batsman['index'],batsman['RG Sharma'])
```

```
Out[6]: [<matplotlib.lines.Line2D at 0x1ab0df11b80>]
```



In [7]: # labels title

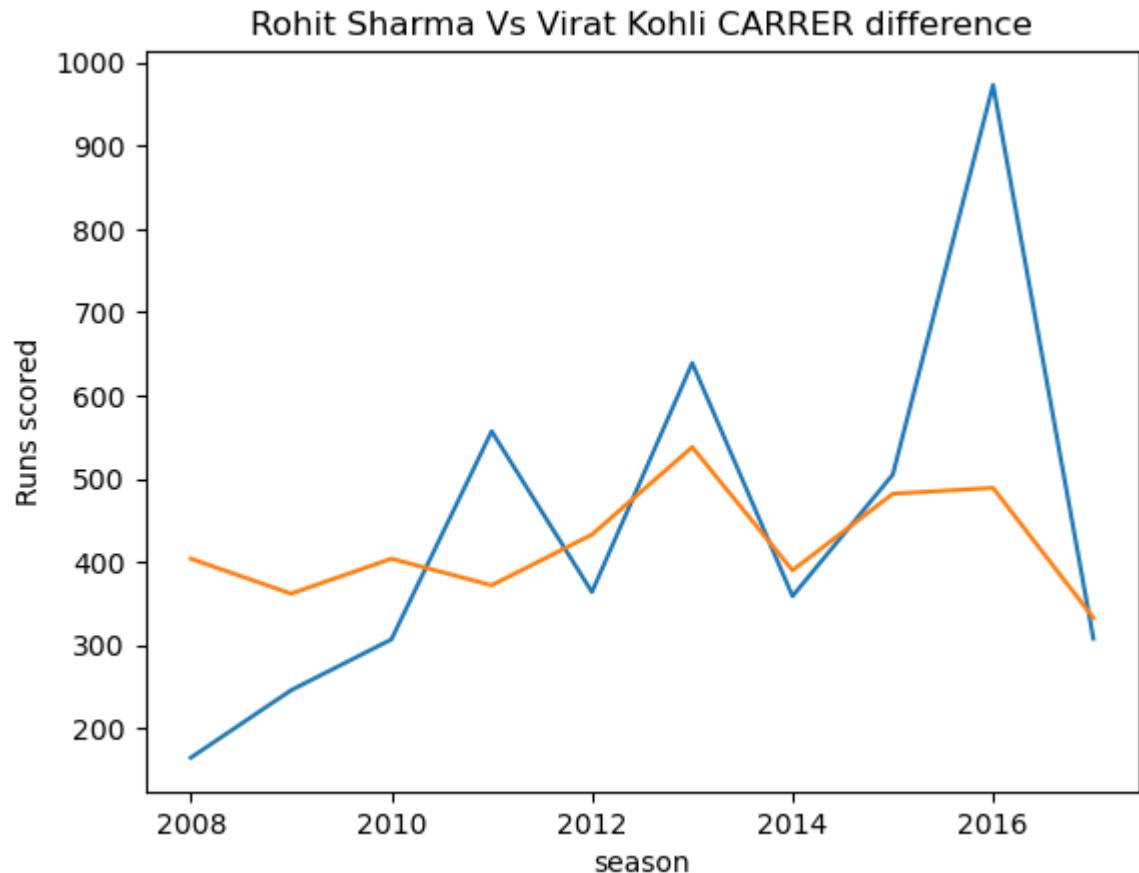
```
plt.plot(batsman['index'],batsman['V Kohli'])
plt.plot(batsman['index'],batsman['RG Sharma'])

plt.title('Rohit Sharma Vs Virat Kohli CARRIER difference')

plt.xlabel('season')

plt.ylabel('Runs scored')
```

Out[7]: Text(0, 0.5, 'Runs scored')



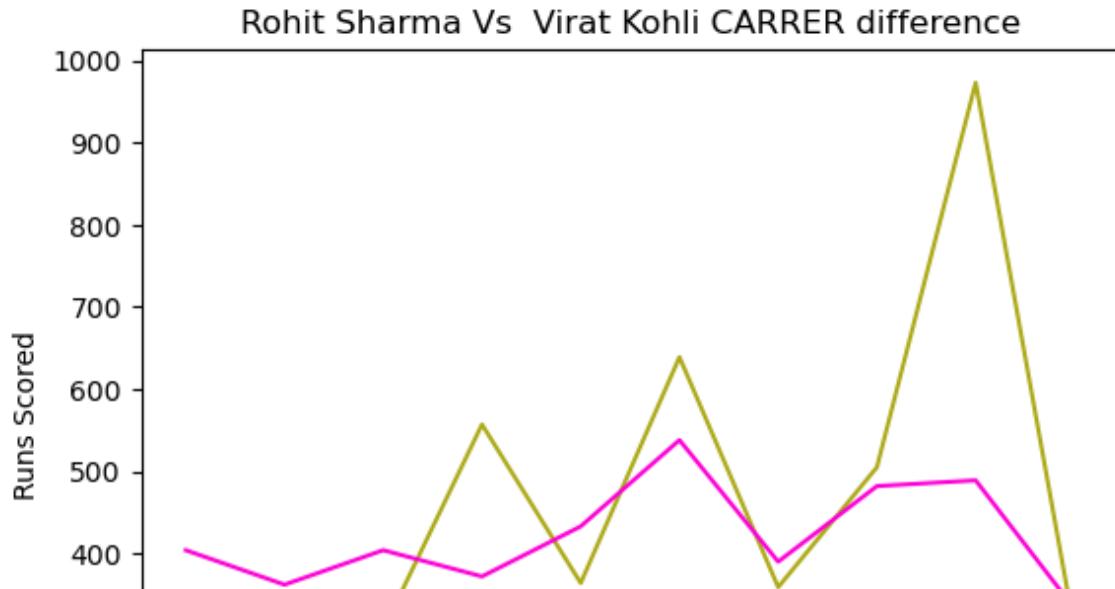
## colors(hex)

```
In [8]: # colors(hex)  # Hex codes

plt.plot(batsman['index'],batsman['V Kohli'],color="#ADAA19") # Yellow
plt.plot(batsman['index'],batsman['RG Sharma'],color="#FC00D6") # pink

plt.title('Rohit Sharma Vs Virat Kohli CARRER difference')
plt.xlabel('Season')
plt.ylabel('Runs Scored')

Out[8]: Text(0, 0.5, 'Runs Scored')
```



## Dashed Lines

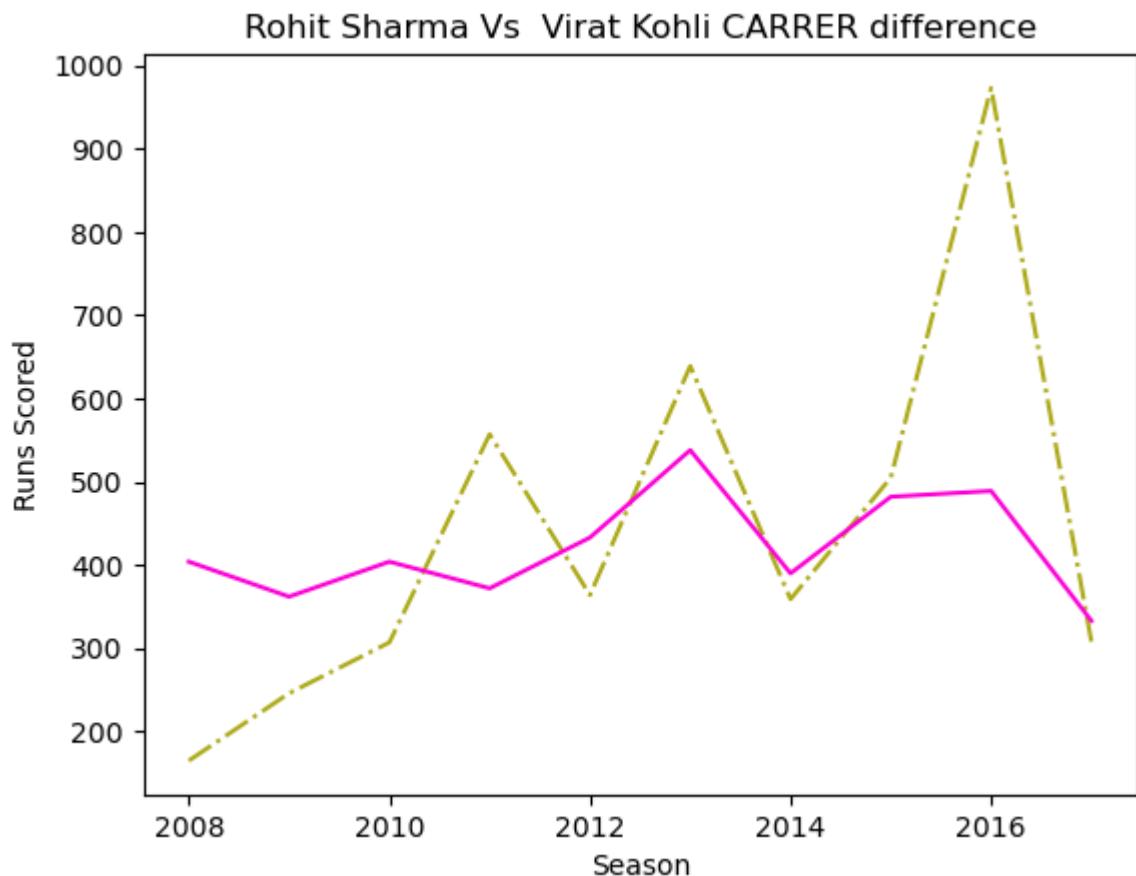
In [9]:

```
plt.plot(batsman['index'],batsman['V Kohli'],color='#ADAA19',
         linestyle = 'dashdot') # dashdot

plt.plot(batsman['index'],batsman['RG Sharma'],color="#FC00D6")

plt.title('Rohit Sharma Vs Virat Kohli CARRER difference')
plt.xlabel('Season')
plt.ylabel('Runs Scored')
```

Out[9]: Text(0, 0.5, 'Runs Scored')



## dotted lines

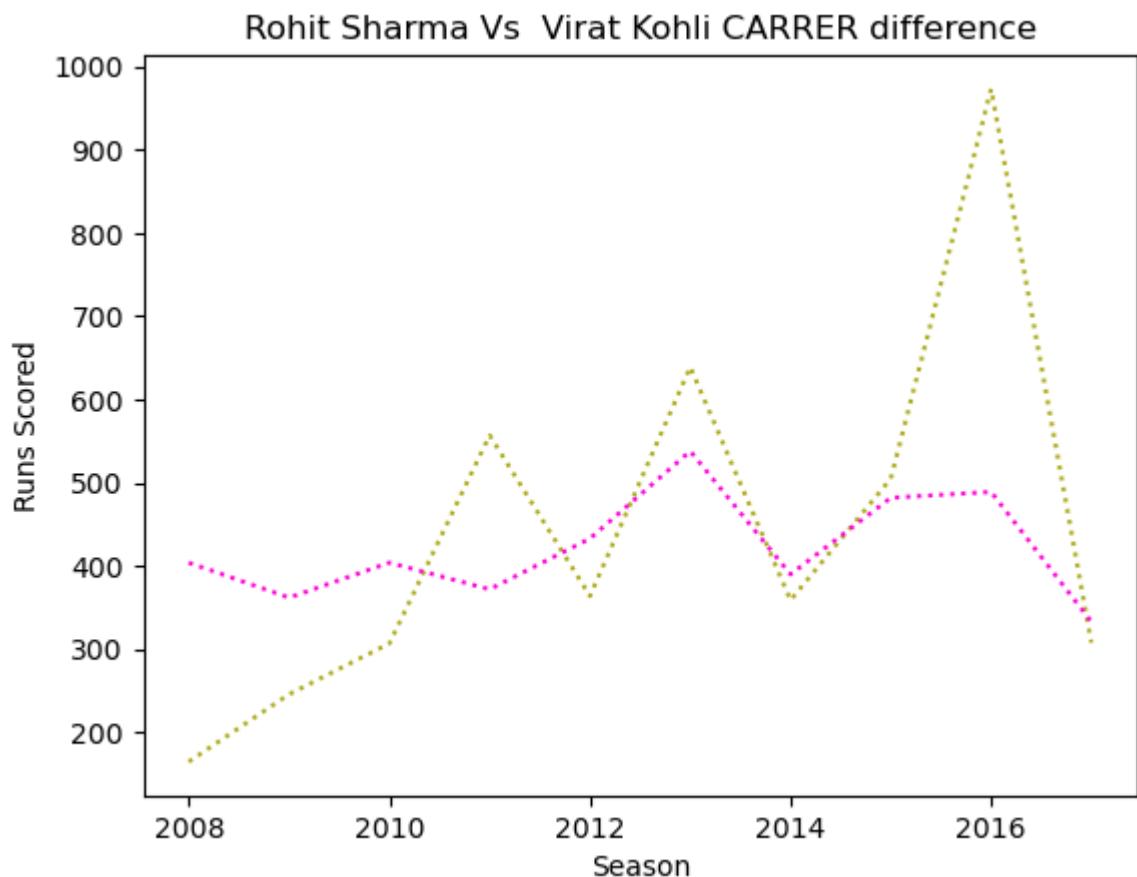
In [10]:

```
plt.plot(batsman['index'],batsman['V Kohli'],color='#ADAA19',
         linestyle = 'dotted') # dotted

plt.plot(batsman['index'],batsman['RG Sharma'],color='#FC00D6',
         linestyle = 'dotted') # dotted

plt.title('Rohit Sharma Vs Virat Kohli CARRER difference')
plt.xlabel('Season')
plt.ylabel('Runs Scored')
```

Out[10]: Text(0, 0.5, 'Runs Scored')



## line width

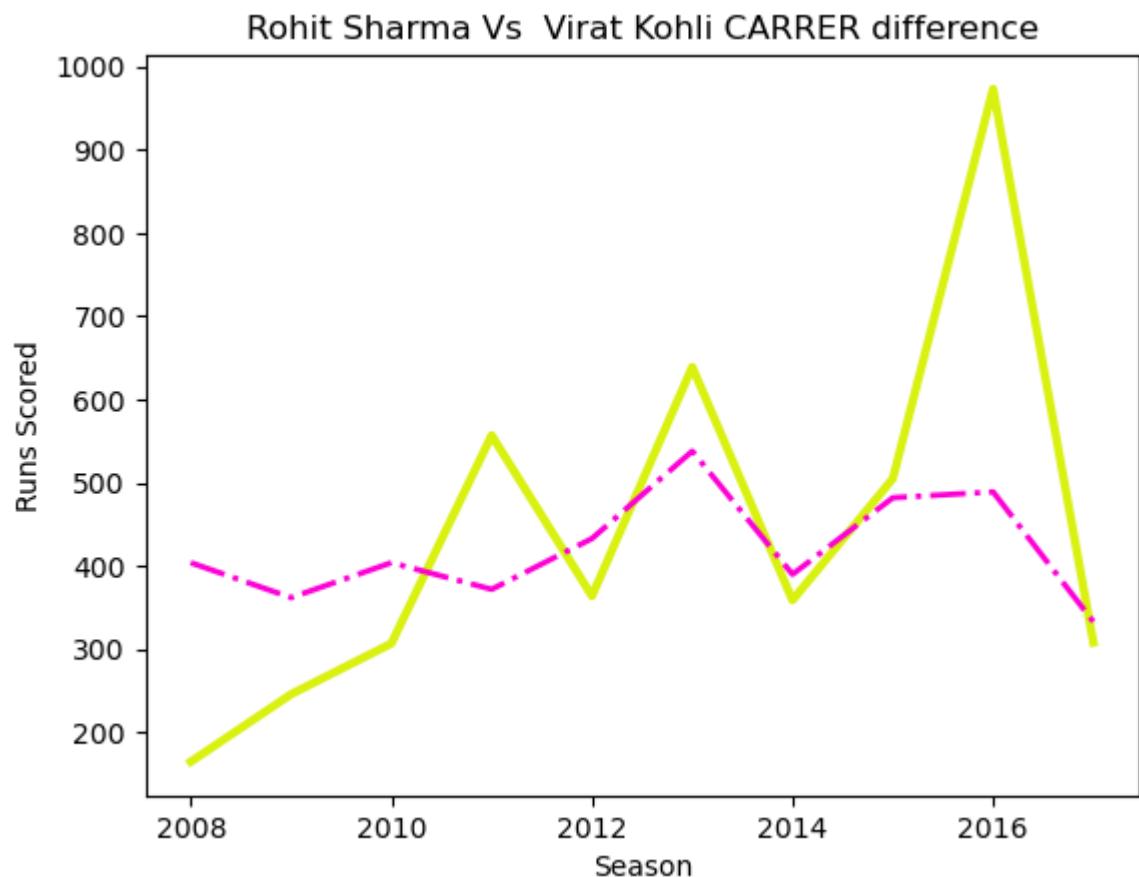
In [12]:

```
plt.plot(batsman['index'],batsman['V Kohli'],color="#D9F10F"
         ,linestyle='solid',linewidth=3) # Linewidth

plt.plot(batsman['index'],batsman['RG Sharma'],
         color="#FC00D6",linestyle='dashdot',linewidth=2)

plt.title('Rohit Sharma Vs Virat Kohli CARRER difference')
plt.xlabel('Season')
plt.ylabel('Runs Scored')
```

Out[12]: Text(0, 0.5, 'Runs Scored')



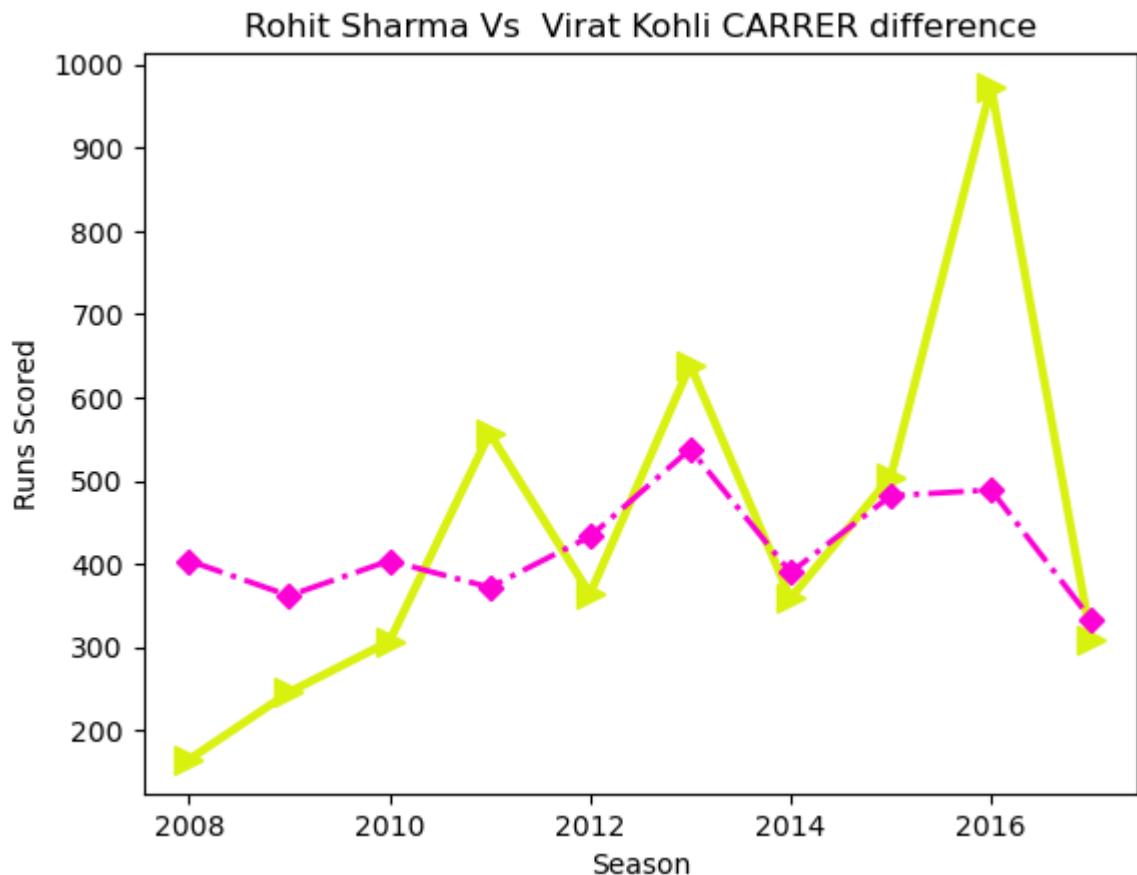
## marker(size)

```
In [16]: plt.plot(batsman['index'],batsman['V Kohli'],color='#D9F10F',
                 linestyle='solid',linewidth=3,
                 marker='>' , markersize =10) # Marker + marker size

plt.plot(batsman['index'],batsman['RG Sharma'],
         color='#FC00D6',linestyle='dashdot',
         linewidth=2 ,marker='D') # Marker ...> D- Diamond

plt.title('Rohit Sharma Vs Virat Kohli CARRER difference')
plt.xlabel('Season')
plt.ylabel('Runs Scored')
```

Out[16]: Text(0, 0.5, 'Runs Scored')



## Legend

In [17]: # Legend -

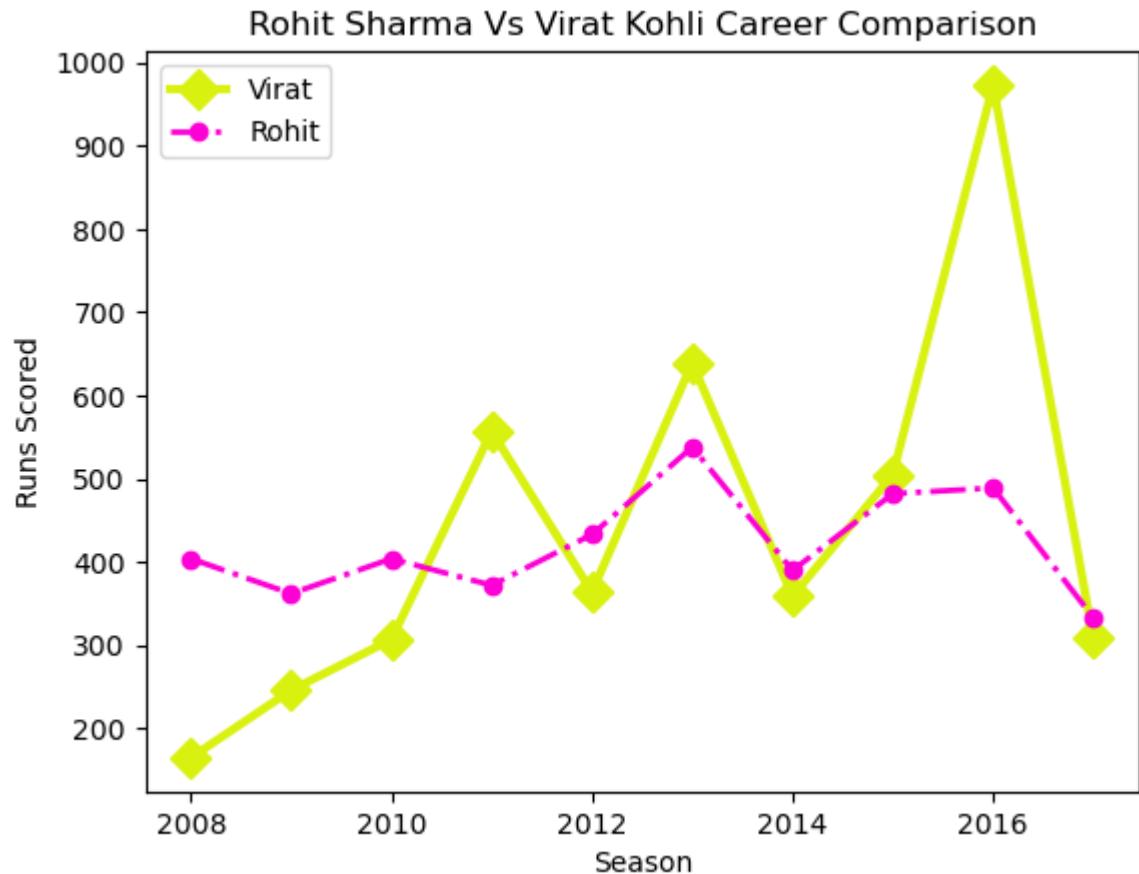
```
plt.plot(batsman['index'],batsman['V Kohli'],
         color='#D9F10F',linestyle='solid',
         linewidth=3,marker='D',markersize=10,label='Virat')

plt.plot(batsman['index'],batsman['RG Sharma'],
         color='#FC00D6',linestyle='dashdot',
         linewidth=2,marker='o',label='Rohit')

plt.title('Rohit Sharma Vs Virat Kohli Career Comparison')
plt.xlabel('Season')
plt.ylabel('Runs Scored')

plt.legend() # loc = best
```

Out[17]: <matplotlib.legend.Legend at 0x1ab0ffa5ca0>



In [18]: # Legend -> location

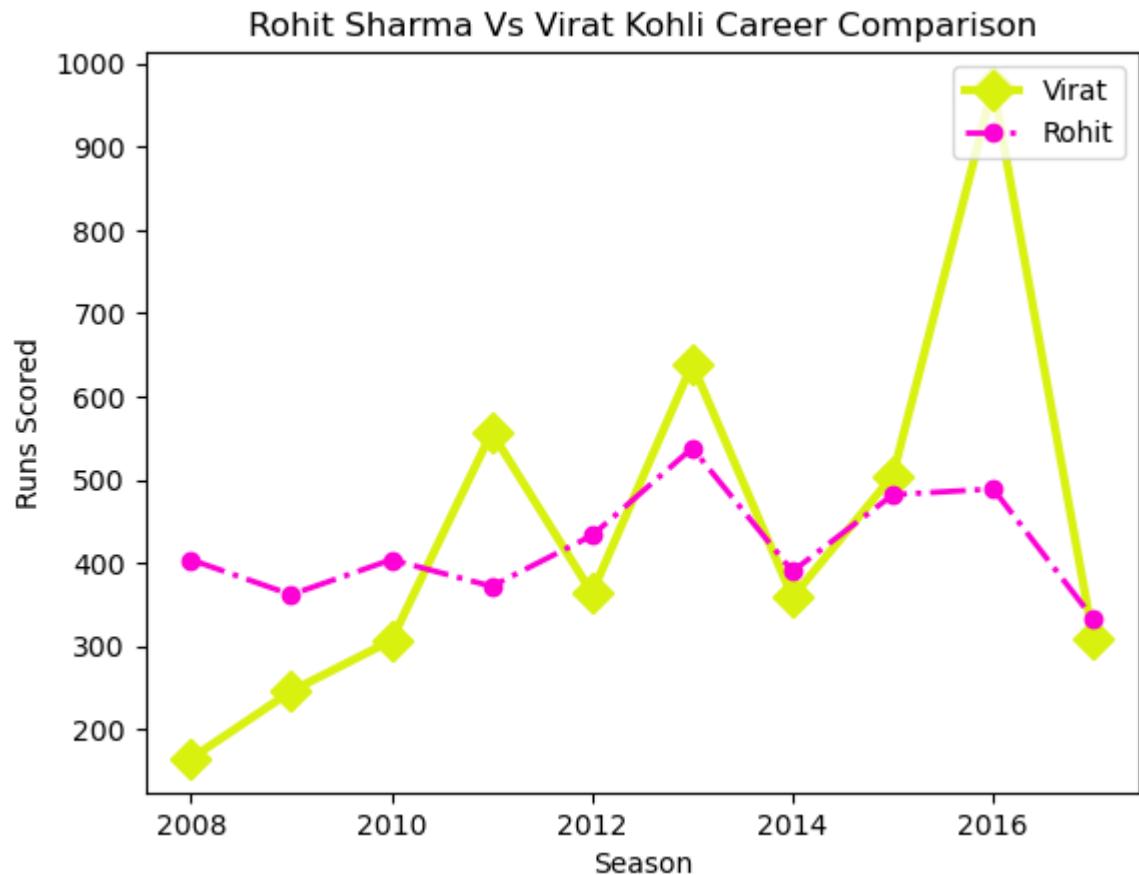
```
plt.plot(batsman['index'],batsman['V Kohli'],
         color="#D9F10F",linestyle='solid',
         linewidth=3,marker='D',markersize=10,label='Virat')

plt.plot(batsman['index'],batsman['RG Sharma'],
         color="#FC00D6",linestyle='dashdot',linewidth=2,
         marker='o',label='Rohit')

plt.title('Rohit Sharma Vs Virat Kohli Career Comparison')
plt.xlabel('Season')
plt.ylabel('Runs Scored')

plt.legend(loc='upper right')
```

Out[18]: <matplotlib.legend.Legend at 0x1ab0ff27910>



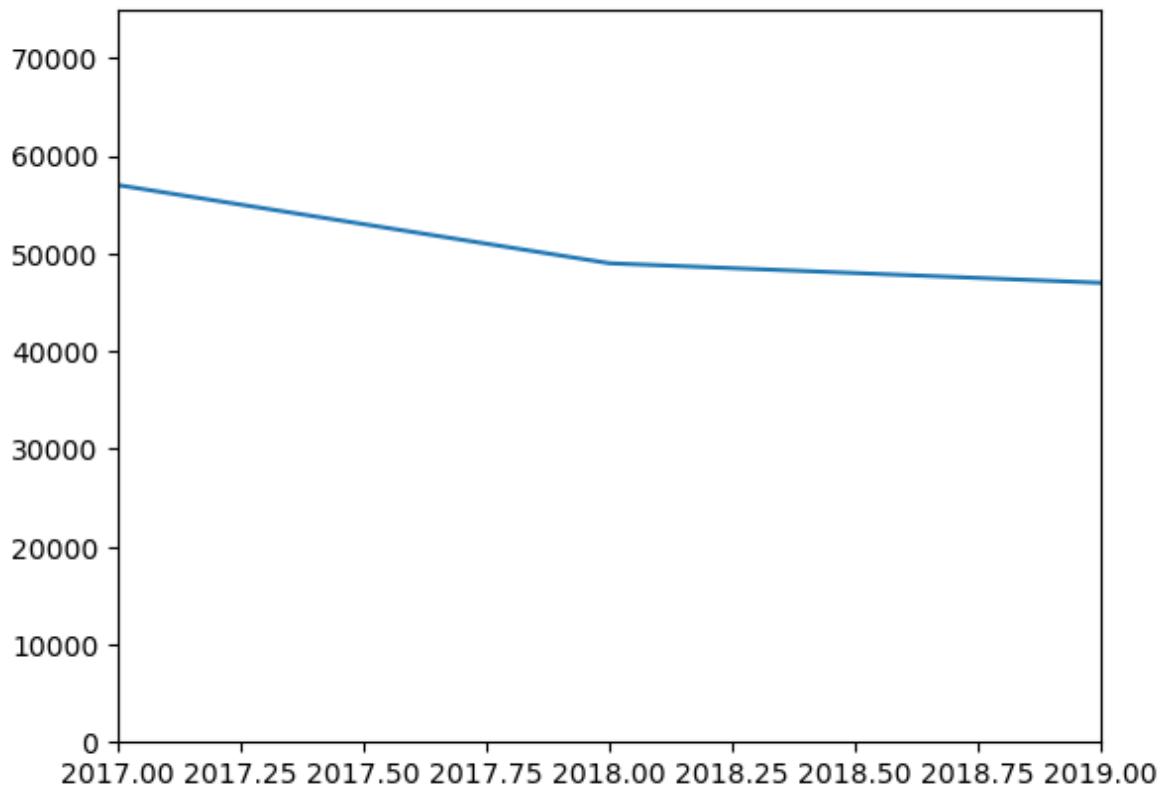
## limiting axes

In [19]: # Because of Outliers

```
price = [48000, 54000, 57000, 49000, 47000, 45000, 4500000]
year = [2015, 2016, 2017, 2018, 2019, 2020, 2021]

plt.plot(year, price)
plt.ylim(0, 75000)
plt.xlim(2017, 2019)
```

Out[19]: (2017.0, 2019.0)



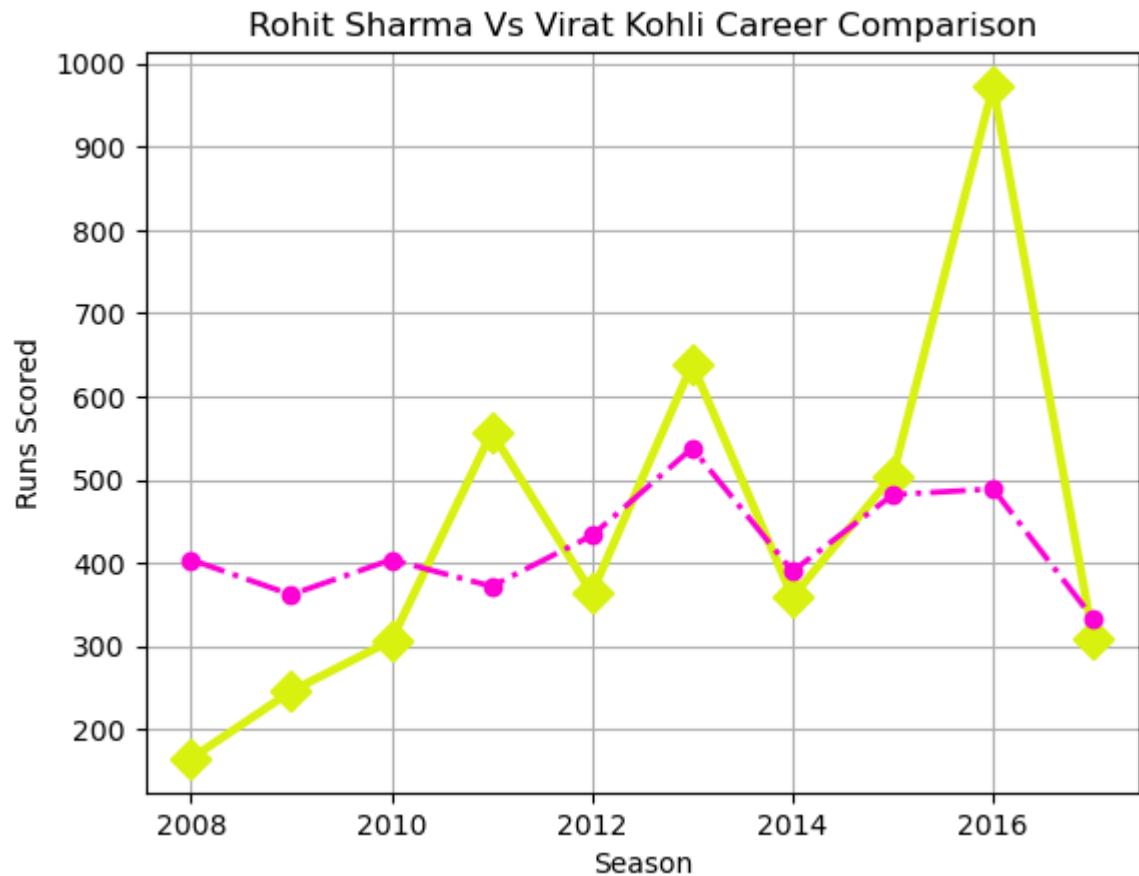
**grid**

```
In [20]: plt.plot(batsman['index'],batsman['V Kohli'],
                 color='#D9F10F',linestyle='solid',
                 linewidth=3,marker='D',markersize=10)

plt.plot(batsman['index'],batsman['RG Sharma'],
                 color='#FC00D6',linestyle='dashdot',
                 linewidth=2,marker='o')

plt.title('Rohit Sharma Vs Virat Kohli Career Comparison')
plt.xlabel('Season')
plt.ylabel('Runs Scored')

plt.grid()
```



## show

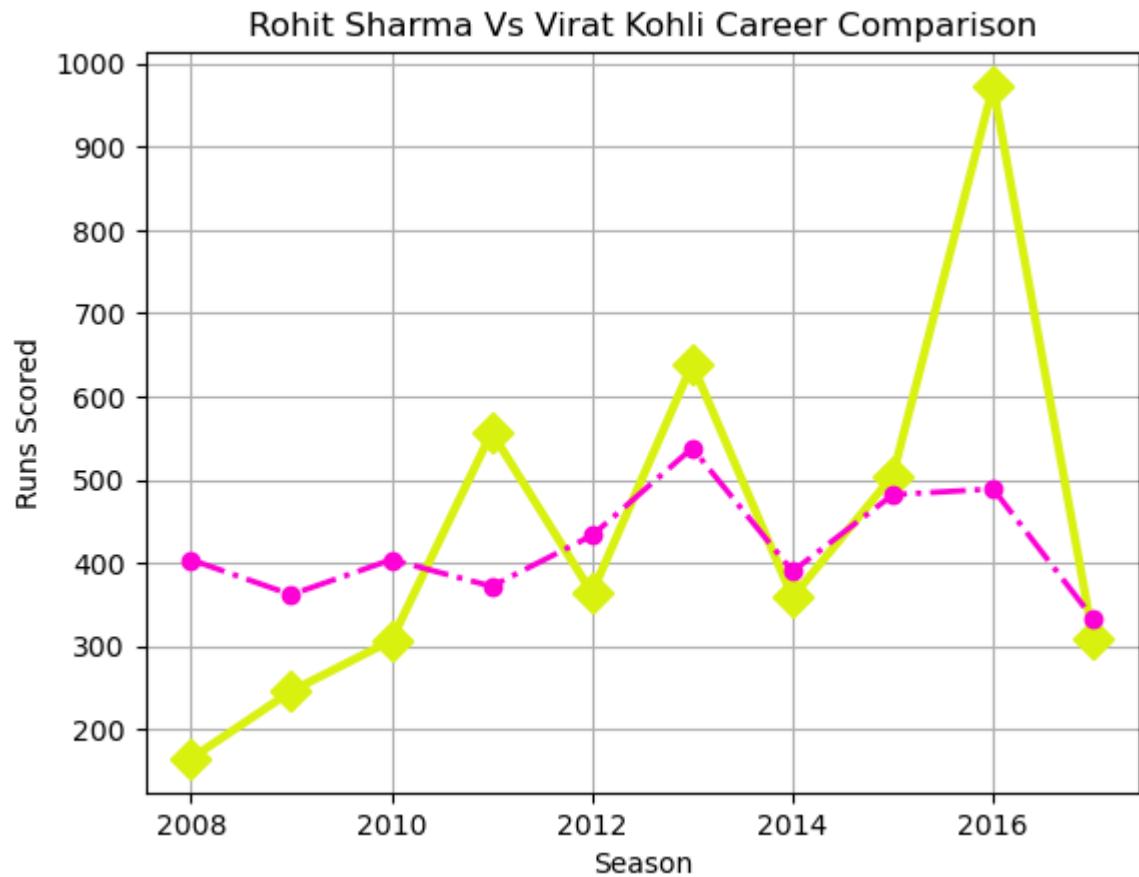
In [21]:

```
plt.plot(batsman['index'],batsman['V Kohli'],color="#D9F10F",linestyle='solid')
plt.plot(batsman['index'],batsman['RG Sharma'],color="#FC00D6",linestyle='dash')

plt.title('Rohit Sharma Vs Virat Kohli Career Comparison')
plt.xlabel('Season')
plt.ylabel('Runs Scored')

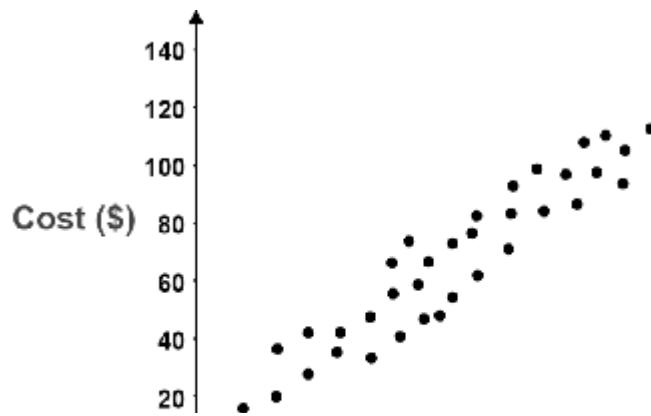
plt.grid()

plt.show()
```



## Scatter plot

A scatter plot in matplotlib is a type of plot used to visualize the relationship between two continuous variables. It displays individual data points as markers on a two-dimensional coordinate system, with one variable represented on the x-axis and the other variable represented on the y-axis.



- Bivariate Analysis
- numerical vs numerical
- Use case - Finding correlation

```
In [22]: # plt.scatter simple function
x = np.linspace(-10,10,50)
x
```

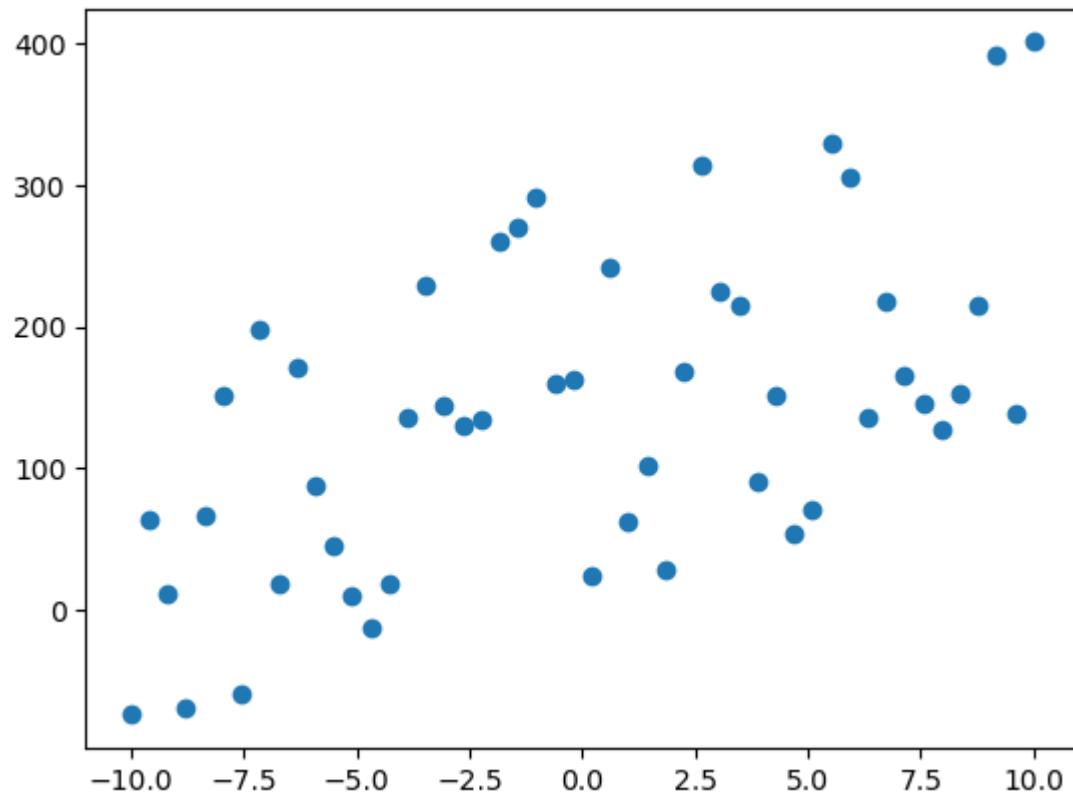
```
Out[22]: array([-10.        , -9.59183673, -9.18367347, -8.7755102 ,
 -8.36734694, -7.95918367, -7.55102041, -7.14285714,
 -6.73469388, -6.32653061, -5.91836735, -5.51020408,
 -5.10204082, -4.69387755, -4.28571429, -3.87755102,
 -3.46938776, -3.06122449, -2.65306122, -2.24489796,
 -1.83673469, -1.42857143, -1.02040816, -0.6122449 ,
 -0.20408163,  0.20408163,  0.6122449 ,  1.02040816,
  1.42857143,  1.83673469,  2.24489796,  2.65306122,
  3.06122449,  3.46938776,  3.87755102,  4.28571429,
  4.69387755,  5.10204082,  5.51020408,  5.91836735,
  6.32653061,  6.73469388,  7.14285714,  7.55102041,
  7.95918367,  8.36734694,  8.7755102 ,  9.18367347,
  9.59183673,  10.        ])
```

```
In [23]: y = 10*x + 3 + np.random.randint(0,300,50)
y
```

```
Out[23]: array([-74.        ,  64.08163265,  11.16326531, -68.75510204,
 66.32653061, 151.40816327, -59.51020408, 198.57142857,
18.65306122, 170.73469388,  87.81632653,  45.89795918,
 9.97959184, -12.93877551,  19.14285714, 135.2244898 ,
229.30612245, 144.3877551 , 130.46938776, 134.55102041,
260.63265306, 269.71428571, 291.79591837, 159.87755102,
162.95918367, 24.04081633, 242.12244898, 62.20408163,
101.28571429, 28.36734694, 168.44897959, 314.53061224,
225.6122449 , 215.69387755, 90.7755102 , 151.85714286,
 53.93877551, 71.02040816, 330.10204082, 305.18367347,
136.26530612, 217.34693878, 165.42857143, 145.51020408,
127.59183673, 152.67346939, 214.75510204, 391.83673469,
138.91836735, 401.        ])
```

```
In [24]: plt.scatter(x,y)
```

```
Out[24]: <matplotlib.collections.PathCollection at 0x1ab1039dd60>
```



In [26]: # plt.scatter on pandas data

```
df = pd.read_csv("batter.csv")
df = df.head(50)
df
```

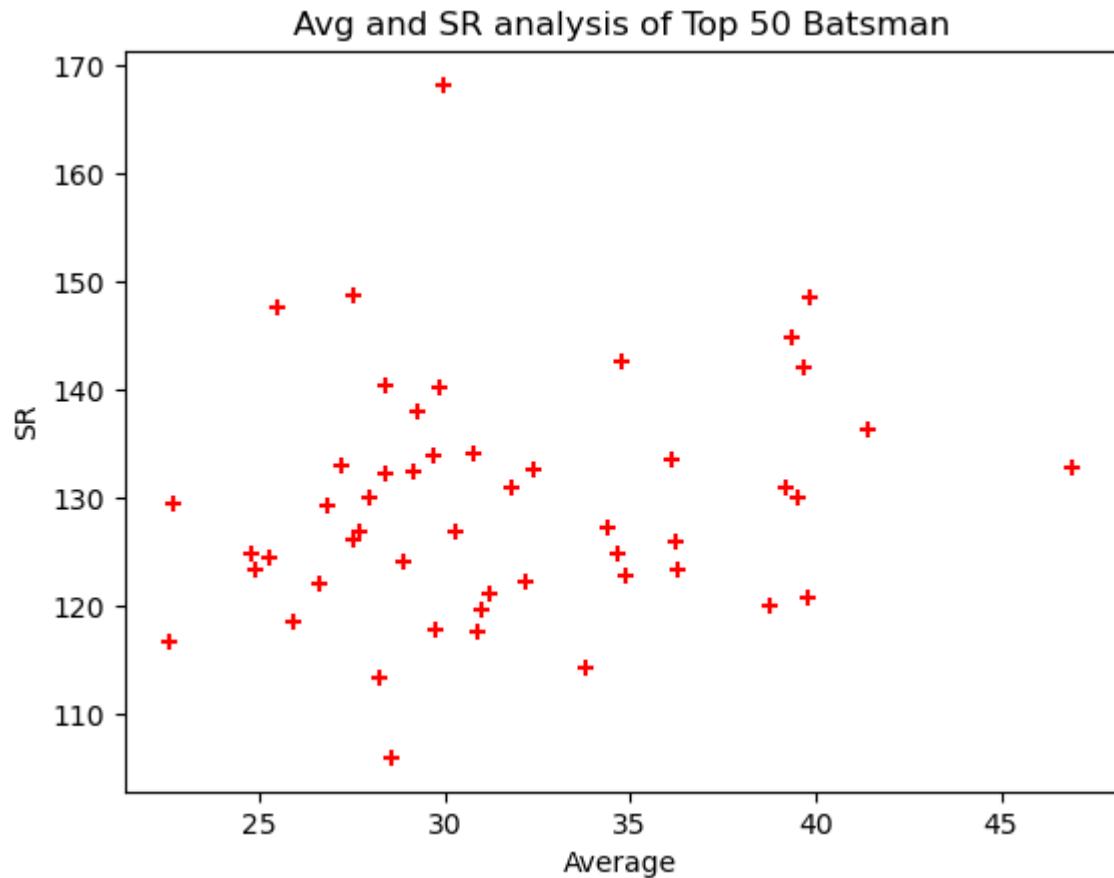
Out[26]:

	batter	runs	avg	strike_rate
0	V Kohli	6634	36.251366	125.977972
1	S Dhawan	6244	34.882682	122.840842
2	DA Warner	5883	41.429577	136.401577
3	RG Sharma	5881	30.314433	126.964594
4	SK Raina	5536	32.374269	132.535312
5	AB de Villiers	5181	39.853846	148.580442
6	CH Gayle	4997	39.658730	142.121729
7	MS Dhoni	4978	39.196850	130.931089
8	RV Uthappa	4954	27.522222	126.152279
9	KD Karthik	4377	26.852761	129.267572
10	G Gambhir	4217	31.007353	119.665153
11	AT Rayudu	4190	28.896552	124.148148
12	AM Rahane	4074	30.863636	117.575758
13	KL Rahul	3895	46.927711	132.799182
14	SR Watson	3880	30.793651	134.163209
15	MK Pandey	3657	29.731707	117.739858
16	SV Samson	3526	29.140496	132.407060
17	KA Pollard	3437	28.404959	140.457703
18	F du Plessis	3403	34.373737	127.167414
19	YK Pathan	3222	29.290909	138.046272
20	BB McCullum	2882	27.711538	126.848592
21	RR Pant	2851	34.768293	142.550000
22	PA Patel	2848	22.603175	116.625717
23	JC Buttler	2832	39.333333	144.859335
24	SS Iyer	2780	31.235955	121.132898
25	Q de Kock	2767	31.804598	130.951254
26	Yuvraj Singh	2754	24.810811	124.784776
27	V Sehwag	2728	27.555556	148.827059
28	SA Yadav	2644	29.707865	134.009123
29	M Vijay	2619	25.930693	118.614130
30	RA Jadeja	2502	26.617021	122.108346
31	SPD Smith	2495	34.652778	124.812406
32	SE Marsh	2489	39.507937	130.109775
33	DA Miller	2455	36.102941	133.569097
34	JH Kallis	2427	28.552941	105.936272

	batter	runs	avg	strike_rate
35	WP Saha	2427	25.281250	124.397745
36	DR Smith	2385	28.392857	132.279534
37	MA Agarwal	2335	22.669903	129.506378
38	SR Tendulkar	2334	33.826087	114.187867
39	GJ Maxwell	2320	25.494505	147.676639
40	N Rana	2181	27.961538	130.053667
41	R Dravid	2174	28.233766	113.347237
42	KS Williamson	2105	36.293103	123.315759
43	AJ Finch	2092	24.904762	123.349057
44	AC Gilchrist	2069	27.223684	133.054662
45	AD Russell	2039	29.985294	168.234323
46	JP Duminy	2029	39.784314	120.773810
47	MEK Hussey	1977	38.764706	119.963592
48	HH Pandya	1972	29.878788	140.256046
49	Shubman Gill	1900	32.203390	122.186495

```
In [27]: plt.scatter(df['avg'],df['strike_rate'],color='red',marker='+')
plt.title('Avg and SR analysis of Top 50 Batsman')
plt.xlabel('Average')
plt.ylabel('SR')
```

```
Out[27]: Text(0, 0.5, 'SR')
```

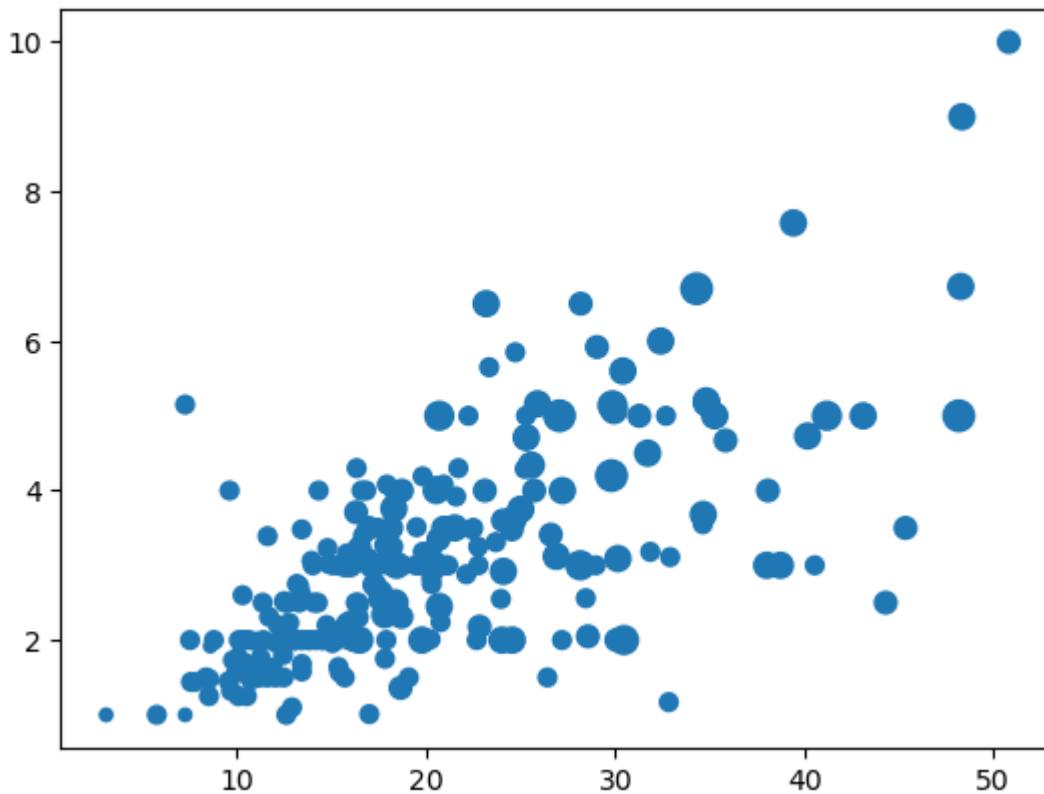


## Size

```
In [31]: sns.load_dataset('tips')
tips = sns.load_dataset('tips')
```

```
In [34]: plt.scatter(tips['total_bill'], tips['tip'] , s = tips ['size']*20)
```

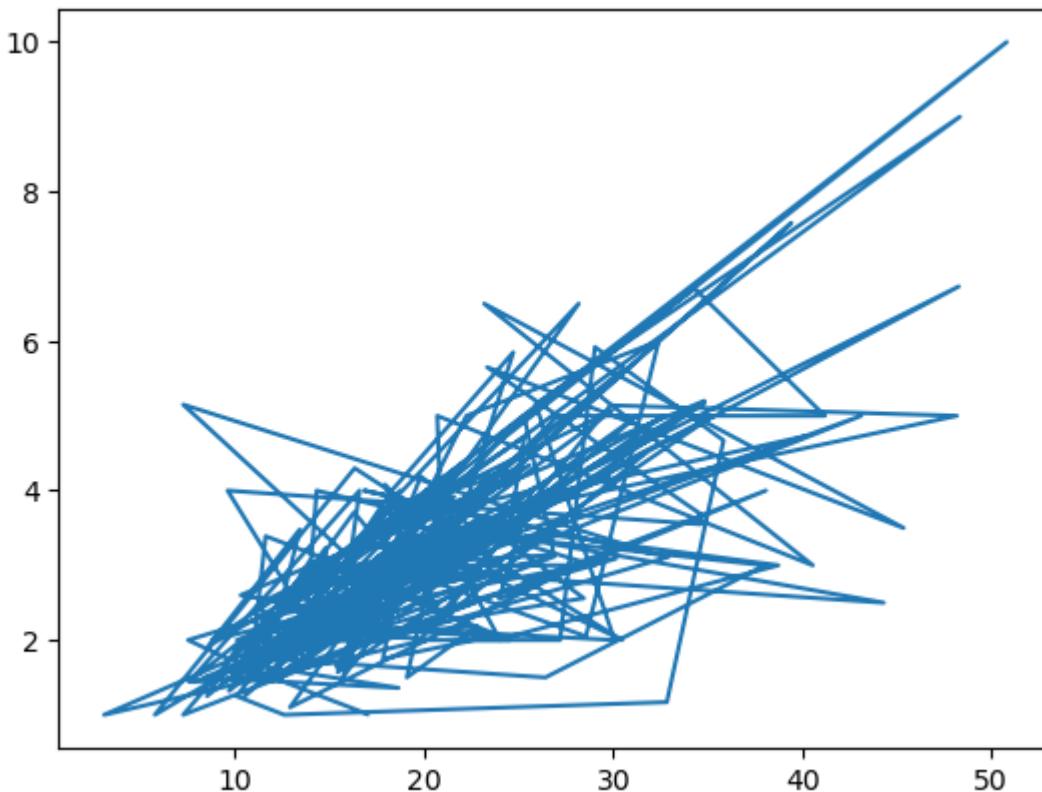
```
Out[34]: <matplotlib.collections.PathCollection at 0x1ab10783220>
```



## scatterplot using plt.plot

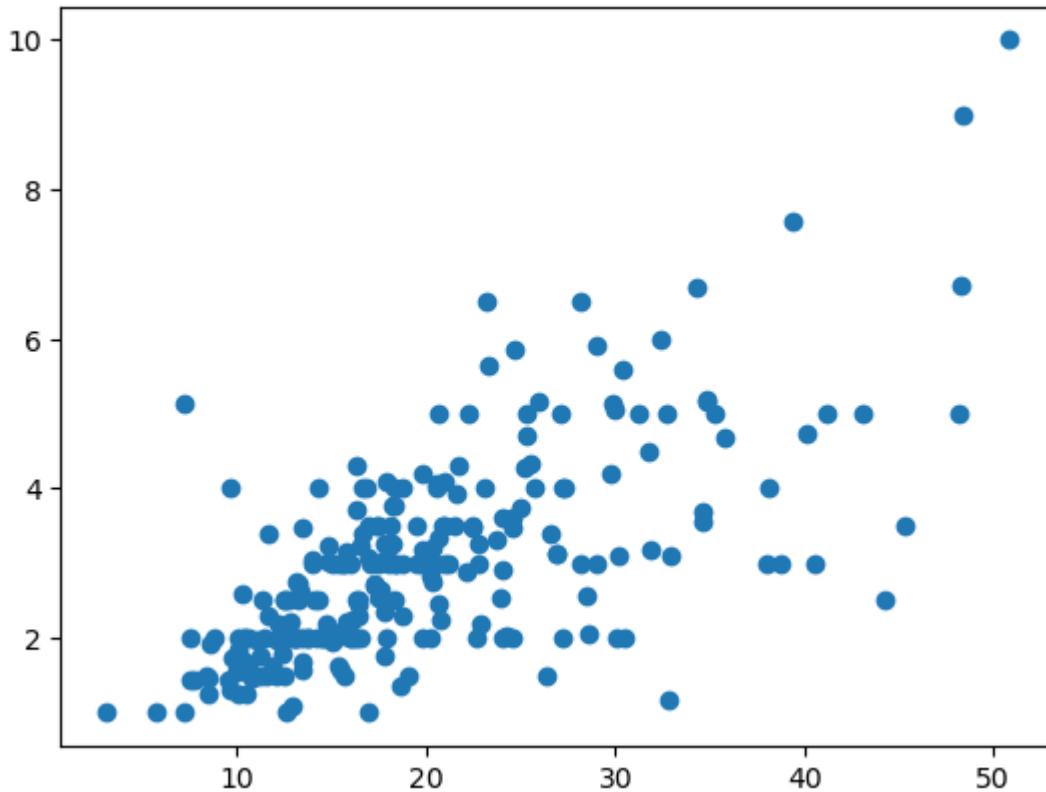
In [38]:

```
plt.plot(tips['total_bill'],tips['tip']) # Faster Technique
```

Out[38]: [`<matplotlib.lines.Line2D at 0x1ab11c21100>`]

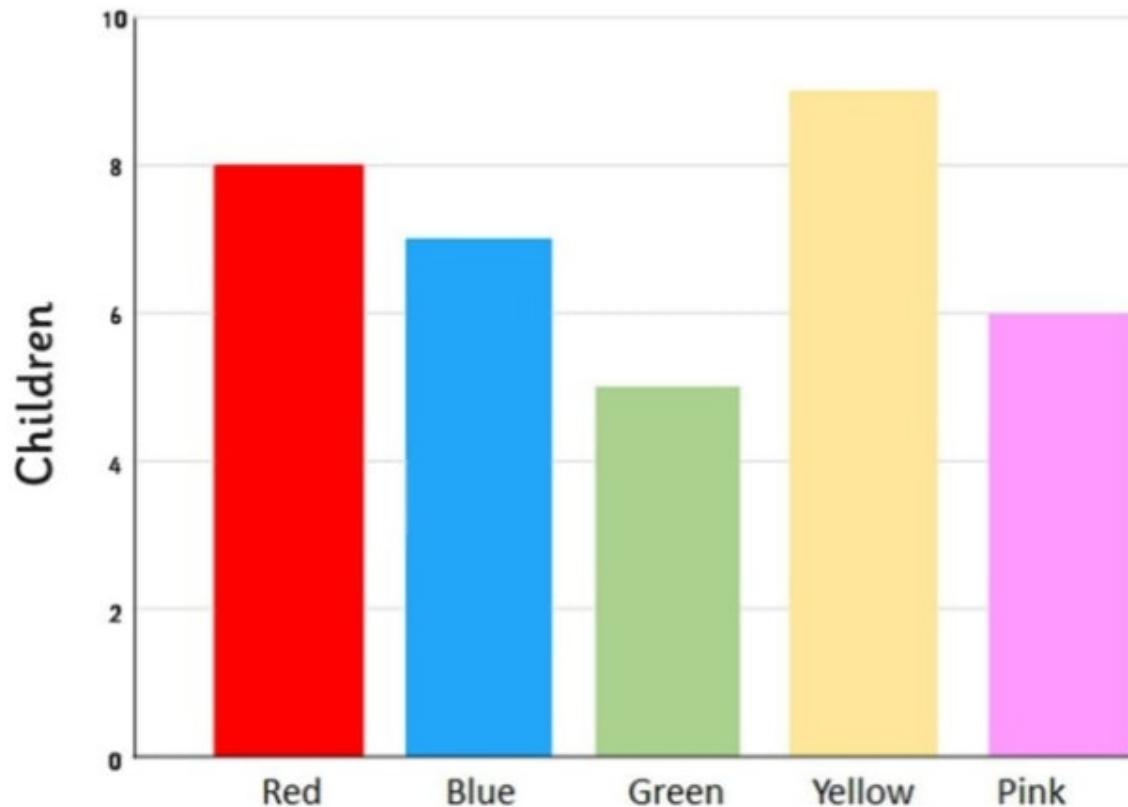
```
In [37]: plt.plot(tips['total_bill'],tips['tip'],'o')
```

```
Out[37]: [
```



## Bar chart

### Favourite Colour

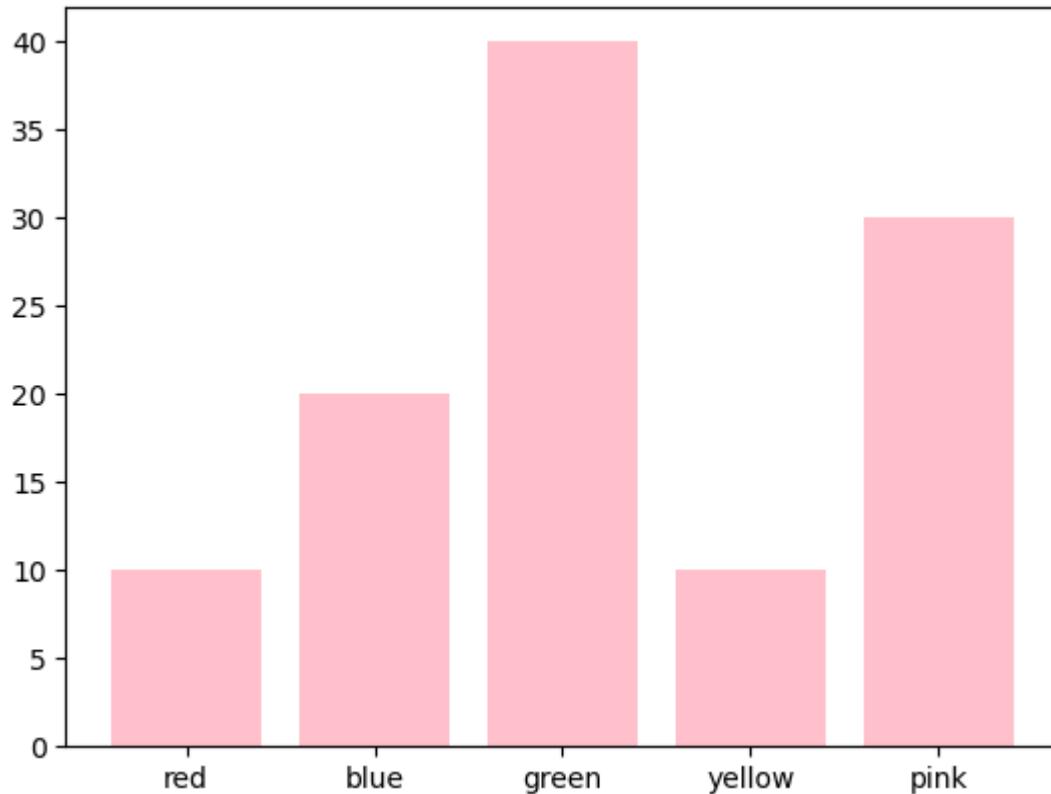


- Bivariate Analysis
- Numerical vs Categorical
- Use case - Aggregate analysis of groups

```
In [39]: # simple bar chart
children = [10,20,40,10,30]
colors = ['red','blue','green','yellow','pink']

plt.bar(colors,children,color='pink')
```

Out[39]: <BarContainer object of 5 artists>

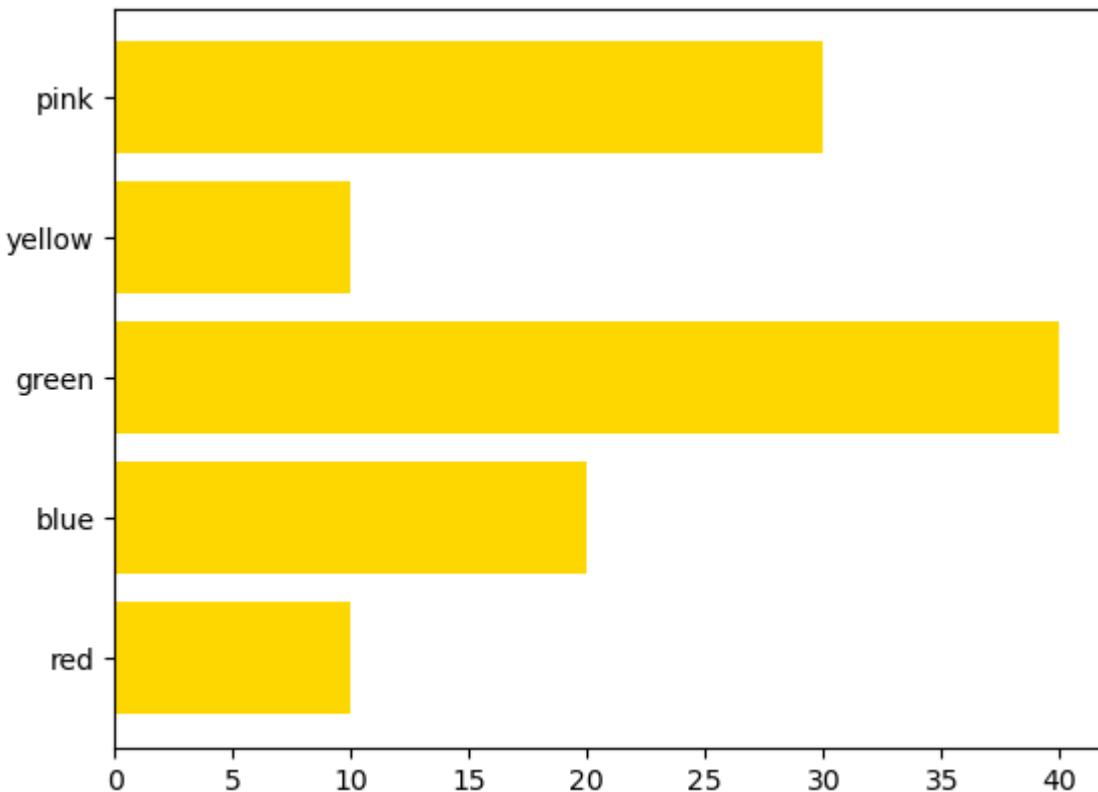


## horizontal bar chart

In [41]:

```
plt.barh(colors,children,color='gold')
```

Out[41]: &lt;BarContainer object of 5 artists&gt;



In [45]: #Color and Label

```
df= pd.read_csv("batsman_season_record.csv")
```

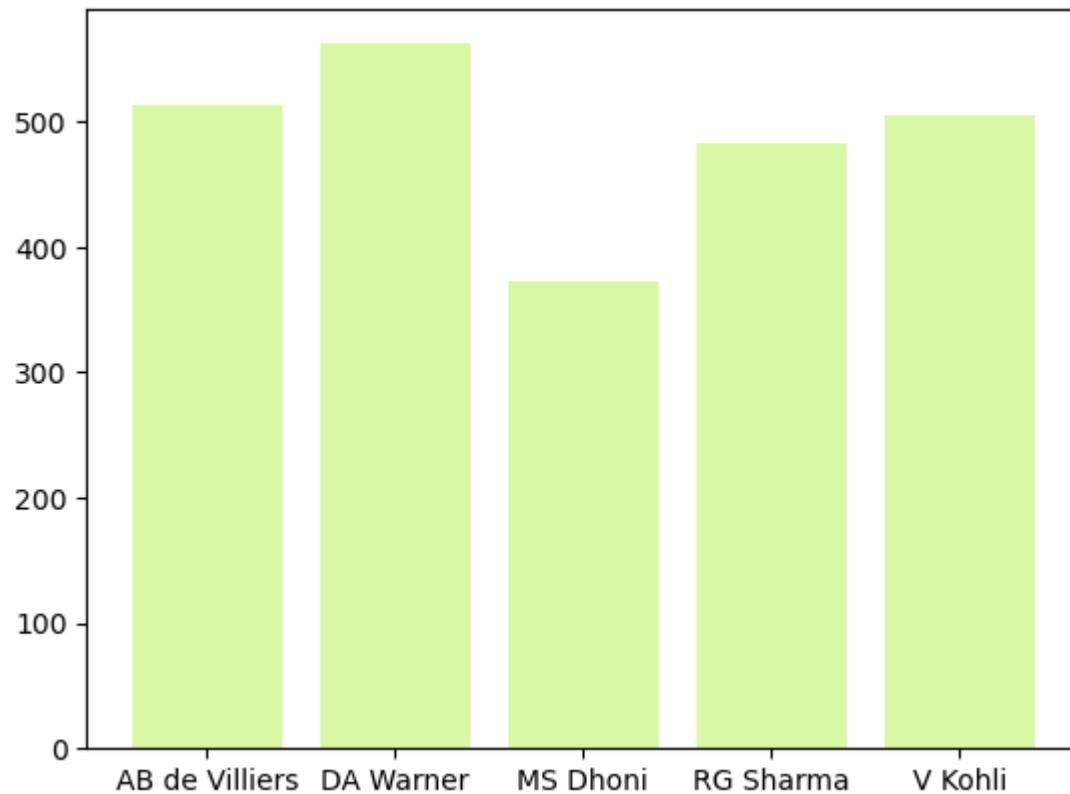
```
df
```

Out[45]:

	batsman	2015	2016	2017
0	AB de Villiers	513	687	216
1	DA Warner	562	848	641
2	MS Dhoni	372	284	290
3	RG Sharma	482	489	333
4	V Kohli	505	973	308

```
In [55]: plt.bar(df['batsman'] , df['2015'] , color ='#DAF7A6')
```

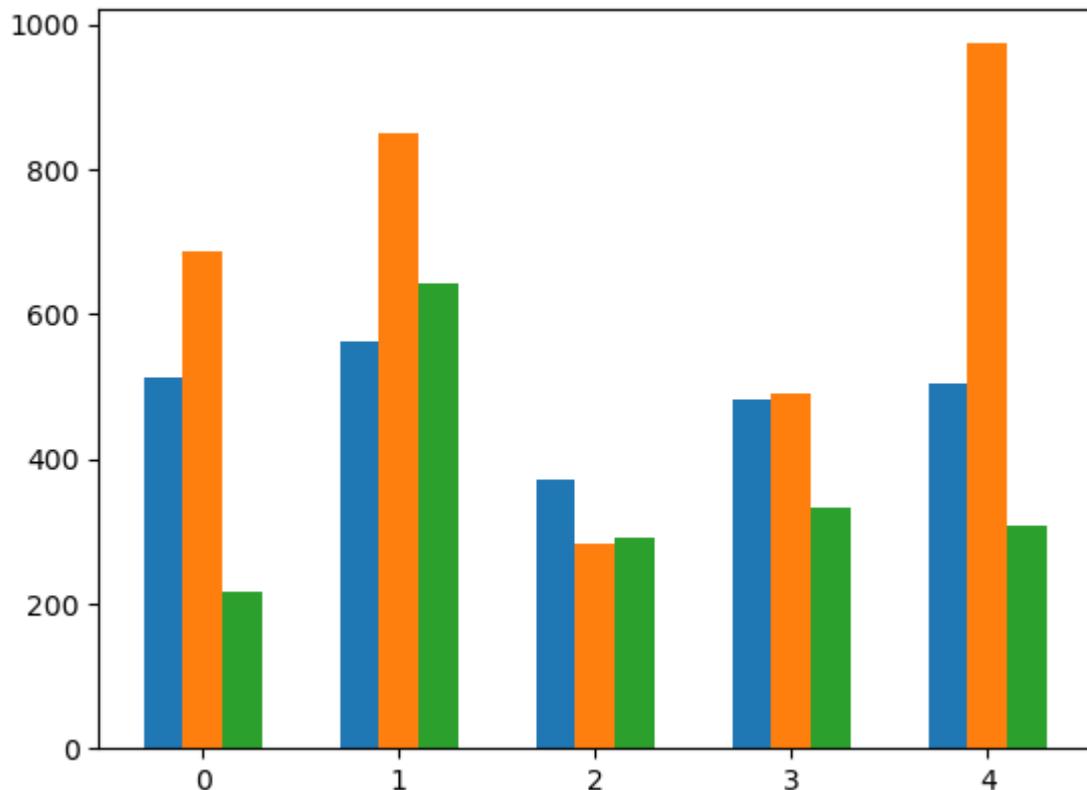
```
Out[55]: <BarContainer object of 5 artists>
```



## Mutiple bar plots

```
In [69]: plt.bar(np.arange(df.shape[0]) - 0.2, df['2015'], width = 0.2)
plt.bar(np.arange(df.shape[0]), df['2016'], width = 0.2)
plt.bar(np.arange(df.shape[0]) + 0.2, df['2017'], width = 0.2)
```

```
Out[69]: <BarContainer object of 5 artists>
```



```
In [68]: df.shape[0] # batsman
```

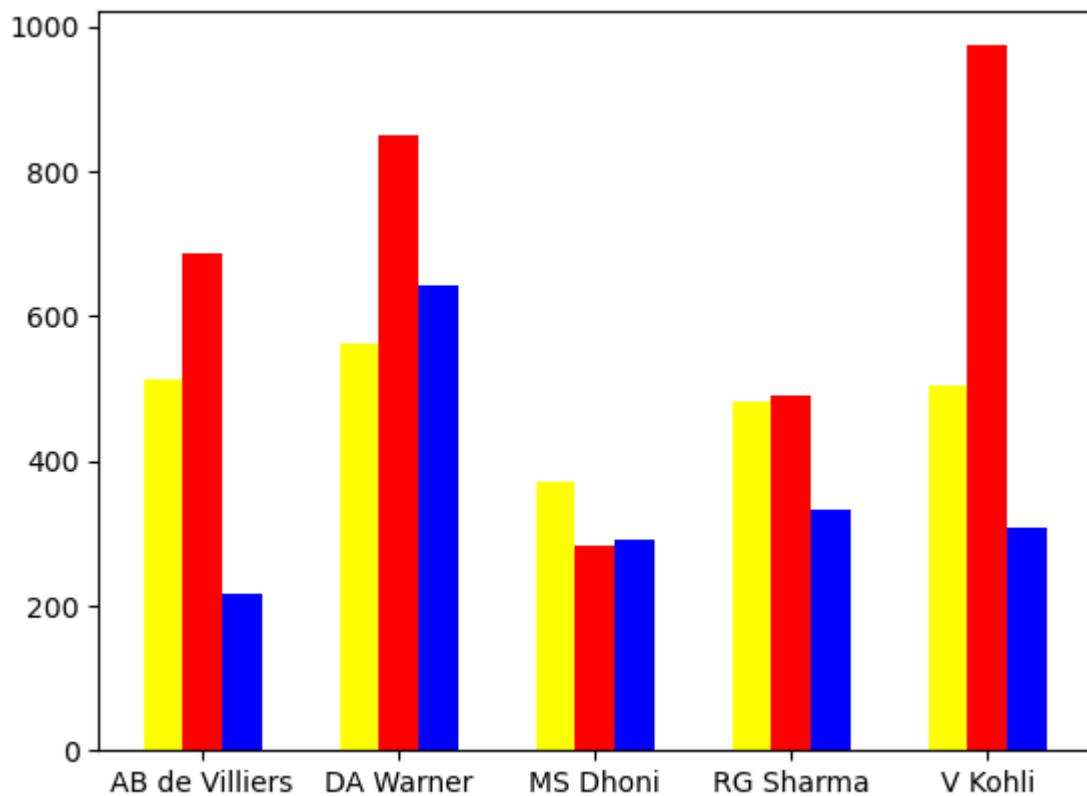
```
Out[68]: 5
```

## Colors

```
In [62]: plt.bar(np.arange(df.shape[0]) - 0.2 , df['2015'] , width = 0.2 ,color ='yellow')
plt.bar(np.arange(df.shape[0]) , df['2016'] , width = 0.2,color ='red')
plt.bar(np.arange(df.shape[0]) + 0.2 , df['2017'] , width = 0.2 , color ='blue')

plt.xticks(np.arange(df.shape[0]), df['batsman'])

plt.show()
```

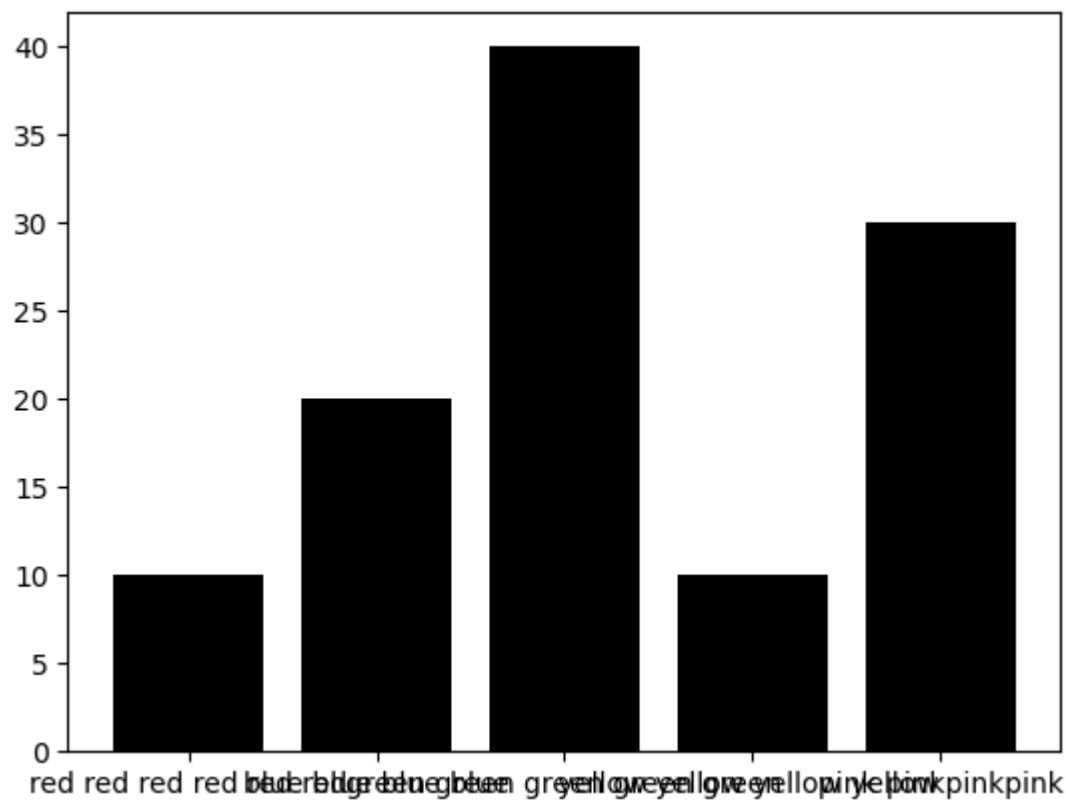


## Overlapping problem

```
In [72]: children = [10,20,40,10,30]
colors = ['red red red red red red',
          'blue blue blue blue',
          'green green green green green',
          'yellow yellow yellow yellow',
          'pink pinkpinkpink']

plt.bar(colors,children,color='black')

plt.show()
```



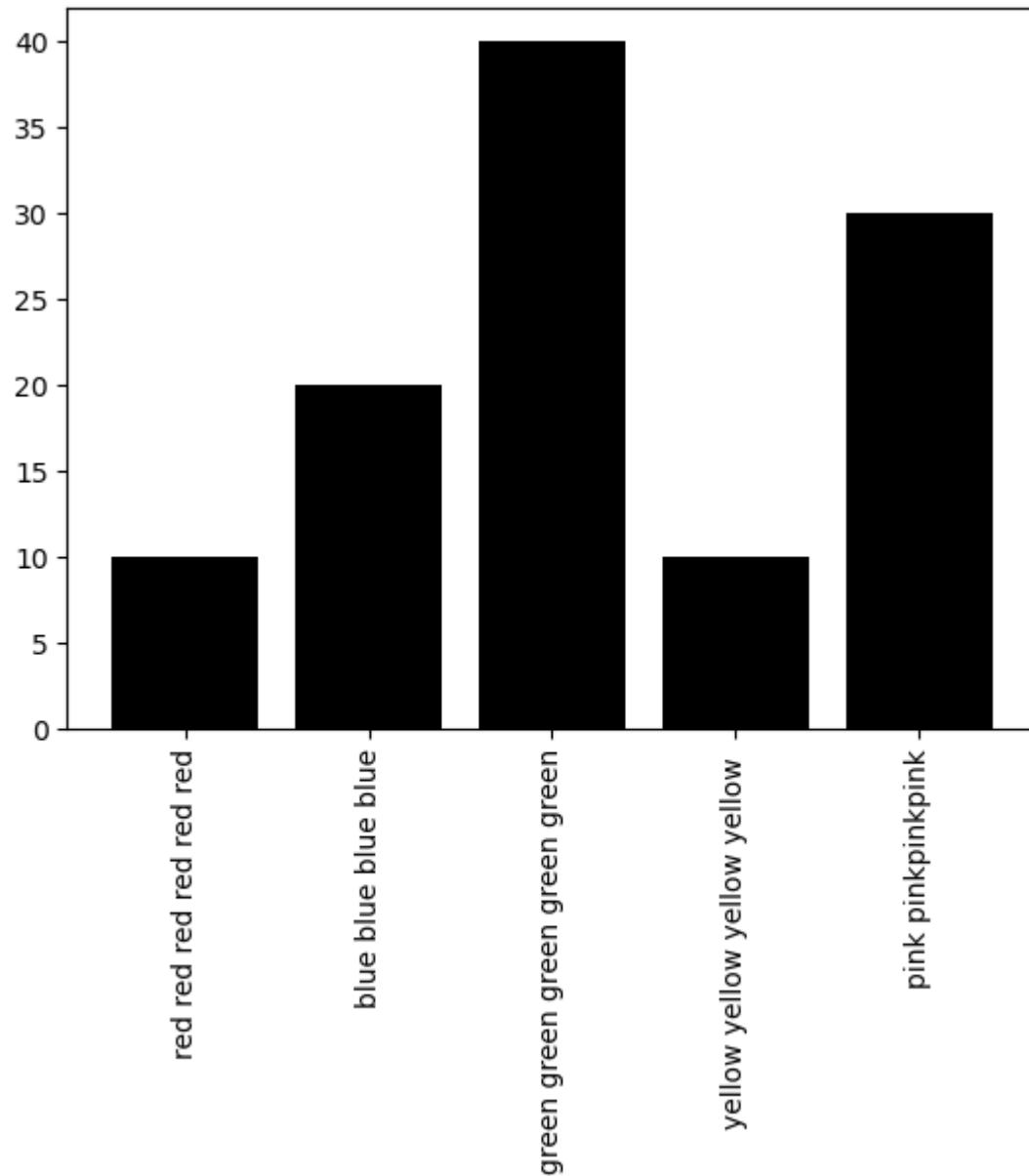
In [73]: *### Solution*

```
children = [10,20,40,10,30]
colors = ['red red red red red red',
          'blue blue blue blue',
          'green green green green green',
          'yellow yellow yellow yellow',
          'pink pinkpinkpink']

plt.bar(colors,children,color='black')

plt.xticks(rotation='vertical') # Use vertical

plt.show()
```



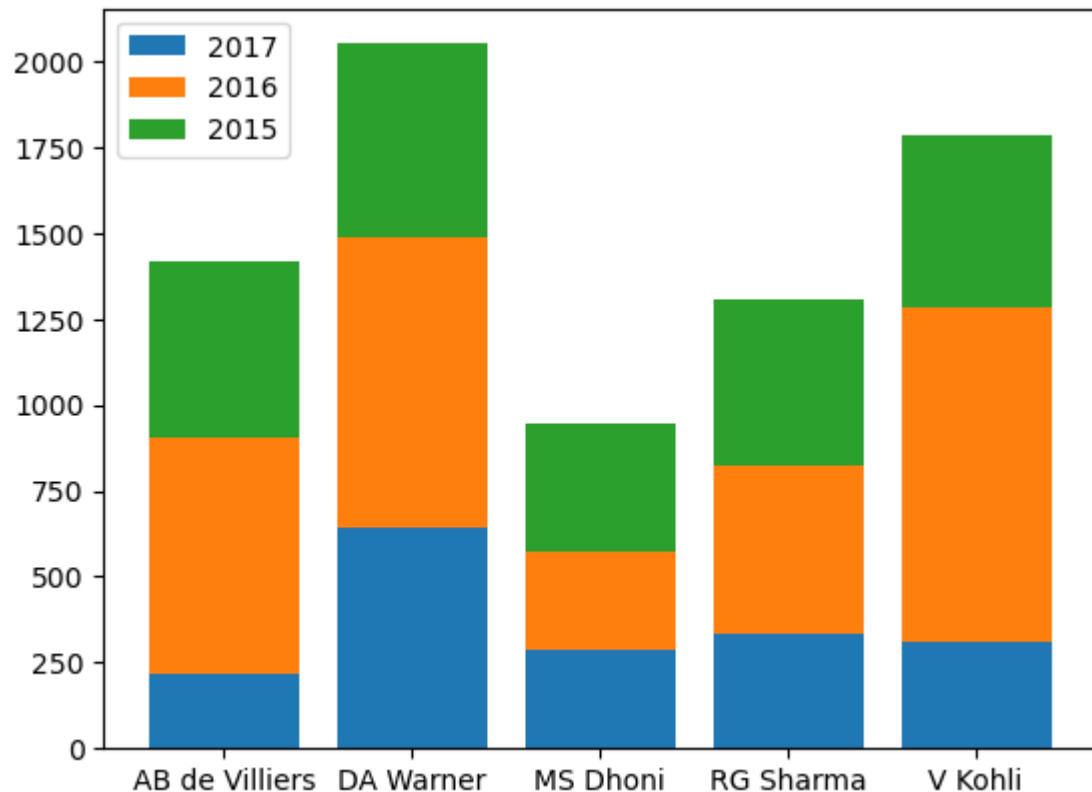
## Stacked bar chart

```
In [75]: plt.bar(df['batsman'],df['2017'],label='2017')

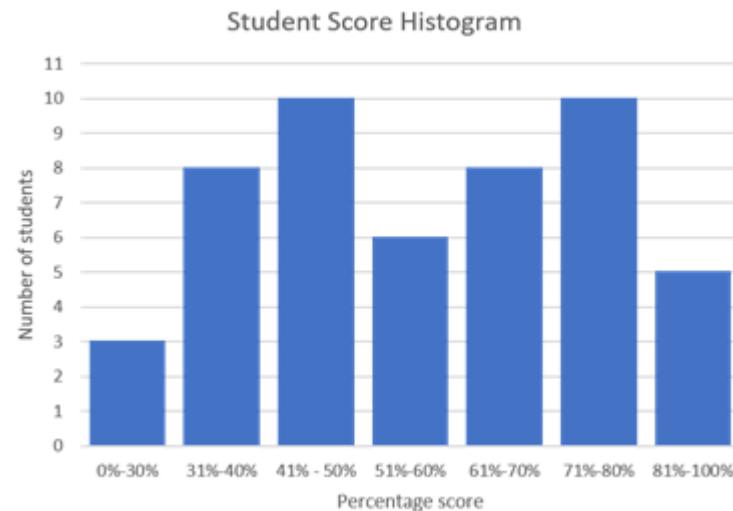
plt.bar(df['batsman'],df['2016'],bottom=df['2017'],label='2016')

plt.bar(df['batsman'],df['2015'],bottom=(df['2016'] + df['2017'])
       ,label='2015')

plt.legend()
plt.show()
```



# Histogram

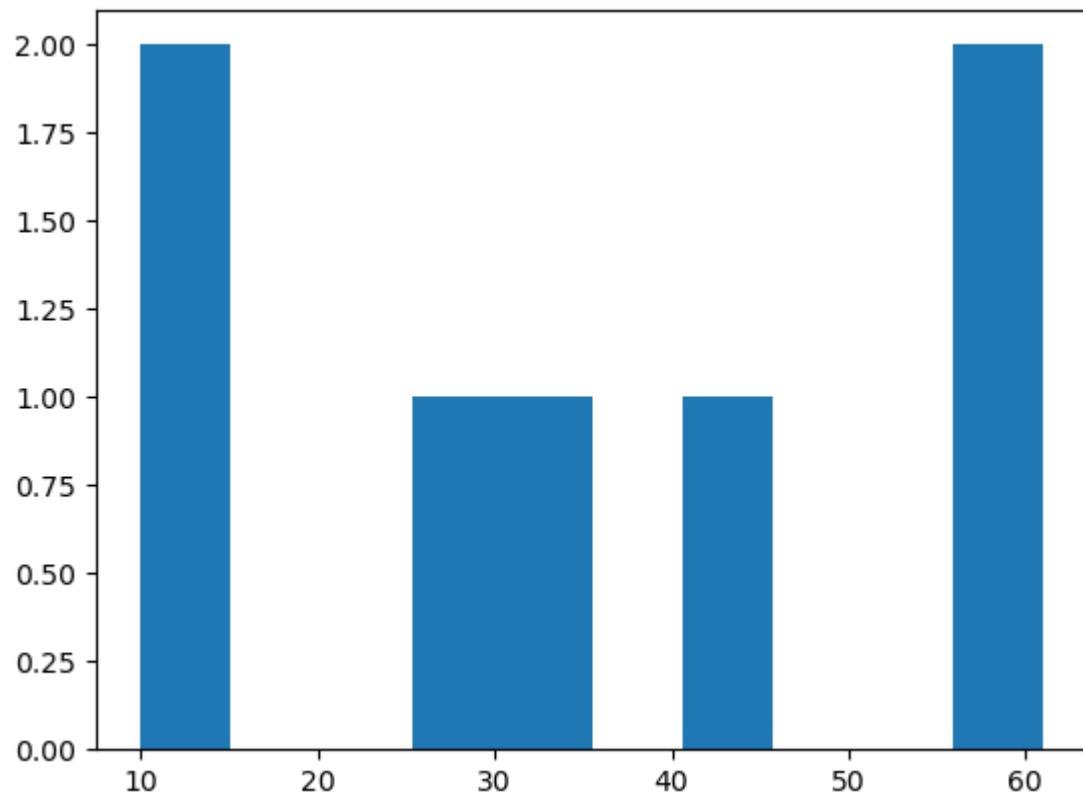


- Univariate Analysis
- Numerical col
- Use case - Frequency Count

```
In [77]: # simple data
```

```
data = [32, 45, 56, 10, 15, 27, 61]  
plt.hist(data)
```

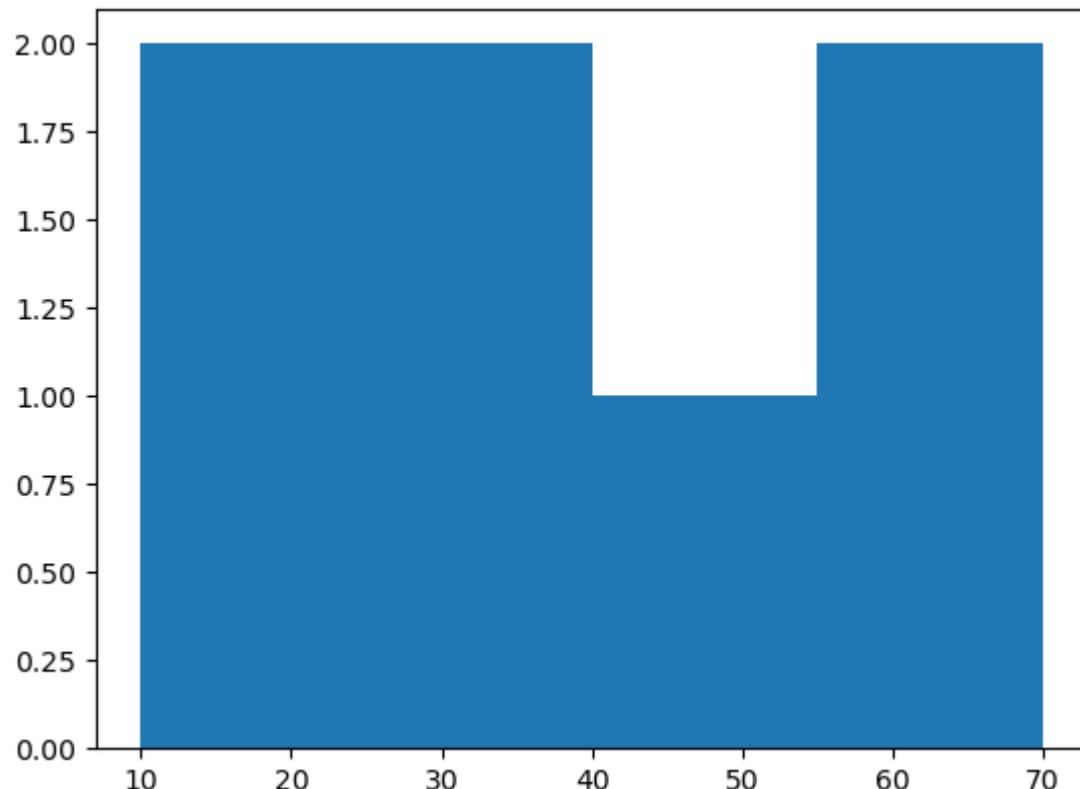
```
Out[77]: (array([2., 0., 0., 1., 1., 0., 0., 2.]),  
 array([10. , 15.1, 20.2, 25.3, 30.4, 35.5, 40.6, 45.7, 50.8, 55.9, 61. ]),  
 <BarContainer object of 10 artists>)
```



## bins

```
In [78]: data = [32,45,56,10,15,27,61]  
plt.hist(data, bins=[10,25,40,55,70])
```

```
Out[78]: (array([2., 2., 1., 2.]),  
 array([10, 25, 40, 55, 70]),  
 <BarContainer object of 4 artists>)
```



In [80]: # on Data

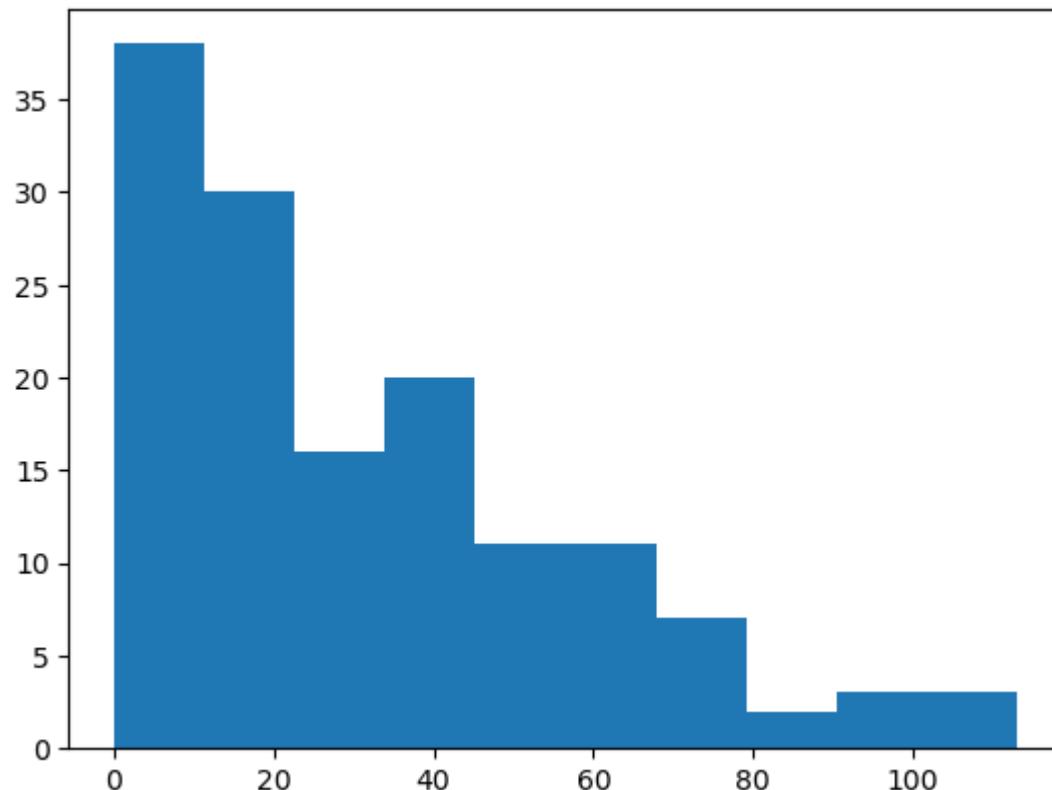
```
df = pd.read_csv("vk.csv")  
df
```

Out[80]:

	match_id	batsman_runs
0	12	62
1	17	28
2	20	64
3	27	0
4	30	10
...	...	...
136	624	75
137	626	113
138	632	54
139	633	0
140	636	54

141 rows × 2 columns

In [85]: plt.hist(df['batsman\_runs'])  
plt.show()

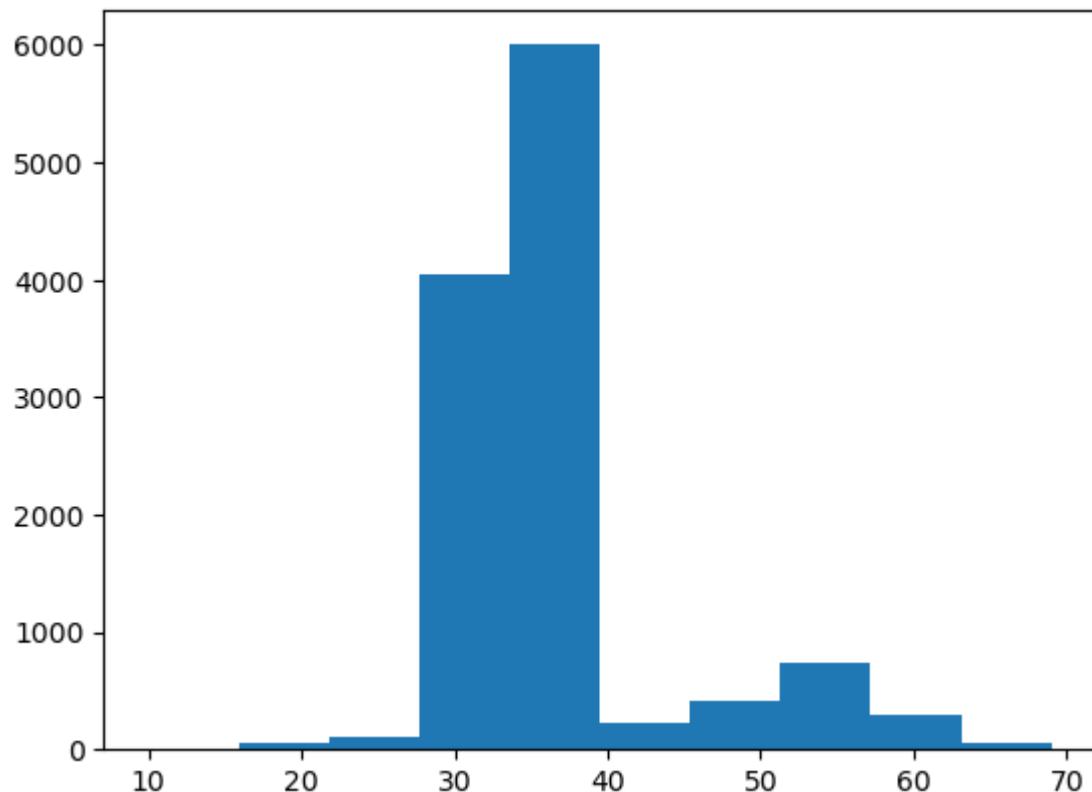


## Logarithmic scale

```
In [91]: arr = np.load("big-array.npy")
```

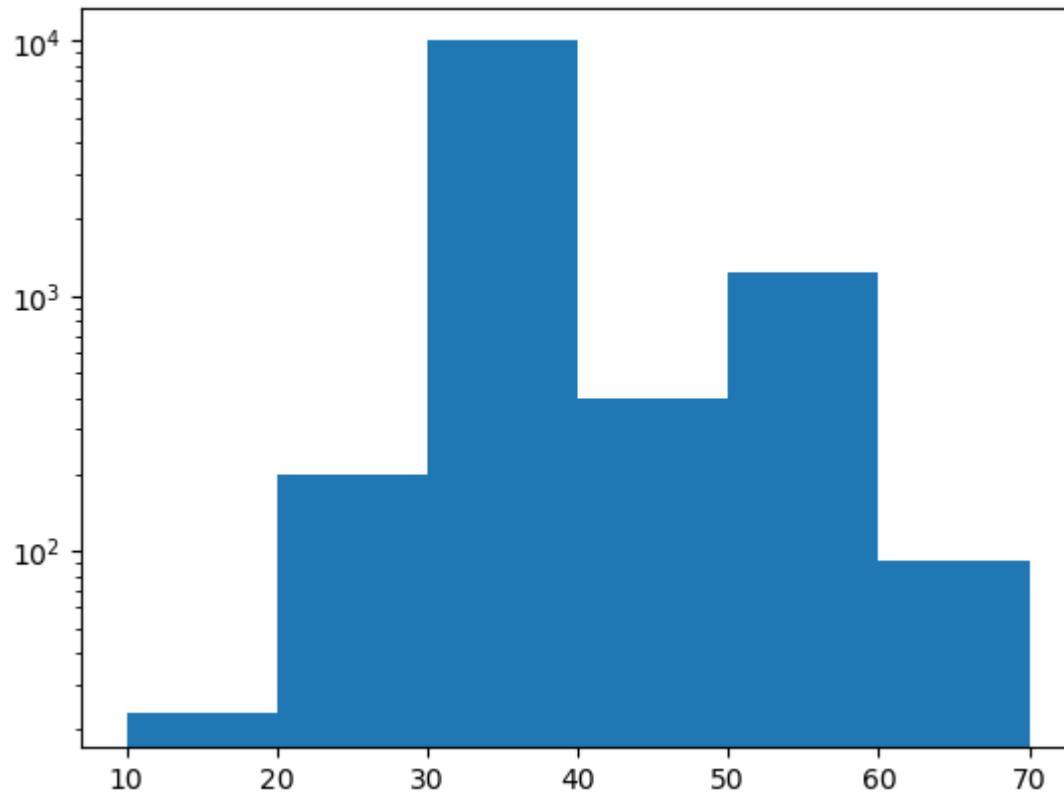
```
In [92]: plt.hist(arr) # problem
```

```
Out[92]: (array([ 12.,  60., 109., 4039., 6003., 230., 410., 744., 291.,
      51.]),
 array([10. , 15.9, 21.8, 27.7, 33.6, 39.5, 45.4, 51.3, 57.2, 63.1, 69. ]),
 <BarContainer object of 10 artists>)
```

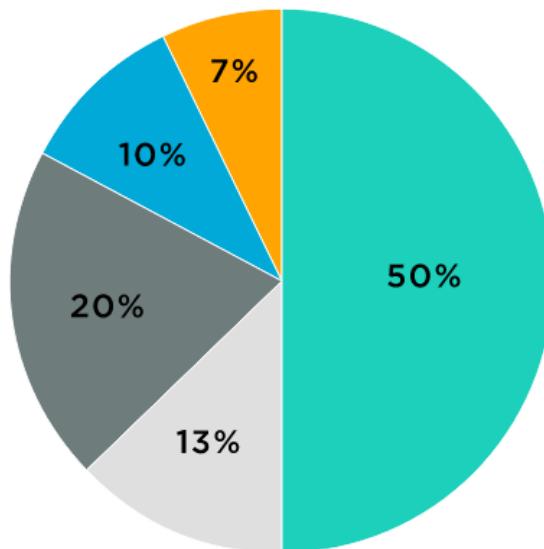


In [93]: # Solution

```
plt.hist(arr,bins=[10,20,30,40,50,60,70],log=True)  
plt.show()
```



## Pie Chart

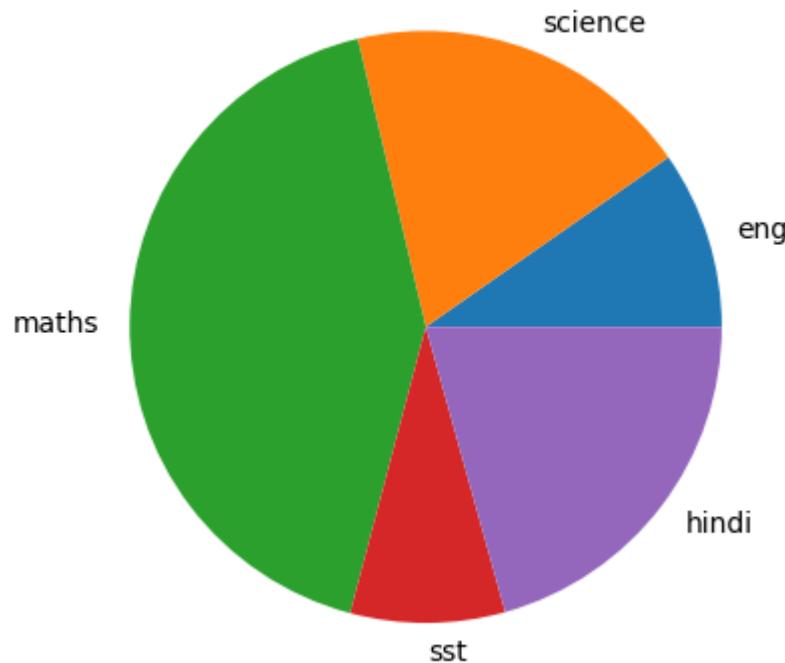


- Univariate/Bivariate Analysis
- Categorical vs numerical

```
In [94]: # simple data
```

```
data = [23,45,100,20,49]
subjects = ['eng','science','maths','sst','hindi']
plt.pie(data,labels=subjects)

plt.show()
```



```
In [95]: # On data
```

```
df = pd.read_csv("gayle-175.csv")

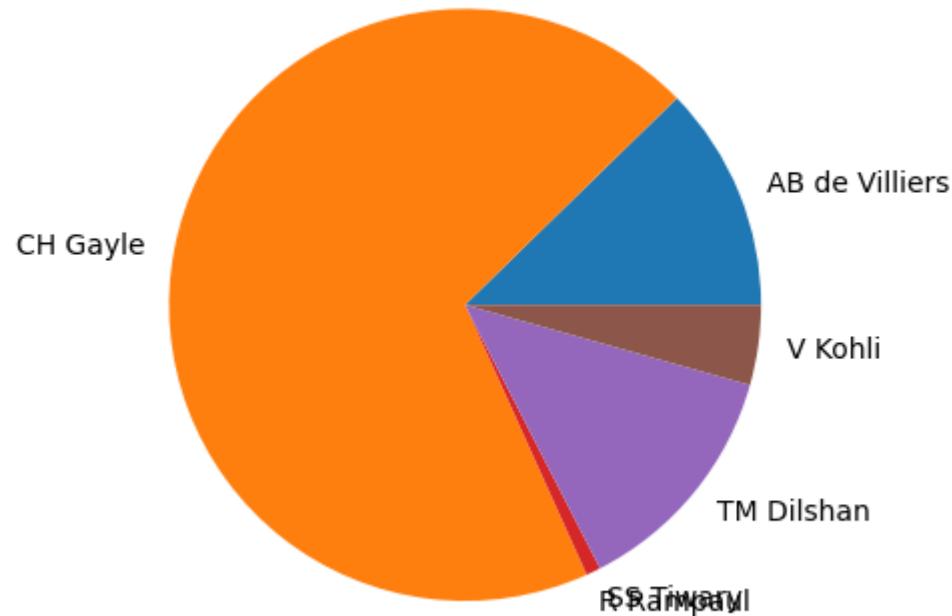
df
```

Out[95]:

	batsman	batsman_runs
0	AB de Villiers	31
1	CH Gayle	175
2	R Rampaul	0
3	SS Tiwary	2
4	TM Dilshan	33
5	V Kohli	11

```
In [97]: plt.pie(df['batsman_runs'], labels=df['batsman'])
```

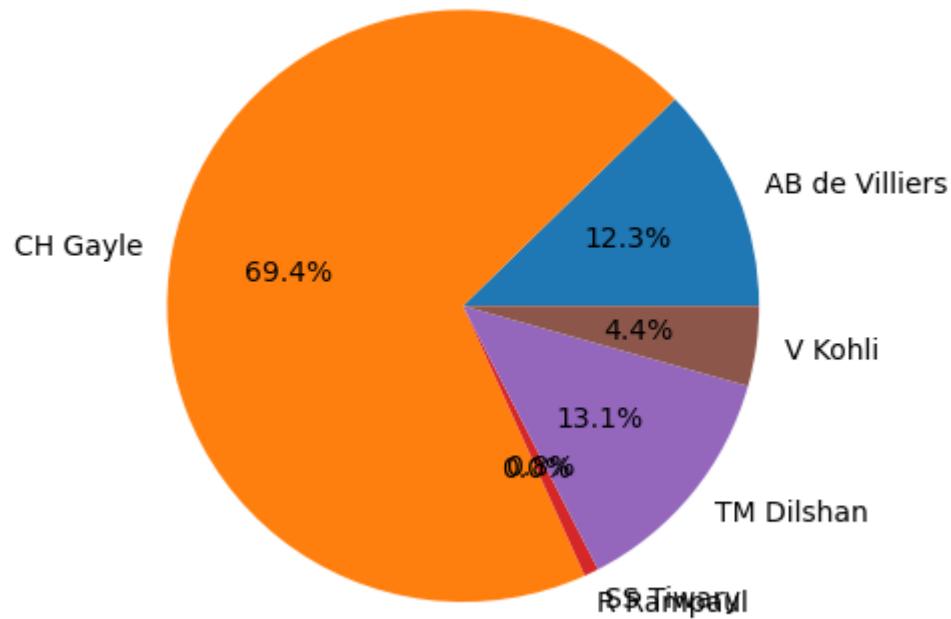
```
plt.show()
```



## Percentages

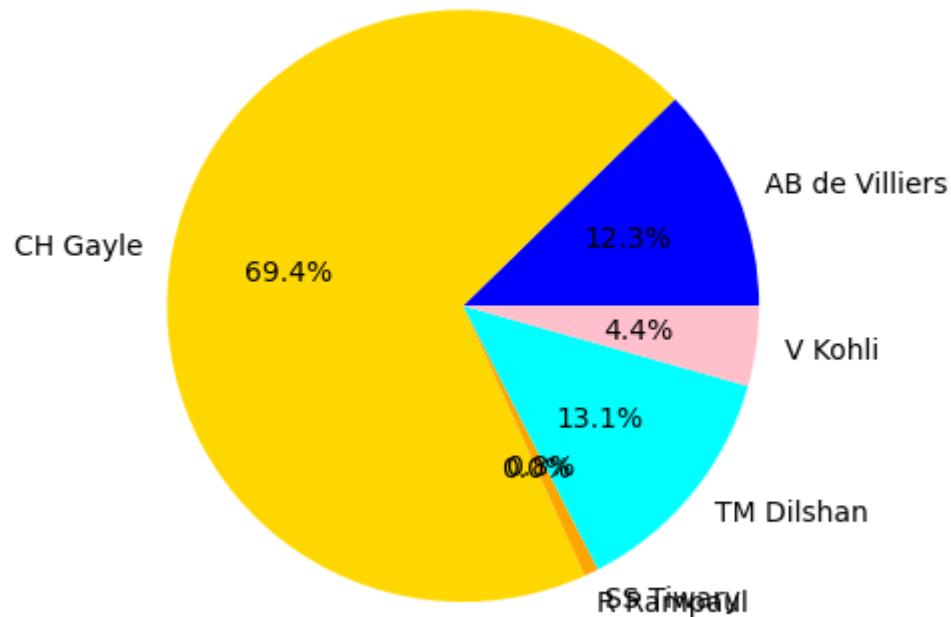
In [98]: `#autopct = auto percentage`

```
plt.pie(df['batsman_runs'], labels=df['batsman'], autopct='%0.1f%%')  
plt.show()
```



## Colours

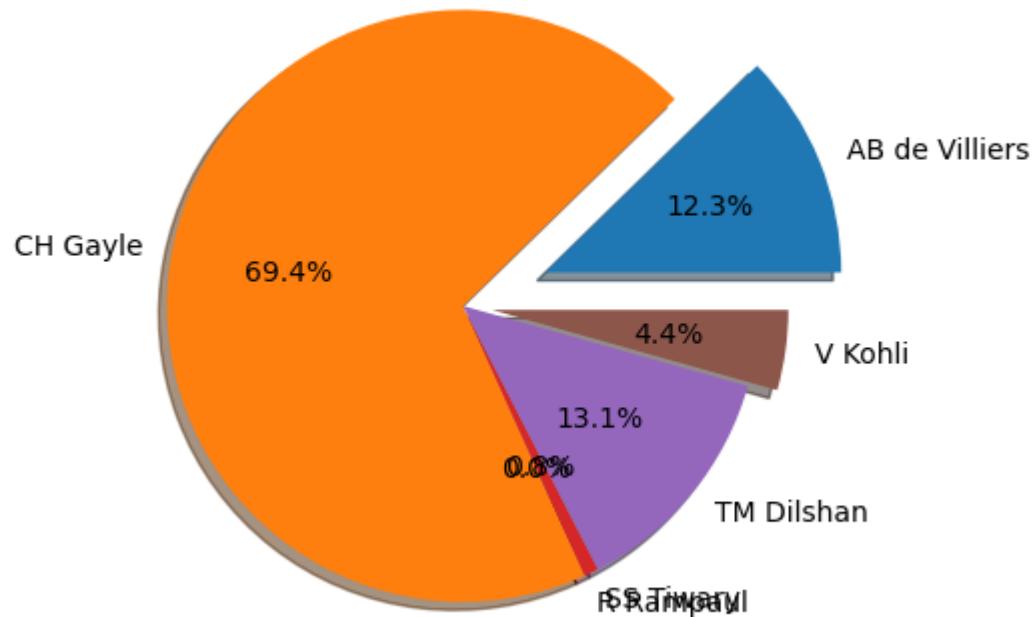
```
In [101]: plt.pie(df['batsman_runs'], labels=df['batsman'],  
                 autopct='%.1f%%',  
                 colors=['blue','gold','green','orange','cyan','pink'])  
  
plt.show()
```



## Explode shadow

```
In [107]: plt.pie(df['batsman_runs'], labels=df['batsman'],  
                 autopct='%.1f%%',  
                 explode=[0.3,0,0,0,0,0.1], shadow=True)
```

```
plt.show()
```



## Changing Styles

```
In [108]: plt.style.available
```

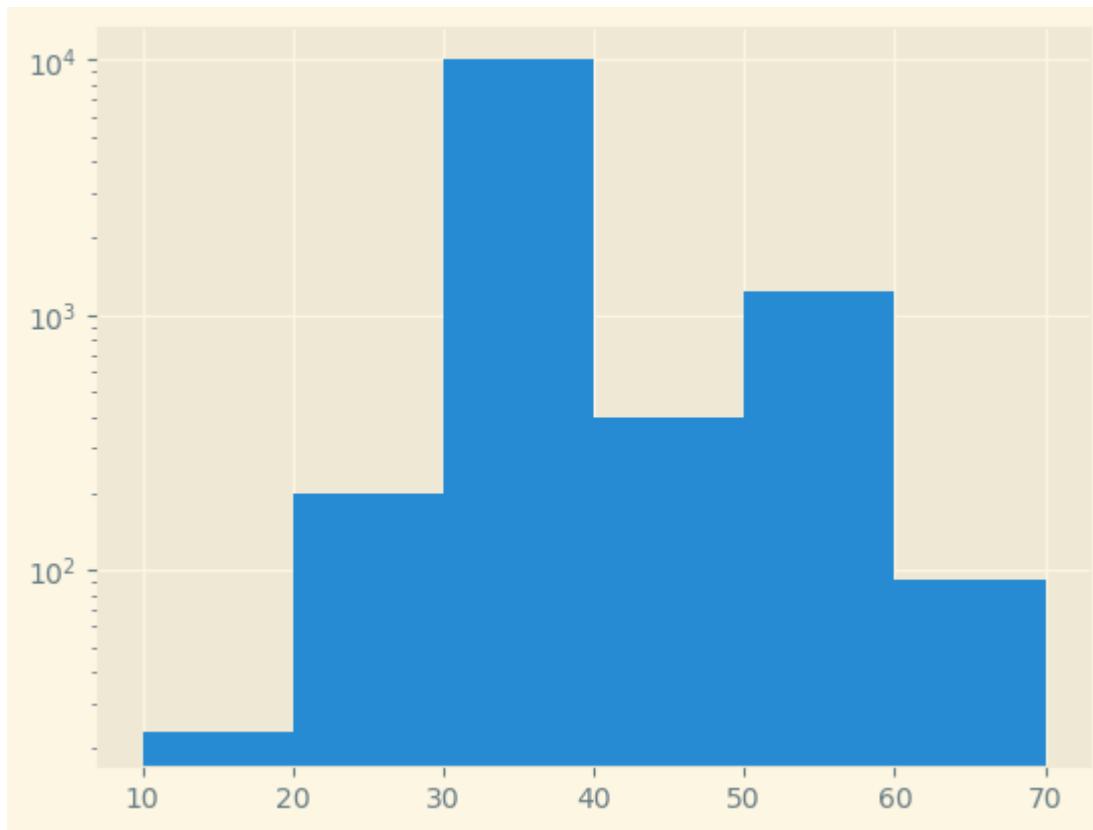
```
Out[108]: ['Solarize_Light2',
 '_classic_test_patch',
 'bmh',
 'classic',
 'dark_background',
 'fast',
 'fivethirtyeight',
 'ggplot',
 'grayscale',
 'seaborn',
 'seaborn-bright',
 'seaborn-colorblind',
 'seaborn-dark',
 'seaborn-dark-palette',
 'seaborn-darkgrid',
 'seaborn-deep',
 'seaborn-muted',
 'seaborn-notebook',
 'seaborn-paper',
 'seaborn-pastel',
 'seaborn-poster',
 'seaborn-talk',
 'seaborn-ticks',
 'seaborn-white',
 'seaborn-whitegrid',
 'tableau-colorblind10']
```

```
In [109]: # style
```

```
plt.style.use('Solarize_Light2')
```

In [110]: # Example

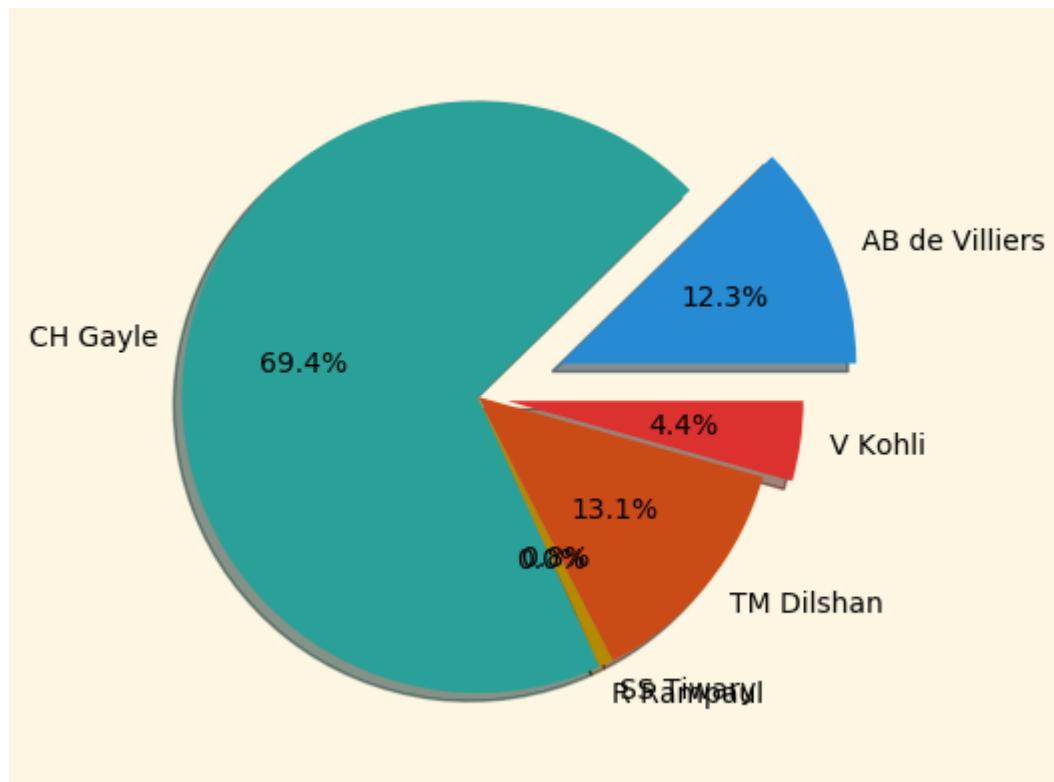
```
plt.hist(arr,bins=[10,20,30,40,50,60,70],log=True)  
plt.show()
```



In [111]: # Style 2

```
plt.style.use('_classic_test_patch')
```

```
In [113]: plt.pie(df['batsman_runs'], labels=df['batsman'],  
                 autopct='%0.1f%%',  
                 explode=[0.3,0,0,0,0,0.1], shadow=True)  
  
plt.show()
```



```
In [114]: # Style 3  
  
plt.style.use('dark_background')
```

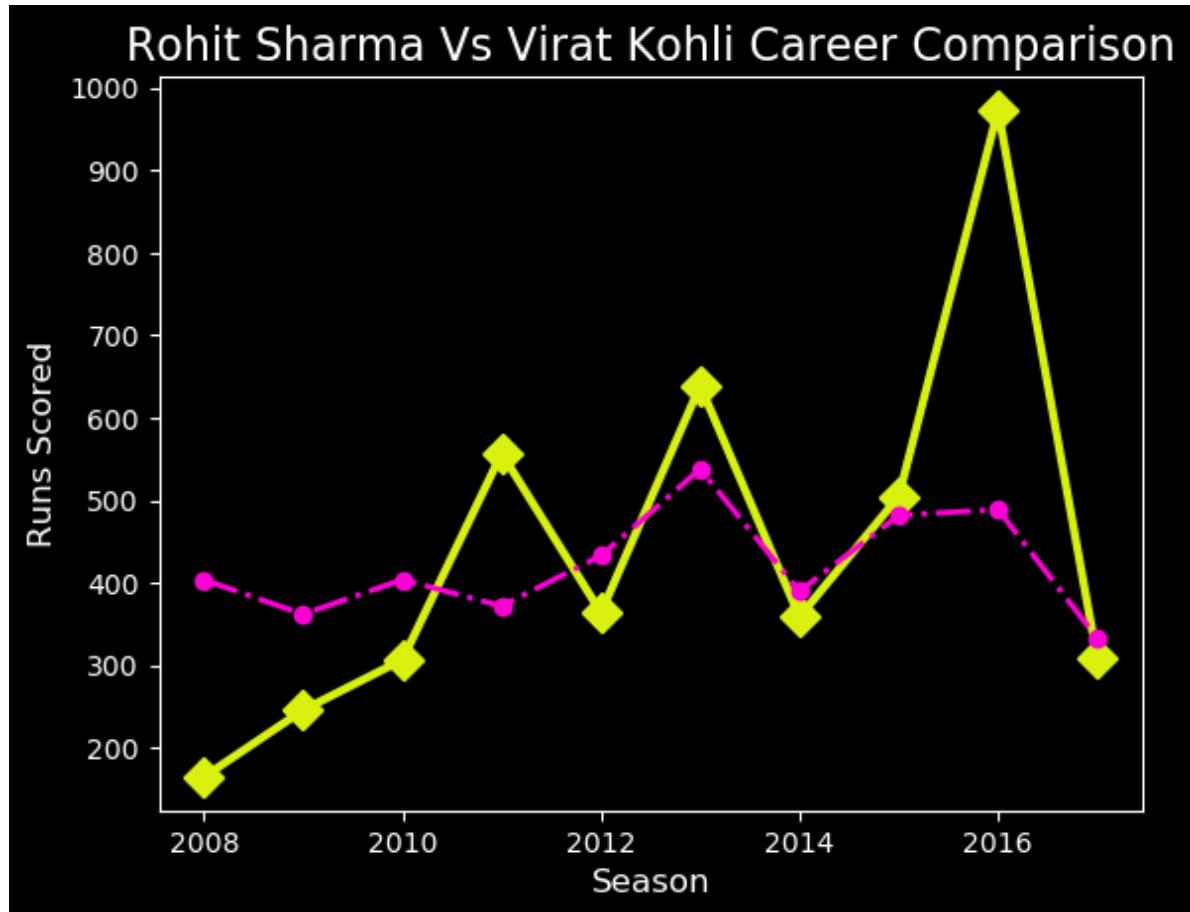
In [115]: # Example

```
plt.plot(batsman['index'],batsman['V Kohli'],color="#D9F10F",linestyle='solid')
plt.plot(batsman['index'],batsman['RG Sharma'],color="#FC00D6",linestyle='dash')

plt.title('Rohit Sharma Vs Virat Kohli Career Comparison')
plt.xlabel('Season')
plt.ylabel('Runs Scored')

plt.grid()

plt.show()
```



In [116]: # Style 4

```
plt.style.use('seaborn-darkgrid')
```

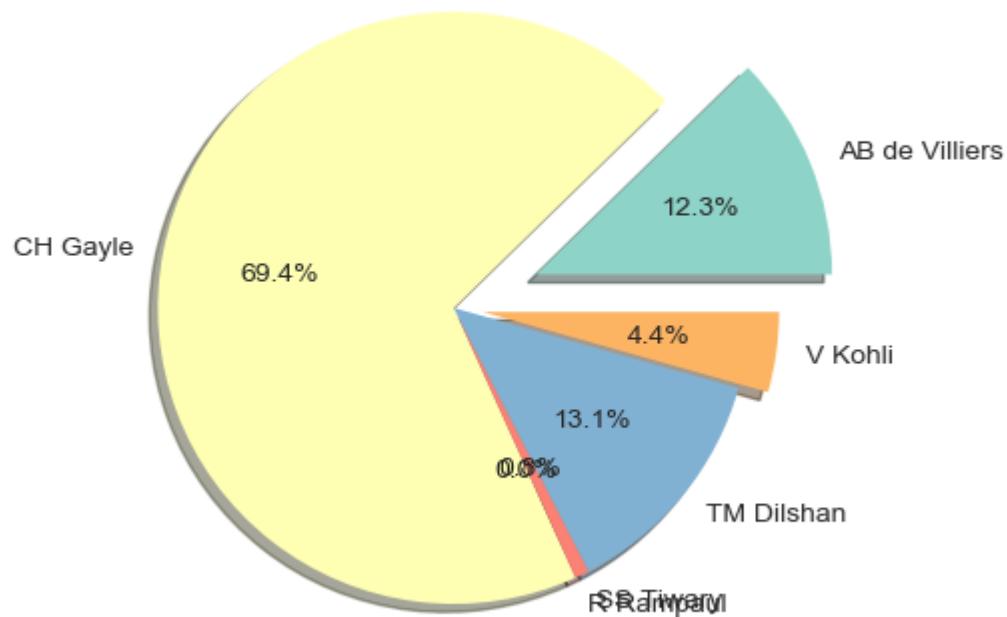
```
In [117]: plt.scatter(tips['total_bill'], tips['tip'] , s = tips ['size']*20)
```

```
Out[117]: <matplotlib.collections.PathCollection at 0x1ab19271b80>
```



```
In [120]: plt.pie(df['batsman_runs'],labels=df['batsman'],  
    autopct='%.1f%%',  
    explode=[0.3,0,0,0,0,0.1],shadow=True)
```

```
plt.show()
```



```
In [121]: # Style 5
```

```
plt.style.use('ggplot')
```

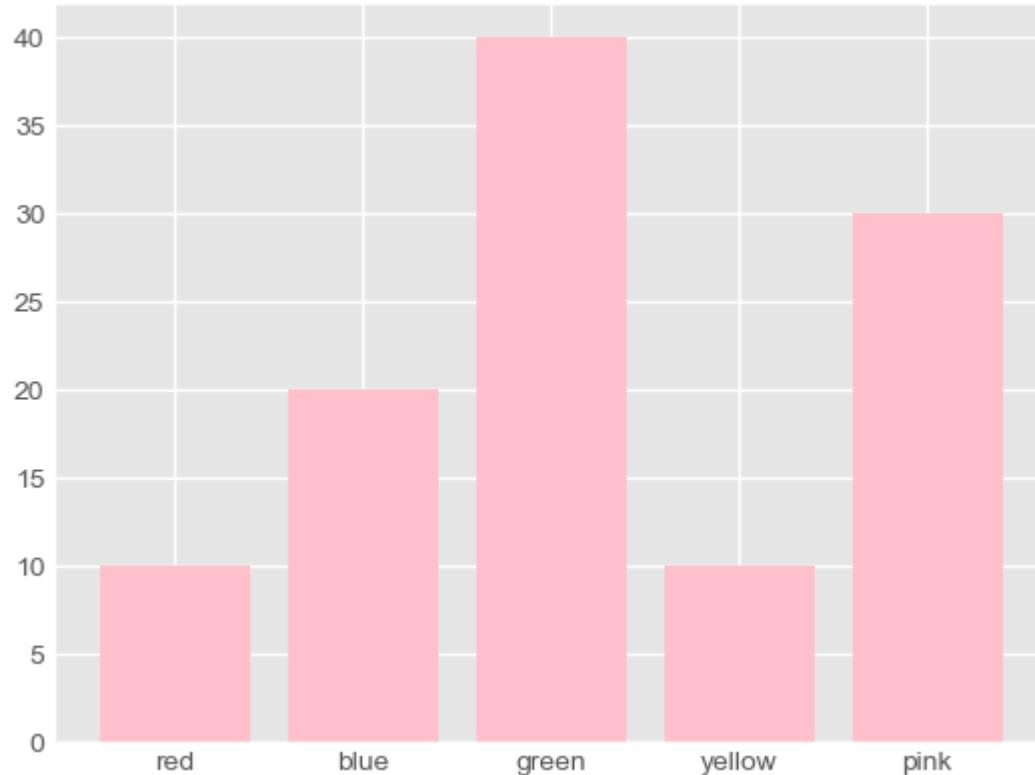
```
In [122]: # simple bar chart
```

```
children = [10,20,40,10,30]
```

```
colors = ['red','blue','green','yellow','pink']
```

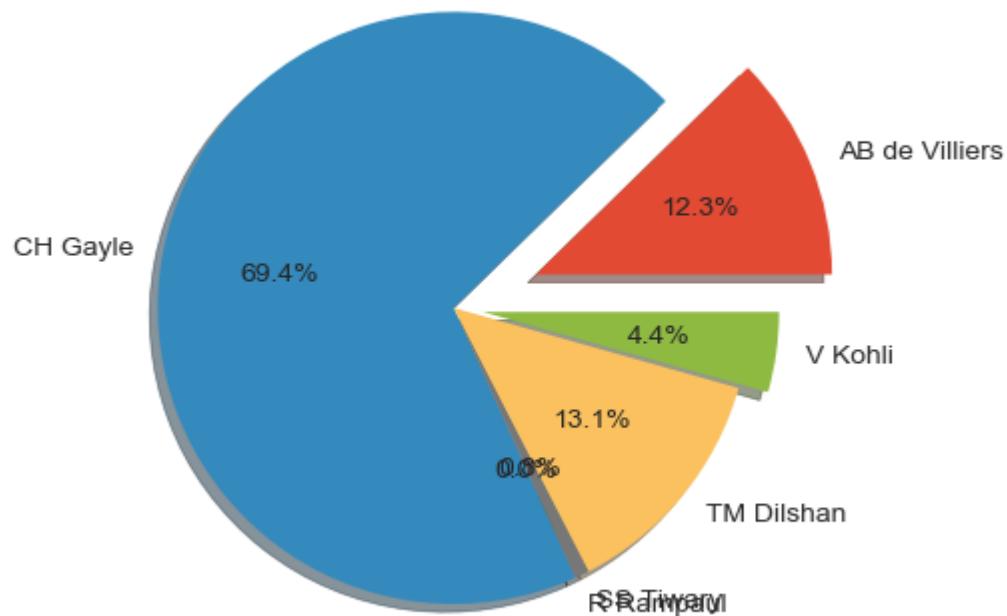
```
plt.bar(colors,children,color='pink')
```

```
Out[122]: <BarContainer object of 5 artists>
```



## Save Figure

```
In [124]: # Dont apply plt.show() , when using the save  
  
plt.pie(df['batsman_runs'], labels=df['batsman'],  
        autopct='%.1f%%',  
        explode=[0.3,0,0,0,0,0.1], shadow=True)  
  
plt.savefig('sample.png') # For saving
```



```
In [ ]:
```

```
In [1]: import numpy as np
import pandas as pd
import matplotlib.pyplot as plt

plt.style.use('ggplot')
```



## Colored Scatterplots

```
In [2]: iris = pd.read_csv("iris.csv")
iris.sample(5)
```

Out[2]:

	<b>Id</b>	<b>SepalLengthCm</b>	<b>SepalWidthCm</b>	<b>PetalLengthCm</b>	<b>PetalWidthCm</b>	<b>Species</b>
	<b>91</b>	92	6.1	3.0	4.6	1.4 Iris-versicolor
	<b>108</b>	109	6.7	2.5	5.8	1.8 Iris-virginica
	<b>93</b>	94	5.0	2.3	3.3	1.0 Iris-versicolor
	<b>147</b>	148	6.5	3.0	5.2	2.0 Iris-virginica
	<b>139</b>	140	6.9	3.1	5.4	2.1 Iris-virginica

```
In [3]: # Replacing
```

```
iris['Species'] = iris['Species'].replace({'Iris-setosa':0 ,
                                         'Iris-versicolor':1 ,
                                         'Iris-virginica':2})

iris.sample(5)
```

Out[3]:

	<b>Id</b>	<b>SepalLengthCm</b>	<b>SepalWidthCm</b>	<b>PetalLengthCm</b>	<b>PetalWidthCm</b>	<b>Species</b>
	<b>11</b>	12	4.8	3.4	1.6	0.2 0
	<b>119</b>	120	6.0	2.2	5.0	1.5 2
	<b>112</b>	113	6.8	3.0	5.5	2.1 2
	<b>135</b>	136	7.7	3.0	6.1	2.3 2
	<b>88</b>	89	5.6	3.0	4.1	1.3 1

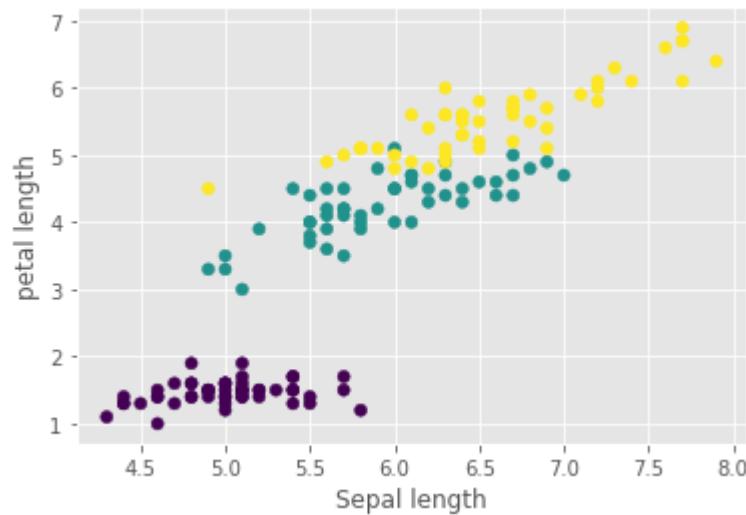
## C - colors

In [4]:

```
plt.scatter( iris['SepalLengthCm'],iris['PetalLengthCm'],
            c= iris['Species']) # c

plt.xlabel('Sepal length')
plt.ylabel('petal length')

plt.show()
```



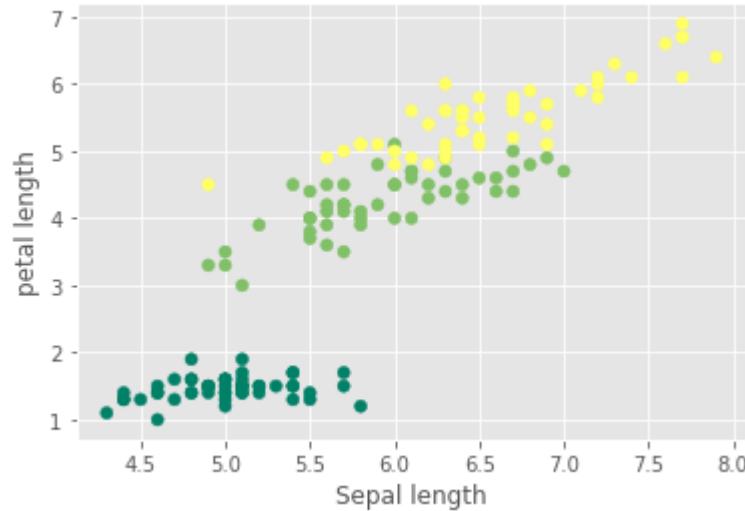
## cmap

```
In [5]: # different themes - 'cmap'
```

```
plt.scatter(iris['SepalLengthCm'], iris['PetalLengthCm'],
            c=iris['Species'], cmap='summer') # cmap

plt.xlabel('Sepal length')
plt.ylabel('petal length')

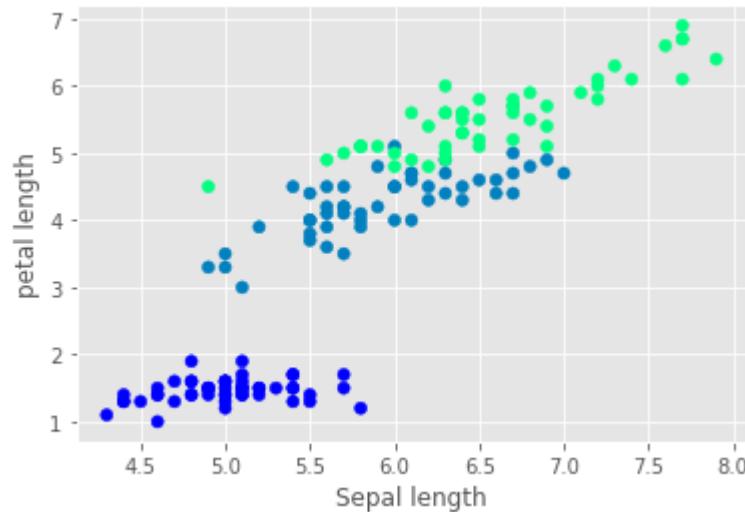
plt.show()
```



```
In [6]: plt.scatter(iris['SepalLengthCm'], iris['PetalLengthCm'],
                  c=iris['Species'], cmap='winter') # winter
```

```
plt.xlabel('Sepal length')
plt.ylabel('petal length')

plt.show()
```



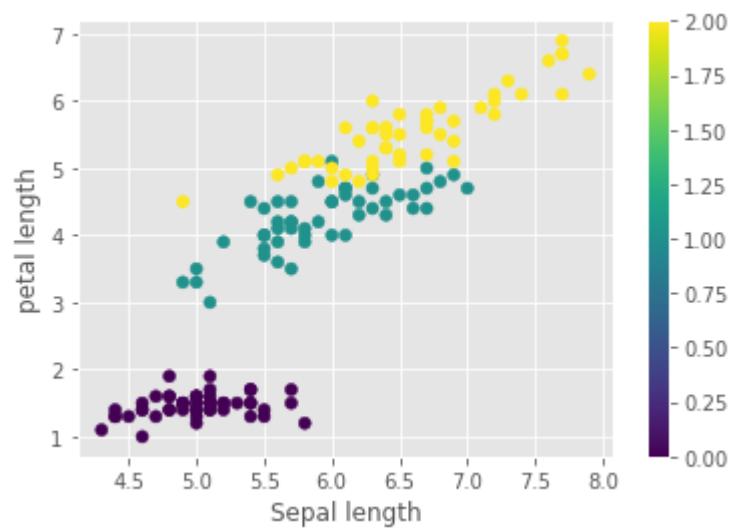
## color bar

```
In [7]: plt.scatter( iris['SepalLengthCm'],iris['PetalLengthCm'],
                   c= iris['Species'] ,cmap = 'viridis')

plt.xlabel('Sepal length')
plt.ylabel('petal length')

plt.colorbar() # colorbar shows variations Levels

plt.show()
```



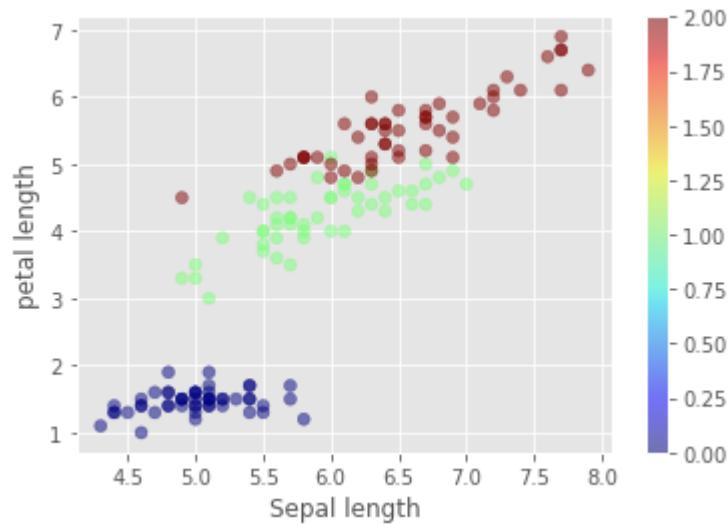
## alpha

```
In [8]: plt.scatter( iris['SepalLengthCm'],iris['PetalLengthCm'],
                   c= iris['Species'] ,cmap ='jet',
                   alpha =0.5) # reduces,increase color

plt.xlabel('Sepal length')
plt.ylabel('petal length')

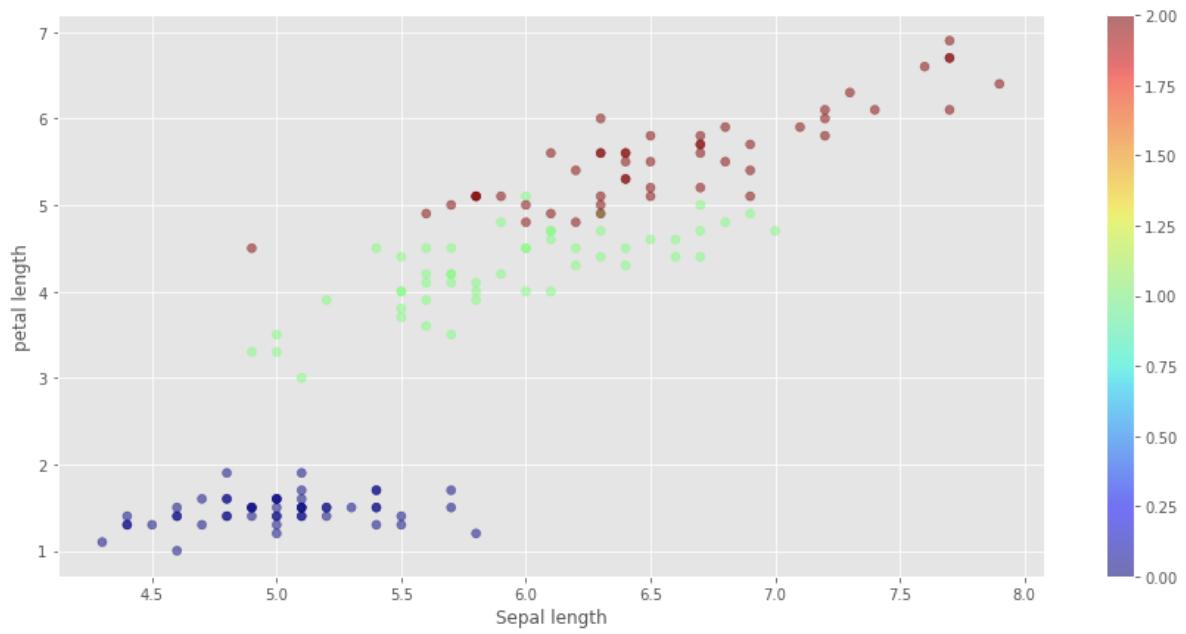
plt.colorbar()

plt.show()
```



## Plot size

```
In [9]: plt.figure(figsize=(15,7)) # 15 -width , 7 -height  
  
plt.scatter( iris['SepalLengthCm'],iris['PetalLengthCm'],  
            c= iris['Species'] ,cmap ='jet', alpha =0.5) # reduces color  
  
plt.xlabel('Sepal length')  
plt.ylabel('petal length')  
  
plt.colorbar()  
  
plt.show()
```



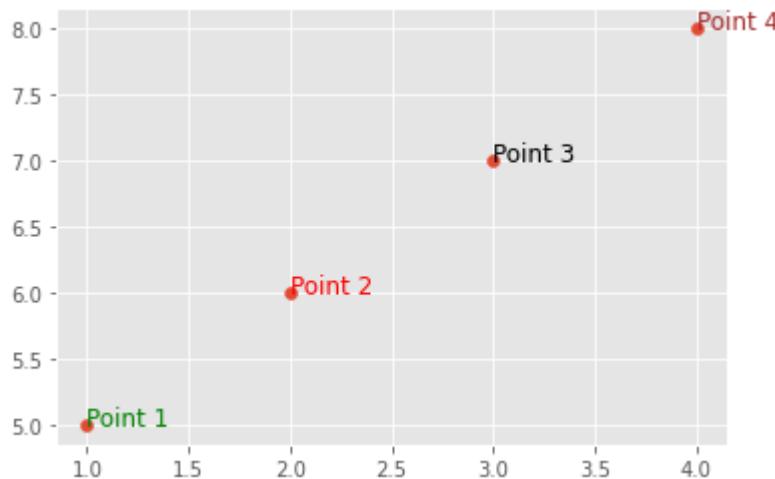
## Annotations

In [10]: # sample annotation - naming

```
x = [1,2,3,4]
y = [5,6,7,8]

plt.scatter(x,y)
plt.text(1,5,'Point 1',fontdict={'size':12,'color':'green'})
plt.text(2,6,'Point 2',fontdict={'size':12,'color':'red'})
plt.text(3,7,'Point 3',fontdict={'size':12,'color':'black'})
plt.text(4,8,'Point 4',fontdict={'size':12,'color':'brown'})
```

Out[10]: Text(4, 8, 'Point 4')



In [11]: batter =pd.read\_csv("batter.csv")
batter.shape

Out[11]: (605, 4)

In [12]: # sample =25

```
sample_df =batter.head(100).sample(25,random_state=29)
```

In [13]: sample\_df.shape

Out[13]: (25, 4)

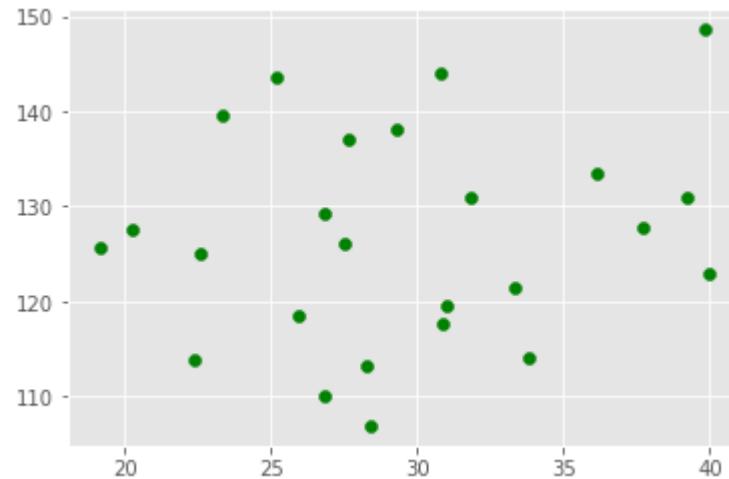
In [14]: sample\_df

Out[14]:

	batter	runs	avg	strike_rate
73	TM Dilshan	1153	26.813953	110.124164
8	RV Uthappa	4954	27.522222	126.152279
10	G Gambhir	4217	31.007353	119.665153
7	MS Dhoni	4978	39.196850	130.931089
19	YK Pathan	3222	29.290909	138.046272
71	RD Gaikwad	1207	37.718750	127.724868
92	STR Binny	880	19.130435	125.714286
25	Q de Kock	2767	31.804598	130.951254
38	SR Tendulkar	2334	33.826087	114.187867
12	AM Rahane	4074	30.863636	117.575758
57	DJ Bravo	1560	22.608696	125.100241
52	RA Tripathi	1798	27.661538	137.042683
77	LMP Simmons	1079	39.962963	122.892938
5	AB de Villiers	5181	39.853846	148.580442
41	R Dravid	2174	28.233766	113.347237
98	GC Smith	739	28.423077	106.946454
70	DJ Hooda	1237	20.278689	127.525773
33	DA Miller	2455	36.102941	133.569097
84	Y Venugopal Rao	985	22.386364	113.872832
55	KC Sangakkara	1687	25.953846	118.469101
63	BJ Hodge	1400	33.333333	121.422376
90	MM Ali	910	23.333333	139.570552
94	SO Hetmyer	831	30.777778	144.020797
56	PP Shaw	1588	25.206349	143.580470
9	KD Karthik	4377	26.852761	129.267572

```
In [41]: plt.scatter(sample_df['avg'],sample_df['strike_rate'], color='green')
```

```
Out[41]: <matplotlib.collections.PathCollection at 0x25b49b5d190>
```



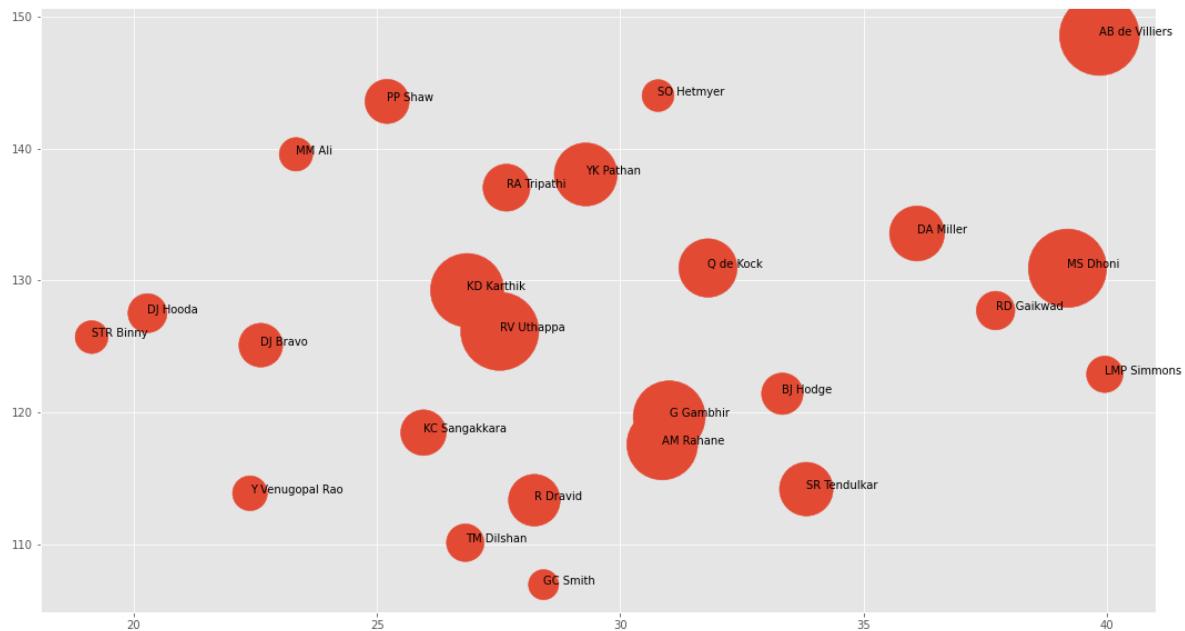
In [16]: sample\_df

Out[16]:

	batter	runs	avg	strike_rate
73	TM Dilshan	1153	26.813953	110.124164
8	RV Uthappa	4954	27.522222	126.152279
10	G Gambhir	4217	31.007353	119.665153
7	MS Dhoni	4978	39.196850	130.931089
19	YK Pathan	3222	29.290909	138.046272
71	RD Gaikwad	1207	37.718750	127.724868
92	STR Binny	880	19.130435	125.714286
25	Q de Kock	2767	31.804598	130.951254
38	SR Tendulkar	2334	33.826087	114.187867
12	AM Rahane	4074	30.863636	117.575758
57	DJ Bravo	1560	22.608696	125.100241
52	RA Tripathi	1798	27.661538	137.042683
77	LMP Simmons	1079	39.962963	122.892938
5	AB de Villiers	5181	39.853846	148.580442
41	R Dravid	2174	28.233766	113.347237
98	GC Smith	739	28.423077	106.946454
70	DJ Hooda	1237	20.278689	127.525773
33	DA Miller	2455	36.102941	133.569097
84	Y Venugopal Rao	985	22.386364	113.872832
55	KC Sangakkara	1687	25.953846	118.469101
63	BJ Hodge	1400	33.333333	121.422376
90	MM Ali	910	23.333333	139.570552
94	SO Hetmyer	831	30.777778	144.020797
56	PP Shaw	1588	25.206349	143.580470
9	KD Karthik	4377	26.852761	129.267572

```
In [17]: plt.figure(figsize=(18,10))
```

```
plt.scatter(sample_df['avg'],sample_df['strike_rate'] ,  
           s =sample_df['runs']) # s = size  
  
for i in range(sample_df.shape[0]):  
    plt.text(sample_df['avg'].values[i],  
             sample_df['strike_rate'].values[i],  
             sample_df['batter'].values[i])
```



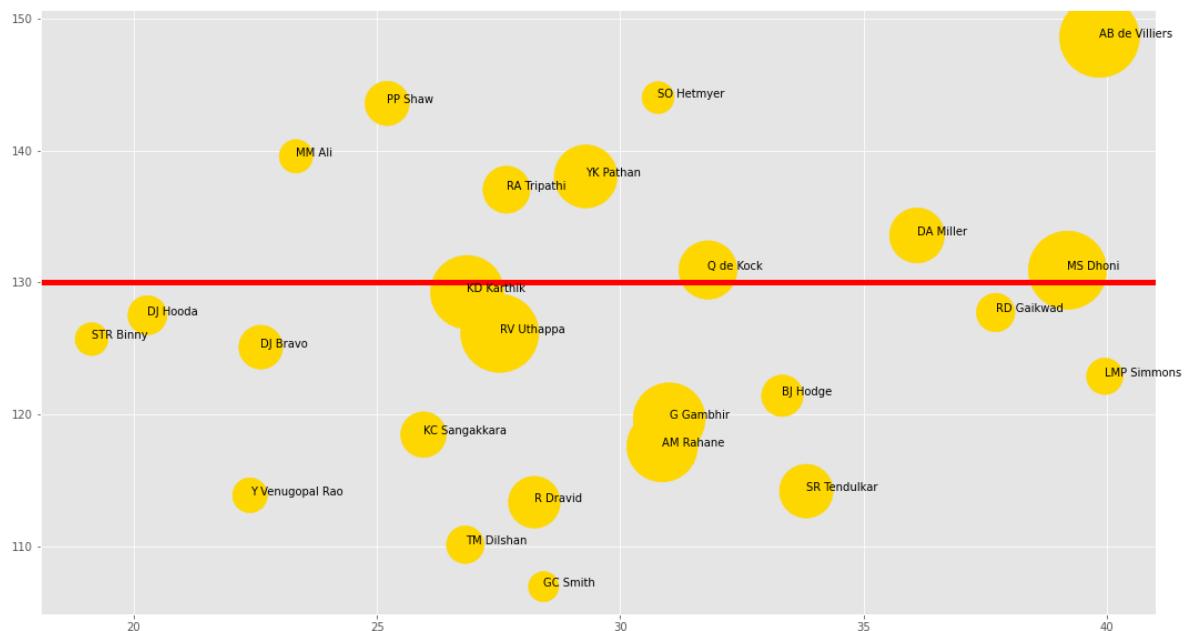
## Horizontal and Vertical Lines

```
In [147]: plt.figure(figsize=(18,10))

plt.axhline(130, color ='red', linewidth=5) # Horizontal line

plt.scatter(sample_df['avg'],sample_df['strike_rate'] ,
           s =sample_df['runs'], color='gold')

for i in range(sample_df.shape[0]):
    plt.text(sample_df['avg'].values[i],
             sample_df['strike_rate'].values[i],
             sample_df['batter'].values[i])
```

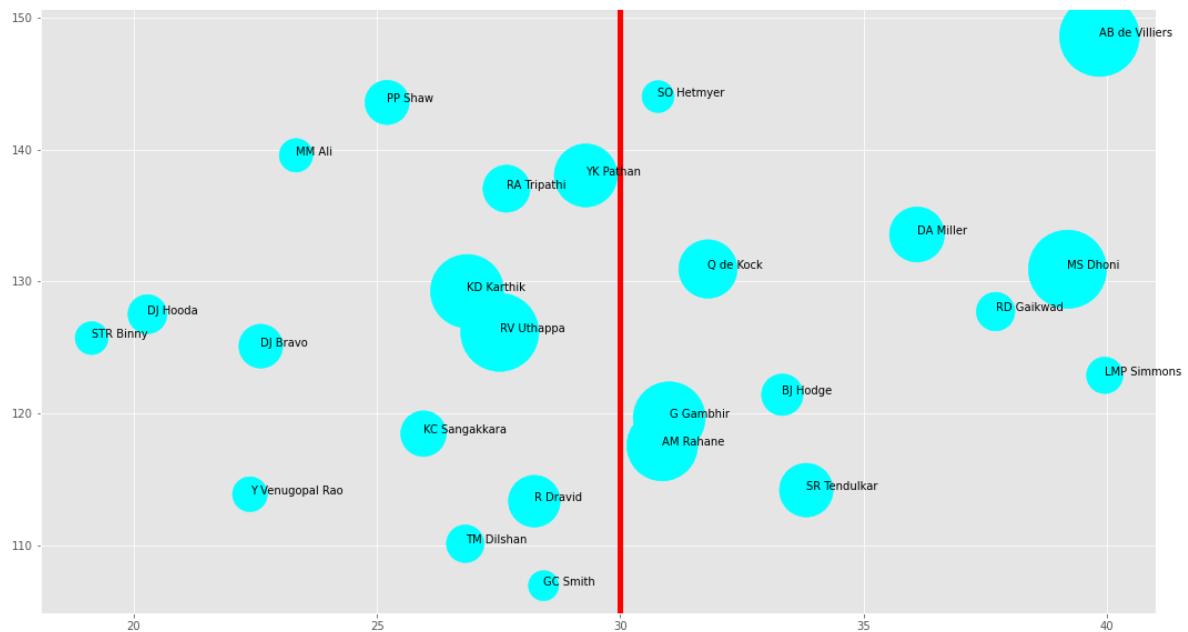


```
In [148]: plt.figure(figsize=(18,10))

plt.axvline(30, color ='red', linewidth=5) # Vertical line

plt.scatter(sample_df['avg'],sample_df['strike_rate'] ,
           s =sample_df['runs'], color ='cyan')

for i in range(sample_df.shape[0]):
    plt.text(sample_df['avg'].values[i],
             sample_df['strike_rate'].values[i],
             sample_df['batter'].values[i])
```

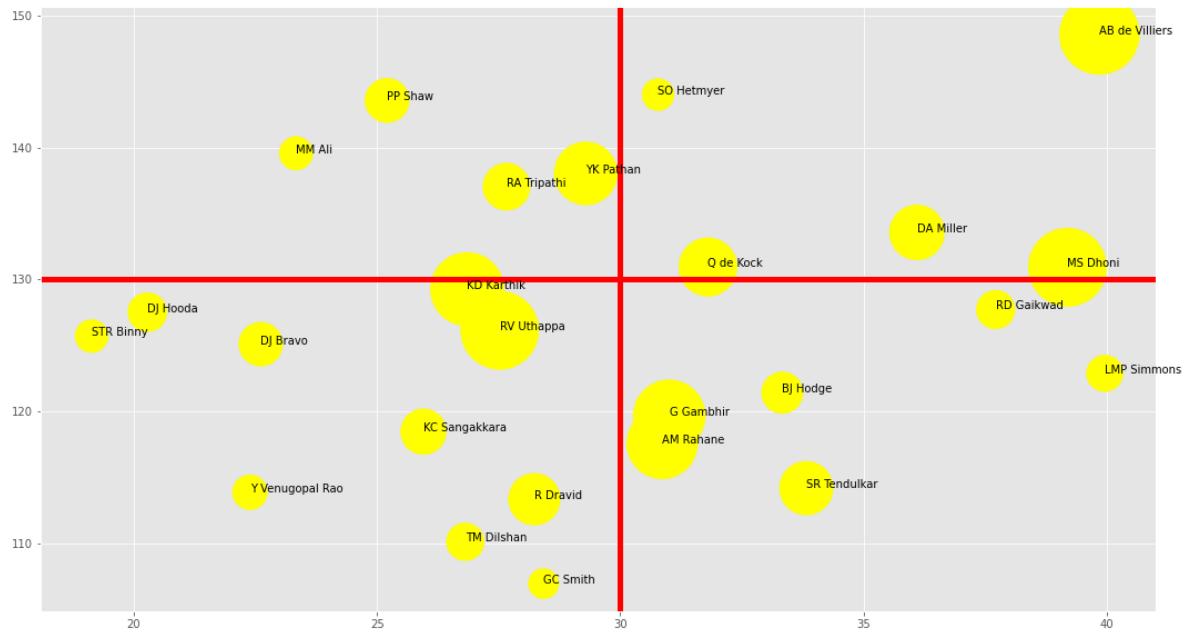


```
In [149]: plt.figure(figsize=(18,10))
```

```
plt.axhline(130, color ='red', linewidth=5) # Horizontal line
plt.axvline(30, color ='red', linewidth=5) # Vertical line

plt.scatter(sample_df['avg'],sample_df['strike_rate'] ,
           s =sample_df['runs'], color ='yellow')

for i in range(sample_df.shape[0]):
    plt.text(sample_df['avg'].values[i],
             sample_df['strike_rate'].values[i],
             sample_df['batter'].values[i])
```

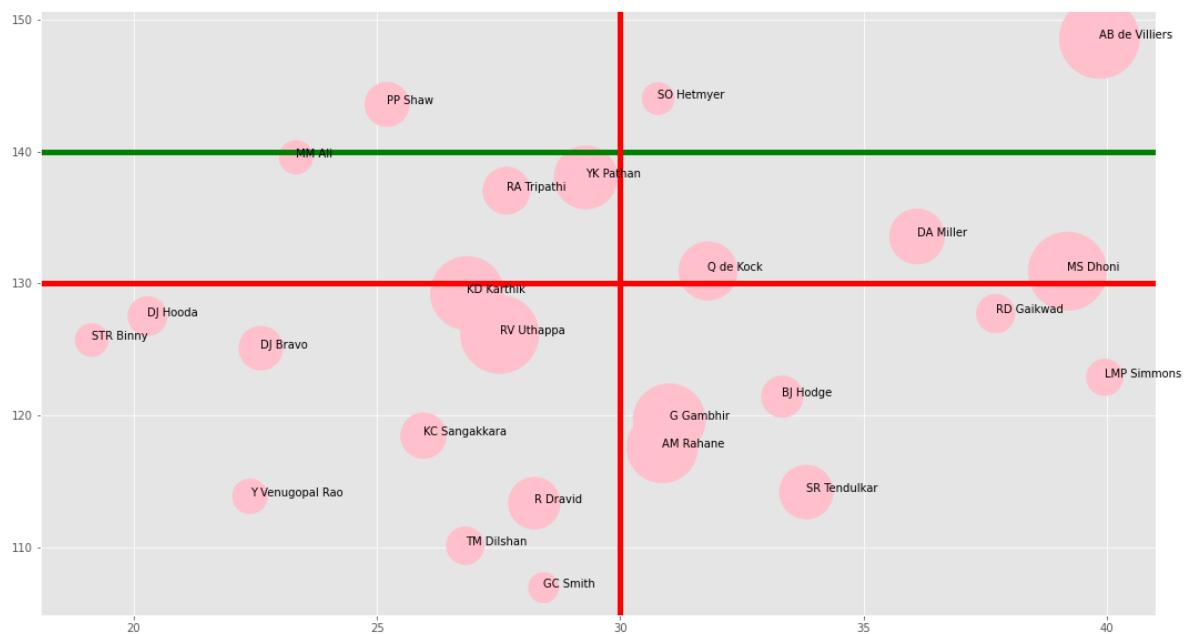


```
In [150]: plt.figure(figsize=(18,10))
```

```
plt.axhline(130, color ='red', linewidth=5) # Horizontal Line
plt.axhline(140, color ='green', linewidth=5) # EXTRA Horizontal Line
plt.axvline(30, color ='red', linewidth=5)

plt.scatter(sample_df['avg'],sample_df['strike_rate'] ,
           s =sample_df['runs'],color='pink')

for i in range(sample_df.shape[0]):
    plt.text(sample_df['avg'].values[i],
             sample_df['strike_rate'].values[i],
             sample_df['batter'].values[i])
```



## Subplots

```
In [22]: batter.head()
```

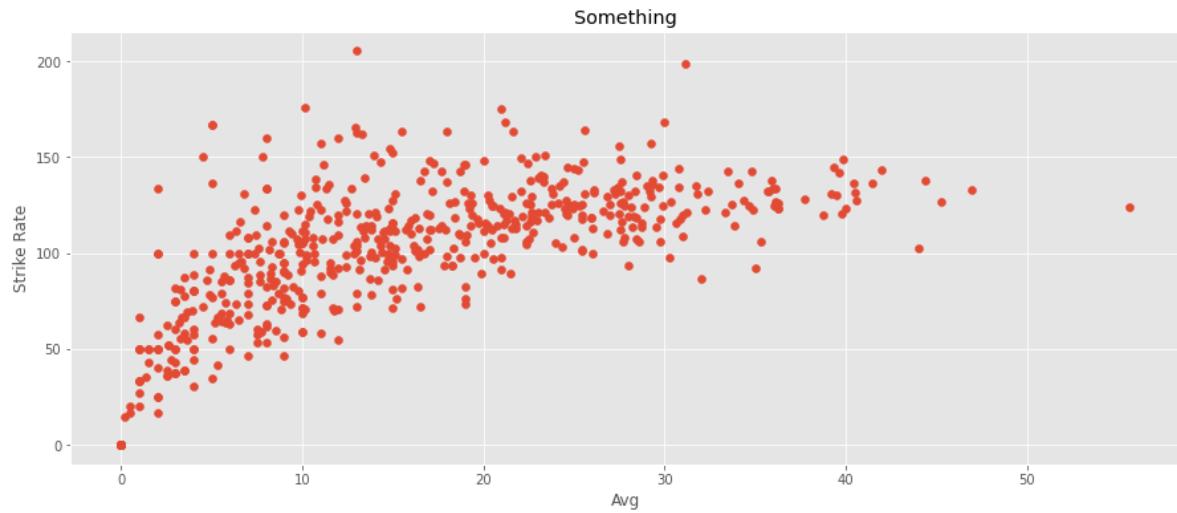
Out[22]:

	batter	runs	avg	strike_rate
0	V Kohli	6634	36.251366	125.977972
1	S Dhawan	6244	34.882682	122.840842
2	DA Warner	5883	41.429577	136.401577
3	RG Sharma	5881	30.314433	126.964594
4	SK Raina	5536	32.374269	132.535312

In [23]: # Normal way

```
plt.figure(figsize=(15,6))
plt.scatter(batter['avg'],batter['strike_rate'])
plt.title('Something')
plt.xlabel('Avg')
plt.ylabel('Strike Rate')

plt.show()
```



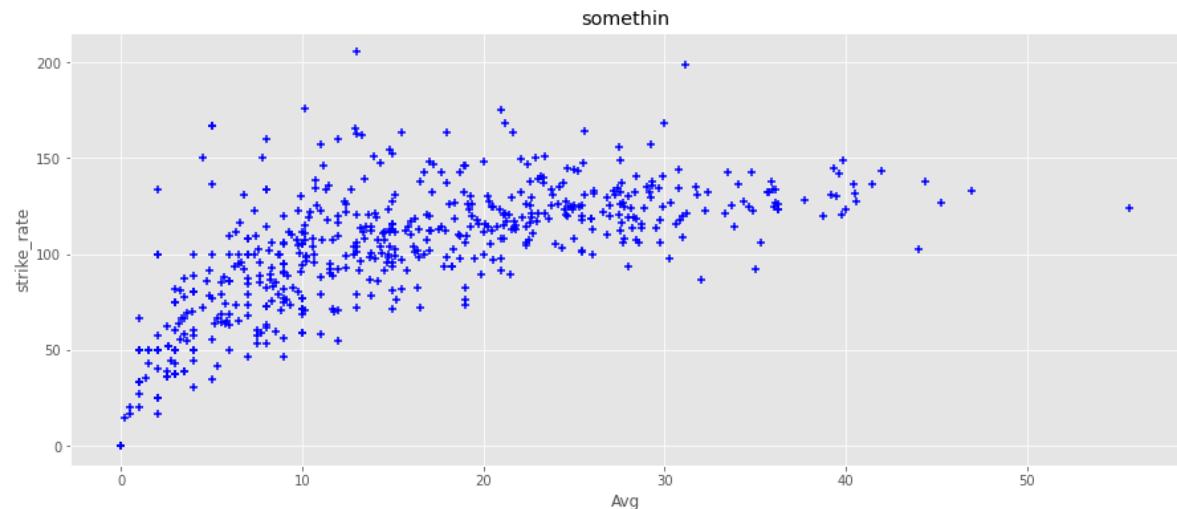
In [43]: fig, ax = plt.subplots(figsize=(15,6))

```
ax.scatter(batter['avg'],batter['strike_rate'] , color ='blue' , marker = '+')
ax.set_title('somethin')
ax.set_xlabel('Avg')
ax.set_ylabel('strike_rate')

fig.show()
```

C:\Users\user\AppData\Local\Temp\ipykernel\_14332\2843873373.py:8: UserWarning:  
g: Matplotlib is currently using module://matplotlib\_inline.backend\_inline, which is a non-GUI backend, so cannot show the figure.

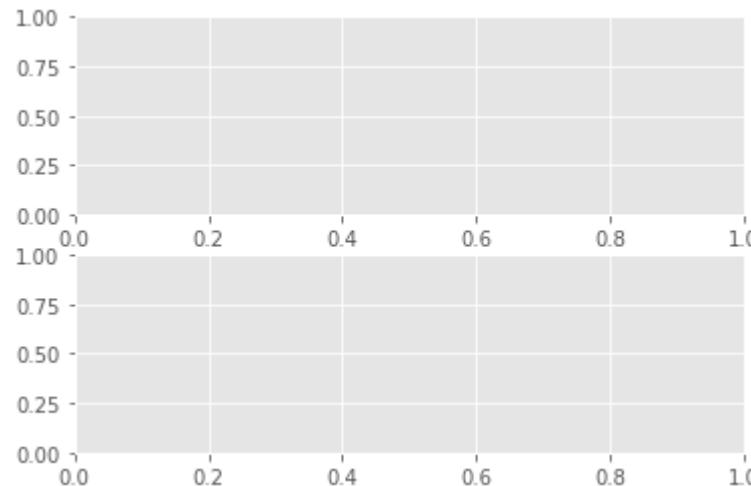
fig.show()



In [25]: # we can plot 2 graphs

```
plt.subplots(nrows=2, ncols =1)
```

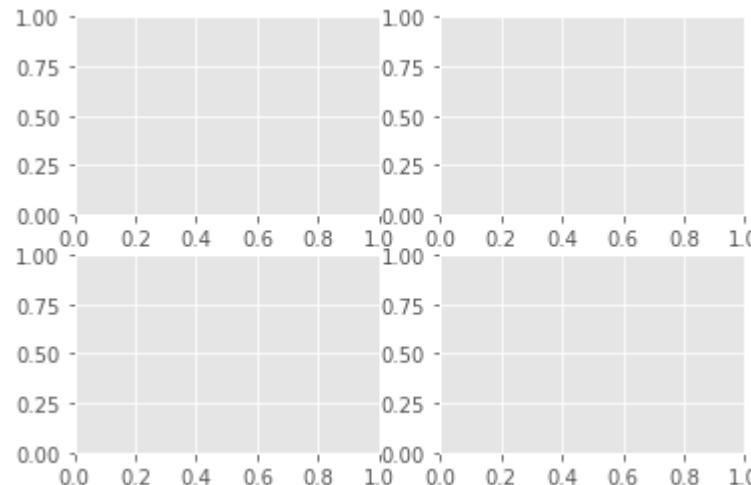
Out[25]: (<Figure size 432x288 with 2 Axes>, array([<AxesSubplot:>, <AxesSubplot:>], dtype=object))



In [26]: # we can want plot 4 graphs

```
plt.subplots(nrows=2, ncols =2)
```

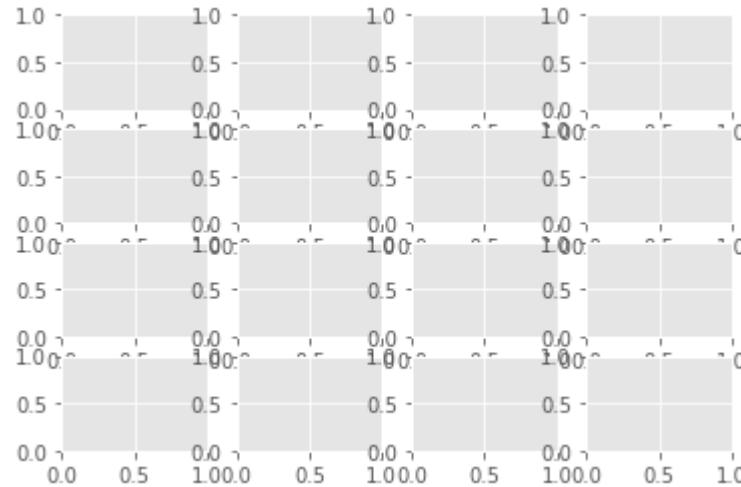
Out[26]: (<Figure size 432x288 with 4 Axes>, array([[<AxesSubplot:>, <AxesSubplot:>], [<AxesSubplot:>, <AxesSubplot:>]], dtype=object))



```
In [27]: # we can want plot 16 graphs
```

```
plt.subplots(nrows=4, ncols =4)
```

```
Out[27]: (<Figure size 432x288 with 16 Axes>,
array([[<AxesSubplot:>, <AxesSubplot:>, <AxesSubplot:>, <AxesSubplot:>],
       [<AxesSubplot:>, <AxesSubplot:>, <AxesSubplot:>, <AxesSubplot:>],
       [<AxesSubplot:>, <AxesSubplot:>, <AxesSubplot:>, <AxesSubplot:>],
       [<AxesSubplot:>, <AxesSubplot:>, <AxesSubplot:>, <AxesSubplot:>]],  
      dtype=object))
```



In [37]: # on Data

```
fig, ax = plt.subplots(nrows=2, ncols=1, sharex=True, figsize=(10,6))

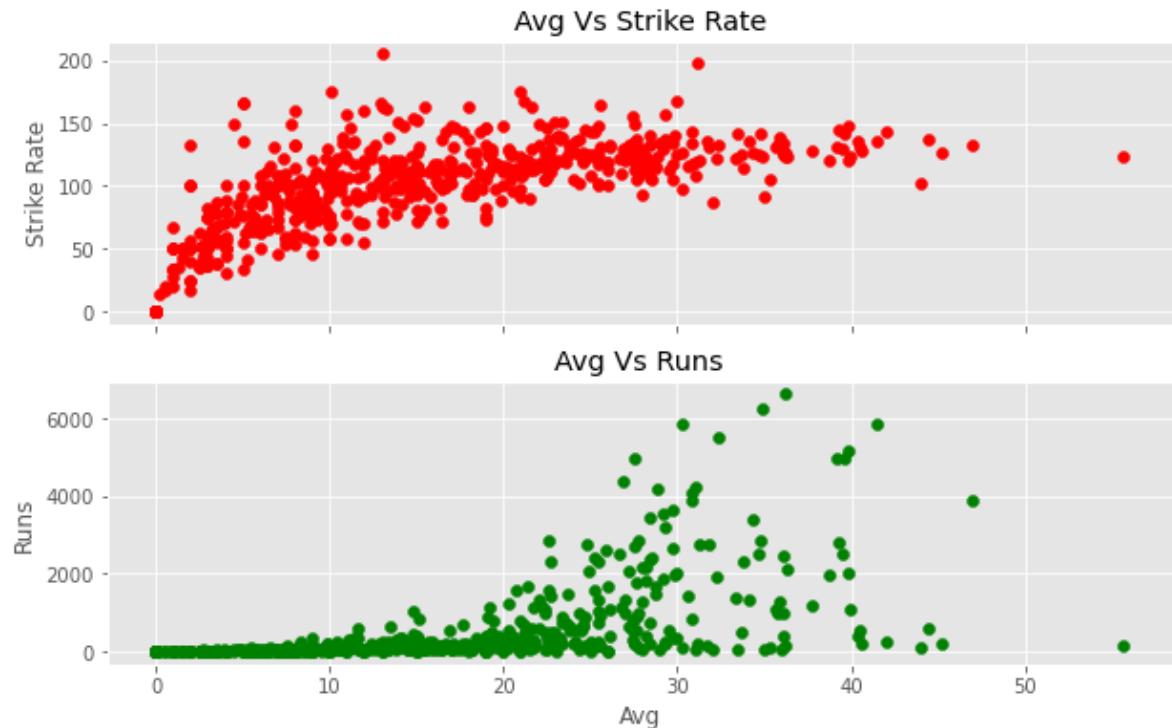
#sharex = Controls sharing of properties among x (*sharex*) or y (*sharey*)

# axis
ax[0].scatter(batter['avg'],batter['strike_rate'],color='red')
ax[1].scatter(batter['avg'],batter['runs'],color ='green')

ax[0].set_title('Avg Vs Strike Rate')
ax[0].set_ylabel('Strike Rate')

ax[1].set_title('Avg Vs Runs')
ax[1].set_xlabel('Avg')
ax[1].set_ylabel('Runs')
```

Out[37]: Text(0.5, 0, 'Avg')



```
In [29]: fig, ax = plt.subplots(nrows=2, ncols=2, figsize=(10,10))

# its 2D array we have to mention (0,0)(0,1)(1,0)(1,1)

ax[0,0].scatter(batter['avg'],batter['strike_rate']
                 ,color='red') # gives first set of axis

ax[0,1].scatter(batter['avg'],
                 batter['runs']
                 ,color='gold') # gives second set of axis

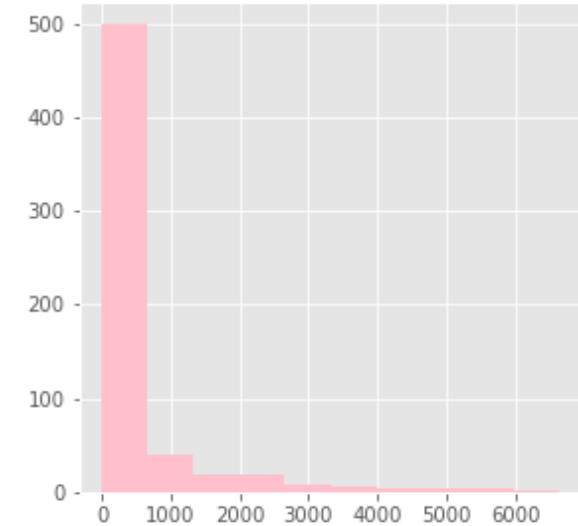
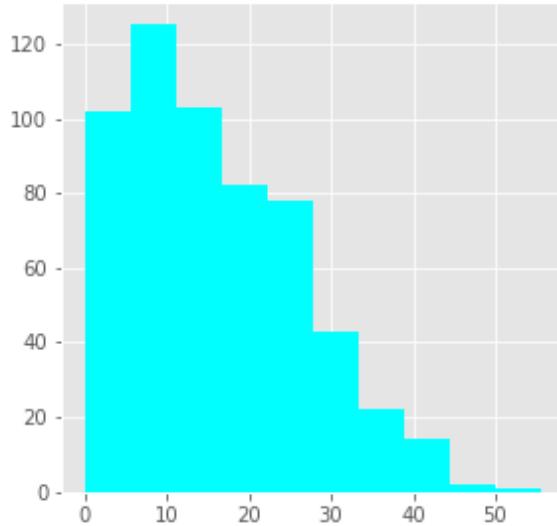
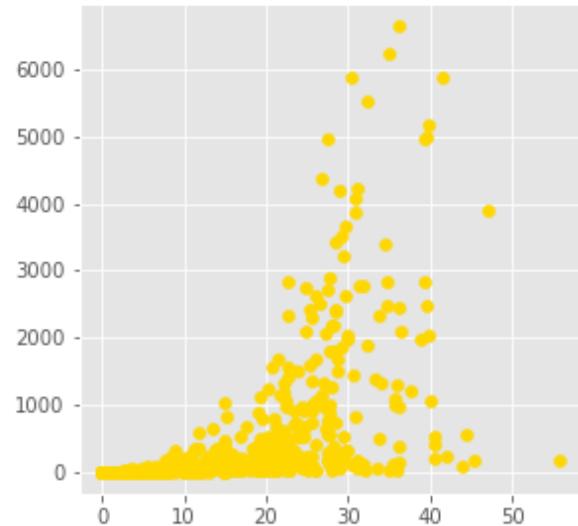
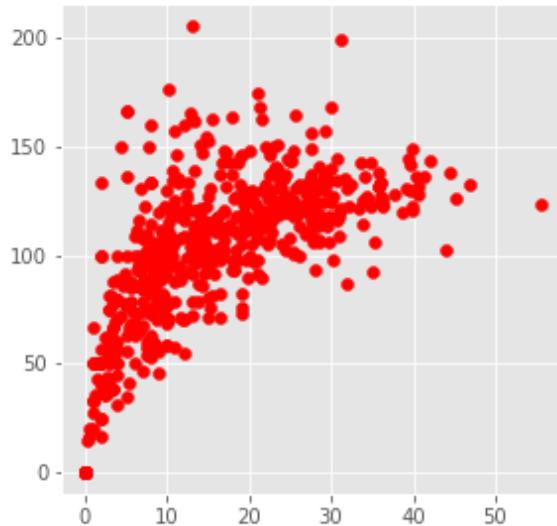
ax[1,0].hist(batter['avg'],color='cyan') # gives third set of axis

ax[1,1].hist(batter['runs'],color='pink') # gives fourth set of axis

fig.show()
```

C:\Users\user\AppData\Local\Temp\ipykernel\_14332\3464065883.py:16: UserWarning: Matplotlib is currently using module://matplotlib\_inline.backend\_inline, which is a non-GUI backend, so cannot show the figure.

```
fig.show()
```



In [36]: # Manual way of adding subplots

```
fig = plt.figure(figsize=(10,10))

ax1 = fig.add_subplot(2,2,1) #2 rows , 2 column , 1 graph
ax1.scatter(batter['avg'],batter['strike_rate'],color='red')

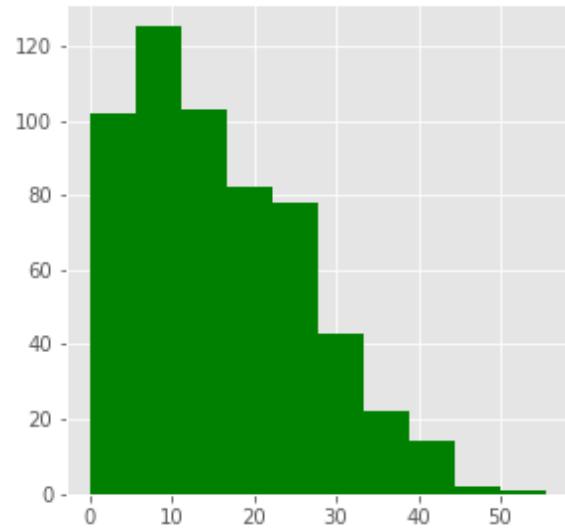
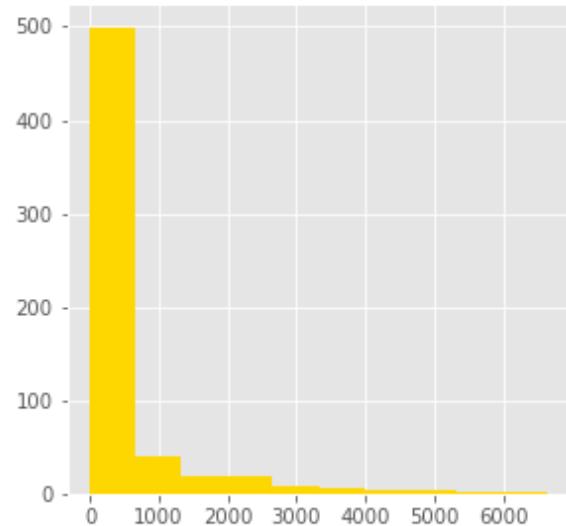
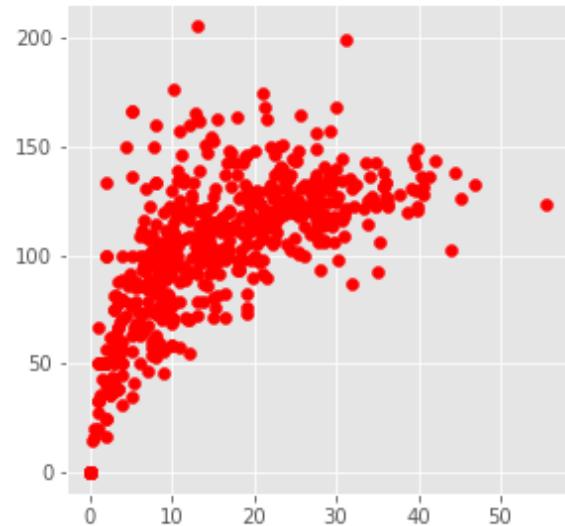
ax2 = fig.add_subplot(2,2,2) #2 rows , 2 column , 2 graph
ax2.hist(batter['runs'],color='gold')

ax3 = fig.add_subplot(2,2,3) #2 rows , 2 column , 3 graph
ax3.hist(batter['avg'],color ='green')

fig.show()
```

C:\Users\user\AppData\Local\Temp\ipykernel\_14332\2368418411.py:14: UserWarning: Matplotlib is currently using module://matplotlib\_inline.backend\_inline, which is a non-GUI backend, so cannot show the figure.

```
fig.show()
```



## 3D scatter plots

In [62]: batter

```
fig = plt.figure(figsize=(10,7))

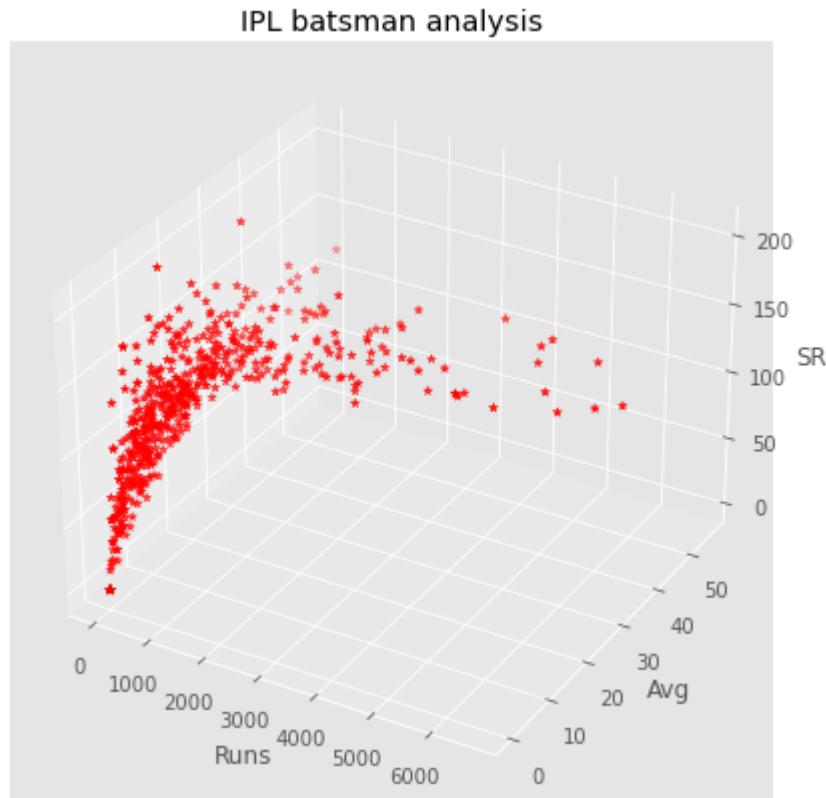
ax = plt.subplot(projection ='3d')

ax.scatter3D(batter['runs'],batter['avg'],batter['strike_rate'],
            color='red' , marker = '*')

ax.set_title('IPL batsman analysis')

ax.set_xlabel('Runs')
ax.set_ylabel('Avg')
ax.set_zlabel('SR')
```

Out[62]: Text(0.5, 0, 'SR')



## 3D Line plot

```
In [61]: x = [0,1,5,25]
y = [0,10,13,0]
z = [0,13,20,9]

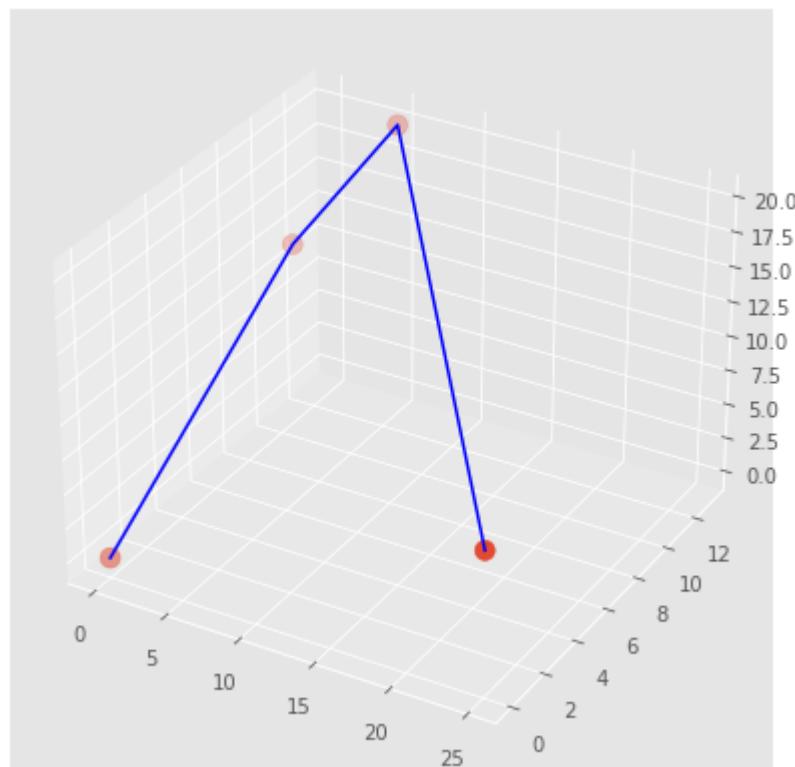
fig = plt.figure(figsize=(10,7))

ax = plt.subplot(projection='3d')

ax.scatter3D(x,y,z,s=[100,100,100,100])

ax.plot3D(x,y,z,color='blue')
```

Out[61]: [<mpl\_toolkits.mplot3d.art3d.Line3D at 0x25b48431250>]



## 3D surface Plot

```
In [63]: # Loss function x2 + y2

# Helpful in Machine Learning

x = np.linspace(-10,10,100)
y = np.linspace(-10,10,100)
```

In [64]: x

```
Out[64]: array([-10.        , -9.7979798 , -9.5959596 , -9.39393939,
 -9.19191919, -8.98989899, -8.78787879, -8.58585859,
 -8.38383838, -8.18181818, -7.97979798, -7.77777778,
 -7.57575758, -7.37373737, -7.17171717, -6.96969697,
 -6.76767677, -6.56565657, -6.36363636, -6.16161616,
 -5.95959596, -5.75757576, -5.55555556, -5.35353535,
 -5.15151515, -4.94949495, -4.74747475, -4.54545455,
 -4.34343434, -4.14141414, -3.93939394, -3.73737374,
 -3.53535354, -3.33333333, -3.13131313, -2.92929293,
 -2.72727273, -2.52525253, -2.32323232, -2.12121212,
 -1.91919192, -1.71717172, -1.51515152, -1.31313131,
 -1.11111111, -0.90909091, -0.70707071, -0.50505051,
 -0.3030303 , -0.1010101 , 0.1010101 , 0.3030303 ,
 0.50505051, 0.70707071, 0.90909091, 1.11111111,
 1.31313131, 1.51515152, 1.71717172, 1.91919192,
 2.12121212, 2.32323232, 2.52525253, 2.72727273,
 2.92929293, 3.13131313, 3.33333333, 3.53535354,
 3.73737374, 3.93939394, 4.14141414, 4.34343434,
 4.54545455, 4.74747475, 4.94949495, 5.15151515,
 5.35353535, 5.55555556, 5.75757576, 5.95959596,
 6.16161616, 6.36363636, 6.56565657, 6.76767677,
 6.96969697, 7.17171717, 7.37373737, 7.57575758,
 7.77777778, 7.97979798, 8.18181818, 8.38383838,
 8.58585859, 8.78787879, 8.98989899, 9.19191919,
 9.39393939, 9.5959596 , 9.7979798 , 10.        ])
```

In [65]: y

```
Out[65]: array([-10.        , -9.7979798 , -9.5959596 , -9.39393939,
 -9.19191919, -8.98989899, -8.78787879, -8.58585859,
 -8.38383838, -8.18181818, -7.97979798, -7.77777778,
 -7.57575758, -7.37373737, -7.17171717, -6.96969697,
 -6.76767677, -6.56565657, -6.36363636, -6.16161616,
 -5.95959596, -5.75757576, -5.55555556, -5.35353535,
 -5.15151515, -4.94949495, -4.74747475, -4.54545455,
 -4.34343434, -4.14141414, -3.93939394, -3.73737374,
 -3.53535354, -3.33333333, -3.13131313, -2.92929293,
 -2.72727273, -2.52525253, -2.32323232, -2.12121212,
 -1.91919192, -1.71717172, -1.51515152, -1.31313131,
 -1.11111111, -0.90909091, -0.70707071, -0.50505051,
 -0.3030303 , -0.1010101 , 0.1010101 , 0.3030303 ,
 0.50505051, 0.70707071, 0.90909091, 1.11111111,
 1.31313131, 1.51515152, 1.71717172, 1.91919192,
 2.12121212, 2.32323232, 2.52525253, 2.72727273,
 2.92929293, 3.13131313, 3.33333333, 3.53535354,
 3.73737374, 3.93939394, 4.14141414, 4.34343434,
 4.54545455, 4.74747475, 4.94949495, 5.15151515,
 5.35353535, 5.55555556, 5.75757576, 5.95959596,
 6.16161616, 6.36363636, 6.56565657, 6.76767677,
 6.96969697, 7.17171717, 7.37373737, 7.57575758,
 7.77777778, 7.97979798, 8.18181818, 8.38383838,
 8.58585859, 8.78787879, 8.98989899, 9.19191919,
 9.39393939, 9.5959596 , 9.7979798 , 10.        ])
```

```
In [66]: np.meshgrid(x,y)
```

```
Out[66]: [array([[ -10.         ,  -9.7979798,  -9.5959596, ... , 9.5959596,
   9.7979798,  10.        ],
 [-10.         ,  -9.7979798,  -9.5959596, ... , 9.5959596,
  9.7979798,  10.        ],
 [-10.         ,  -9.7979798,  -9.5959596, ... , 9.5959596,
  9.7979798,  10.        ],
 ... ,
 [-10.         ,  -9.7979798,  -9.5959596, ... , 9.5959596,
  9.7979798,  10.        ],
 [-10.         ,  -9.7979798,  -9.5959596, ... , 9.5959596,
  9.7979798,  10.        ],
 [-10.         ,  -9.7979798,  -9.5959596, ... , 9.5959596,
  9.7979798,  10.        ]]),
 array([[ -10.         , -10.         , -10.         , ... , -10.         ,
 -10.         , -10.        ],
 [-9.7979798,  -9.7979798,  -9.7979798, ... , -9.7979798,
 -9.7979798,  -9.7979798],
 [-9.5959596,  -9.5959596,  -9.5959596, ... , -9.5959596,
 -9.5959596,  -9.5959596],
 ... ,
 [ 9.5959596,   9.5959596,   9.5959596, ... , 9.5959596,
  9.5959596,  9.5959596],
 [ 9.7979798,   9.7979798,   9.7979798, ... , 9.7979798,
  9.7979798,  9.7979798],
 [ 10.         ,  10.         ,  10.         , ... , 10.         ,
 10.         ,  10.        ]])]
```

```
In [67]: # Mesh grid
```

```
xx,yy = np.meshgrid(x,y)
```

```
In [68]: xx.shape
```

Out[68]: (100, 100)

```
In [69]: yy.shape
```

Out[69]: (100, 100)

```
In [83]: z = xx**2 + yy**2
```

In [71]: z.shape

Out[71]: (100, 100)

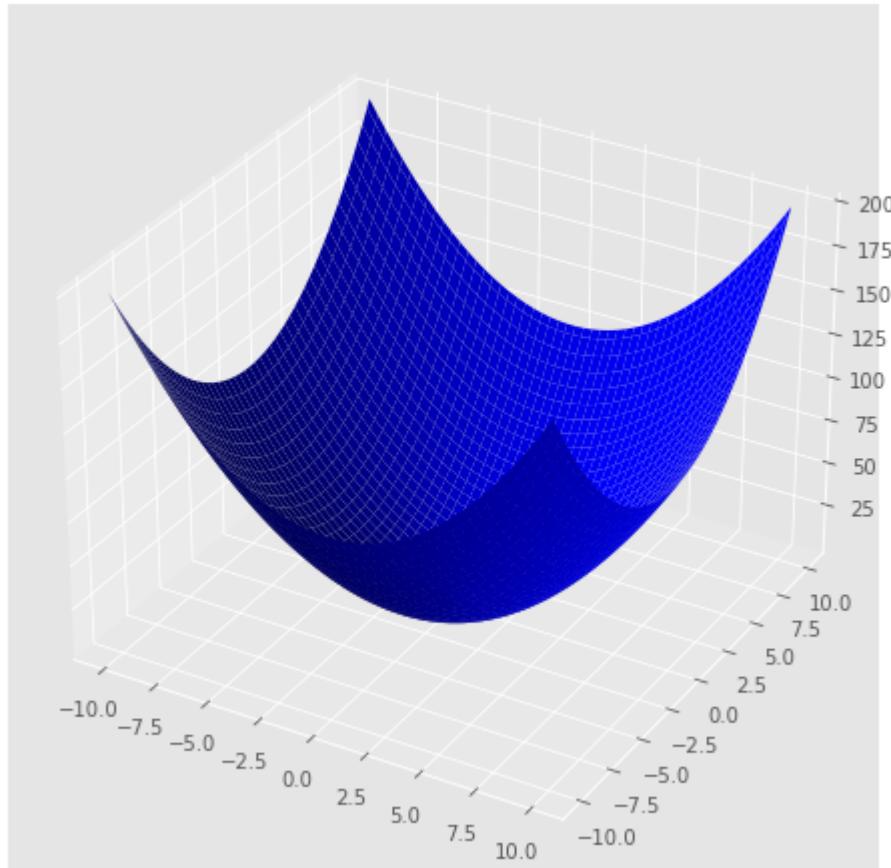
In [76]: # 3D Surface Plot

```
fig = plt.figure(figsize =(12,8))

ax = plt.subplot(projection = '3d')

ax.plot_surface(xx,yy,z, color ='blue')
```

Out[76]: <mpl\_toolkits.mplot3d.art3d.Poly3DCollection at 0x25b4c7d0c40>



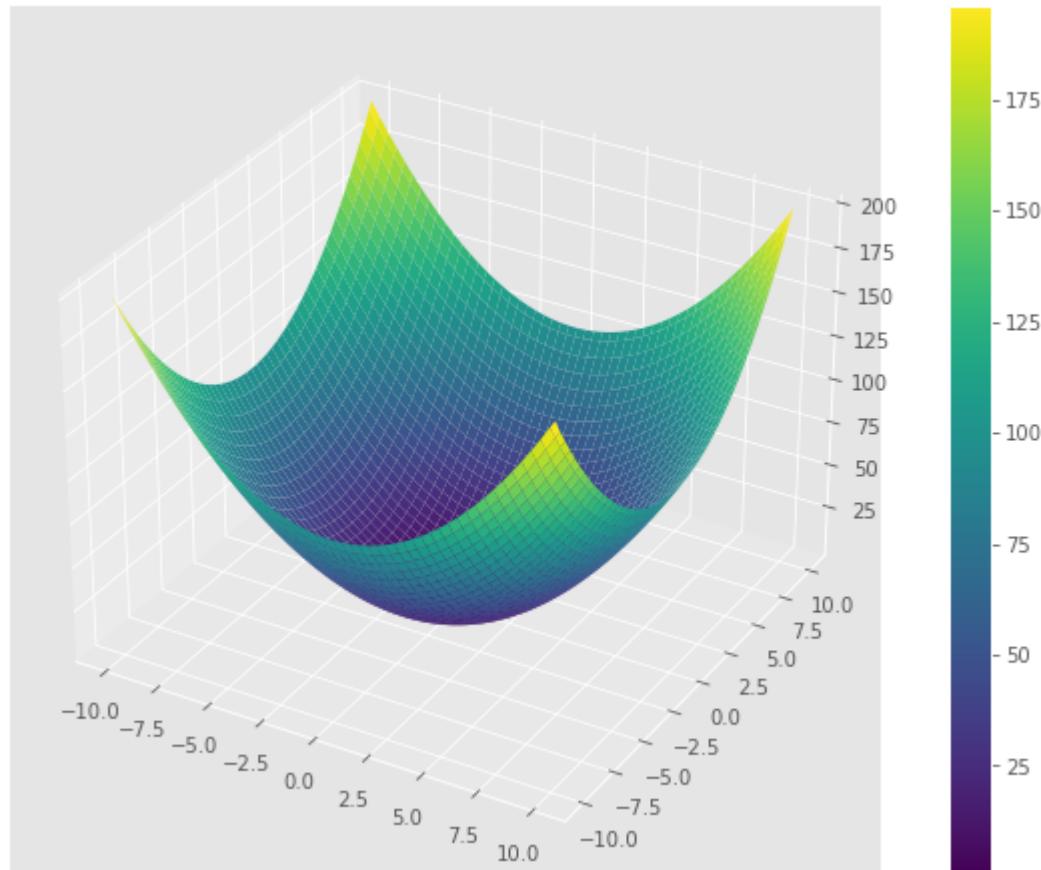
In [74]: # Adding theme

```
fig = plt.figure(figsize=(12,8))

ax = plt.subplot(projection='3d')

p = ax.plot_surface(xx,yy,z,cmap='viridis')
fig.colorbar(p)
```

Out[74]: <matplotlib.colorbar.Colorbar at 0x25b48466d90>



```
In [79]: z = np.sin(xx) + np.cos(yy)

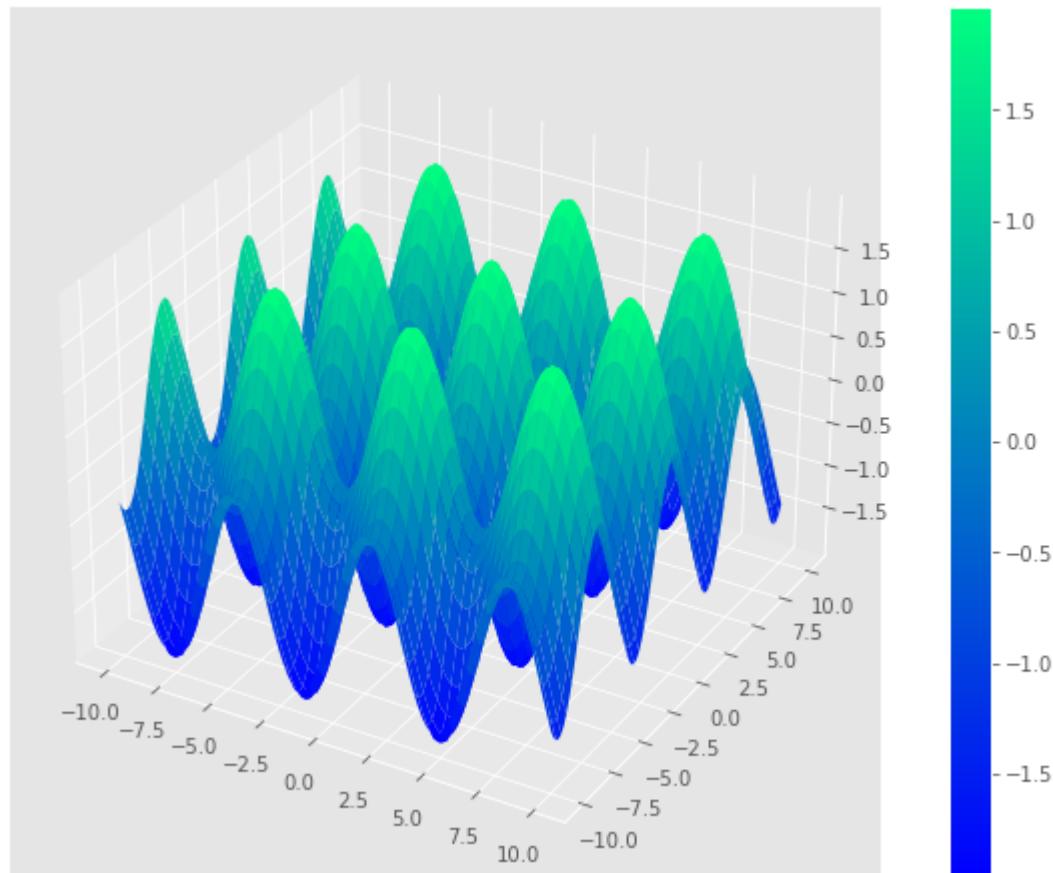
fig = plt.figure(figsize=(12,8))

ax = plt.subplot(projection='3d')

p = ax.plot_surface(xx,yy,z,cmap='winter')

fig.colorbar(p)
```

Out[79]: <matplotlib.colorbar.Colorbar at 0x25b4e03a220>



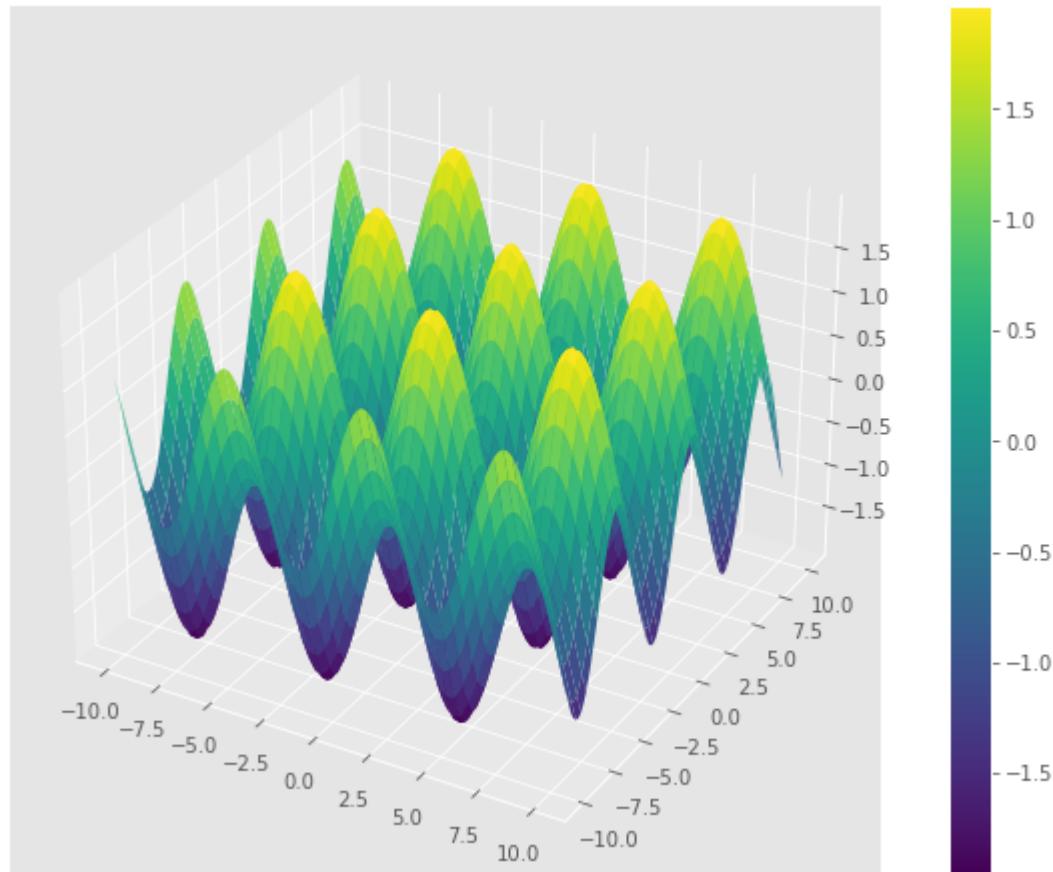
```
In [82]: z = np.sin(xx) + np.sin(yy)

fig = plt.figure(figsize=(12,8))

ax = plt.subplot(projection='3d')

p = ax.plot_surface(xx,yy,z,cmap='viridis')
fig.colorbar(p)
```

Out[82]: <matplotlib.colorbar.Colorbar at 0x25b4e877a30>



## Contour Plots

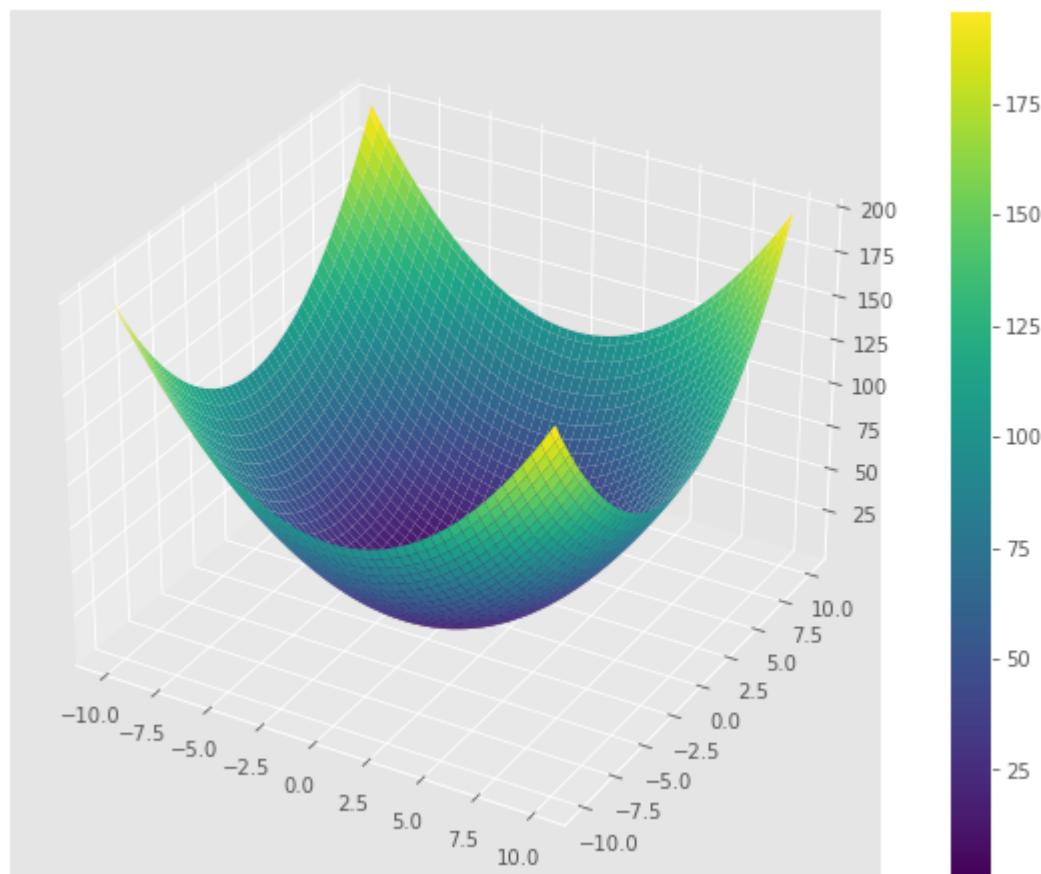
In [84]: # Representing 3D to 2d

```
#3D graph
fig = plt.figure(figsize=(12,8))

ax = plt.subplot(projection='3d')

p = ax.plot_surface(xx,yy,z,cmap='viridis')
fig.colorbar(p)
```

Out[84]: <matplotlib.colorbar.Colorbar at 0x25b4ebe94f0>



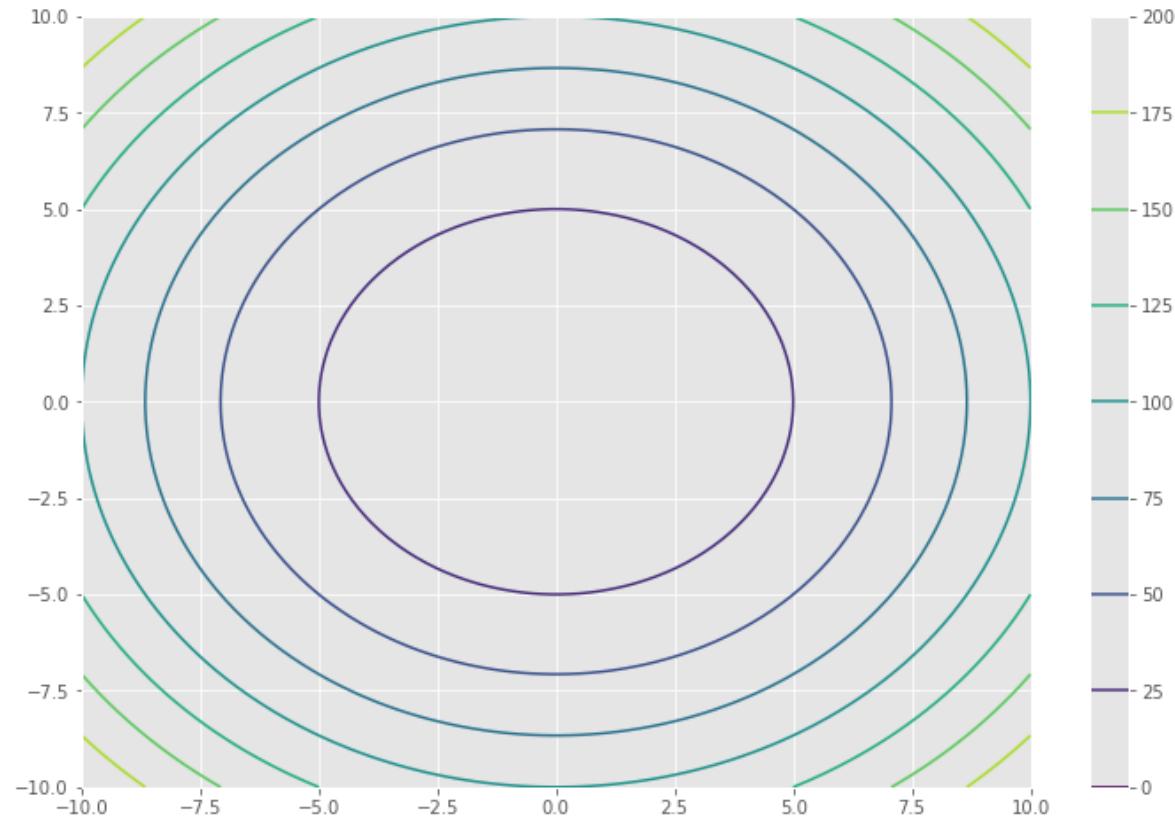
In [86]: # Contour Plot

```
fig = plt.figure(figsize=(12,8))

ax = plt.subplot()

p = ax.contour(xx,yy,z,cmap='viridis')
fig.colorbar(p)
```

Out[86]: <matplotlib.colorbar.Colorbar at 0x25b4fe9bc40>



## Contour Plot

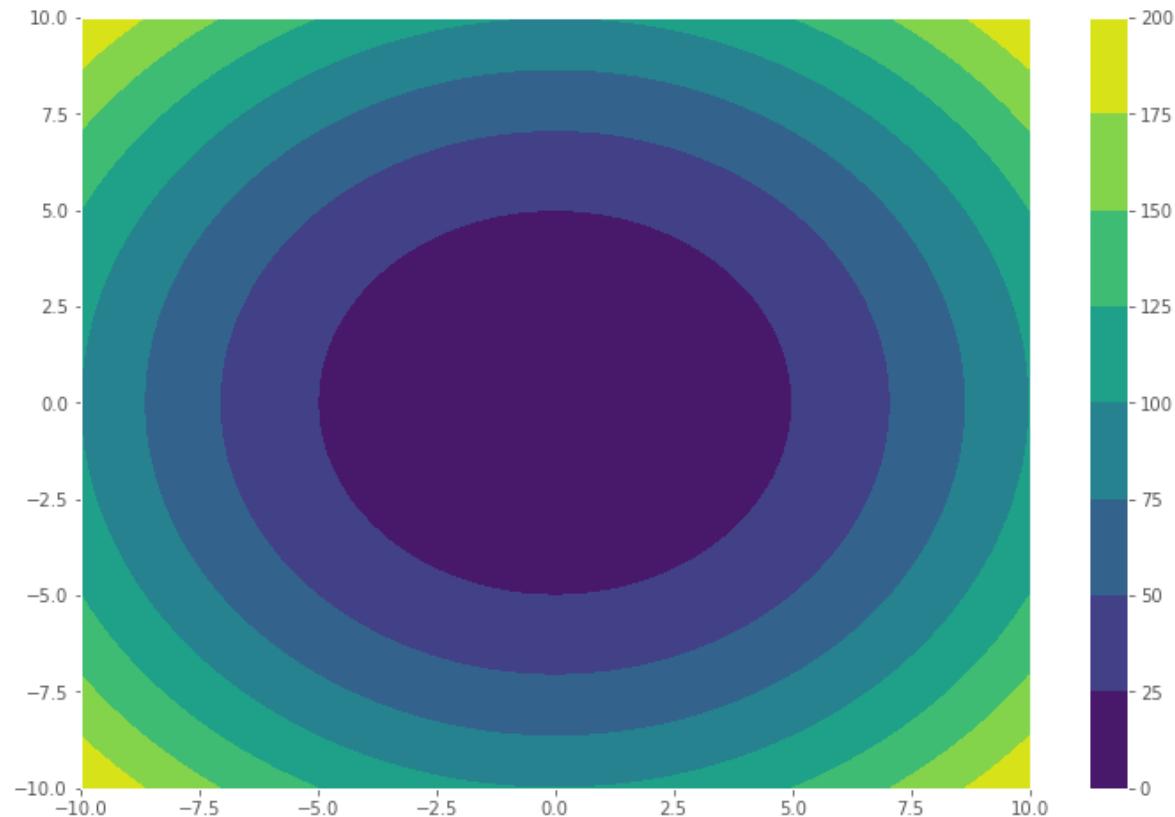
```
In [87]: fig = plt.figure(figsize=(12,8))

ax = plt.subplot()

p = ax.contourf(xx,yy,z,cmap='viridis')
fig.colorbar(p)

# Here blue colour is bend/shallow and yellow is up/top in 3D
```

Out[87]: <matplotlib.colorbar.Colorbar at 0x25b502ccb80>



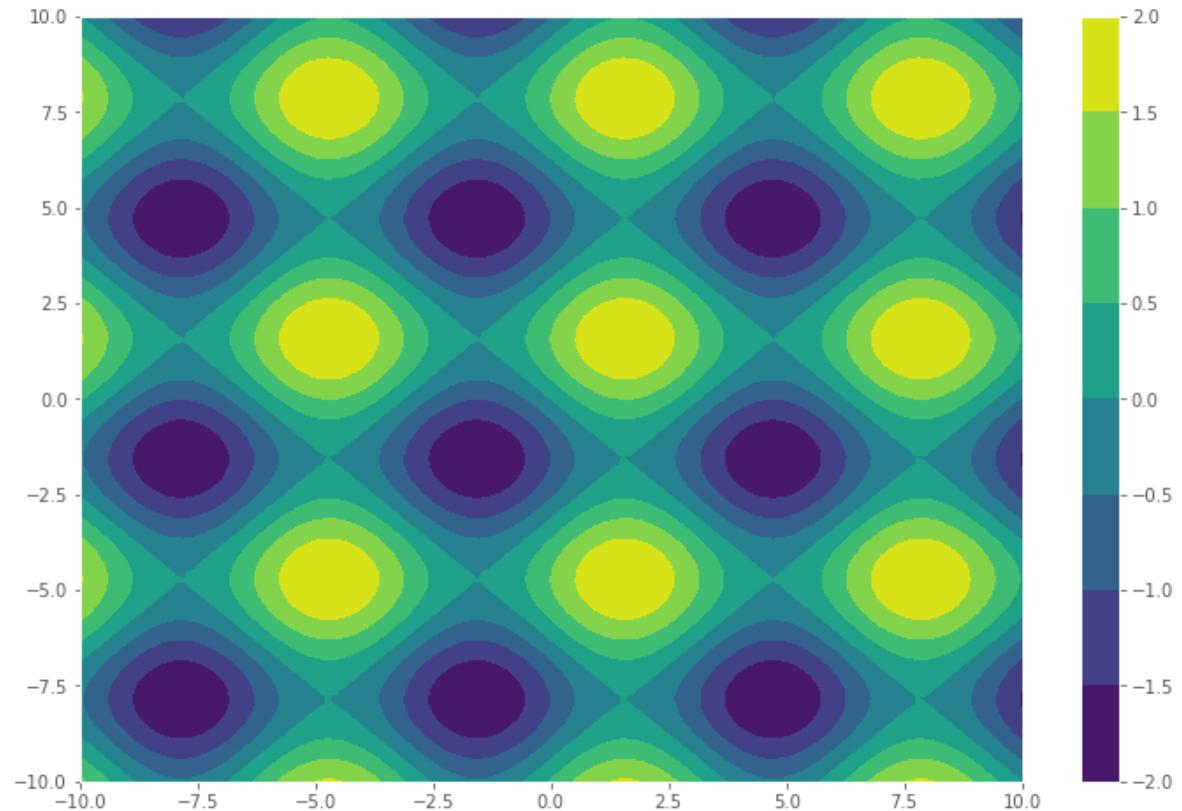
```
In [88]: z = np.sin(xx) + np.sin(yy)

fig = plt.figure(figsize=(12,8))

ax = plt.subplot()

p = ax.contourf(xx,yy,z,cmap='viridis')
fig.colorbar(p)
```

Out[88]: <matplotlib.colorbar.Colorbar at 0x25b506709a0>



## Heat map

```
In [90]: delivery = pd.read_csv("IPL_Ball_by_Ball_2008_2022.csv")
```

In [91]: `delivery.head()`

Out[91]:

	ID	innings	overs	ballnumber	batter	bowler	non-striker	extra_type	batsman_run	extra_runs
0	1312200	1	0	1	YBK Jaiswal	Mohammed Shami	JC Buttler	NaN	0	0
1	1312200	1	0	2	YBK Jaiswal	Mohammed Shami	JC Buttler	legbyes	0	0
2	1312200	1	0	3	JC Buttler	Mohammed Shami	YBK Jaiswal	NaN	1	0
3	1312200	1	0	4	YBK Jaiswal	Mohammed Shami	JC Buttler	NaN	0	0
4	1312200	1	0	5	YBK Jaiswal	Mohammed Shami	JC Buttler	NaN	0	0

◀ ▶

In [92]: `temp_df = delivery[(delivery['ballnumber'].isin([1,2,3,4,5,6])) & (delivery['batsman_run']==6)]`

In [94]: `temp_df.sample()`

Out[94]:

	ID	innings	overs	ballnumber	batter	bowler	non-striker	extra_type	batsman_run	extra_runs
134037	598062		1	15	3	MS Dhoni	A Nehra	RA Jadeja	NaN	6

◀ ▶

In [95]: `grid = temp_df.pivot_table(index='overs',columns='ballnumber', values='batsman_run',aggfunc='count')`

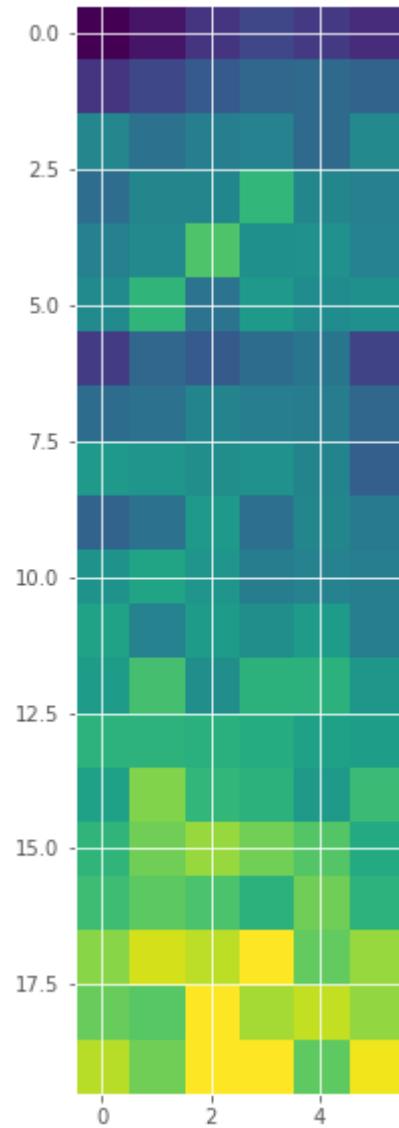
In [96]: grid

Out[96]:

ballnumber	1	2	3	4	5	6
overs						
0	9	17	31	39	33	27
1	31	40	49	56	58	54
2	75	62	70	72	58	76
3	60	74	74	103	74	71
4	71	76	112	80	81	72
5	77	102	63	86	78	80
6	34	56	49	59	64	38
7	59	62	73	70	69	56
8	86	83	79	81	73	52
9	54	62	86	61	74	67
10	82	92	83	69	72	70
11	91	72	87	79	87	70
12	87	109	79	100	100	84
13	101	101	99	97	90	88
14	90	124	103	100	86	106
15	102	120	129	121	113	96
16	107	115	111	100	120	101
17	126	142	137	151	117	129
18	118	114	151	132	138	128
19	136	120	151	151	116	148

```
In [99]: plt.figure(figsize=(20,10))
plt.imshow(grid)
```

```
Out[99]: <matplotlib.image.AxesImage at 0x25b506e4760>
```



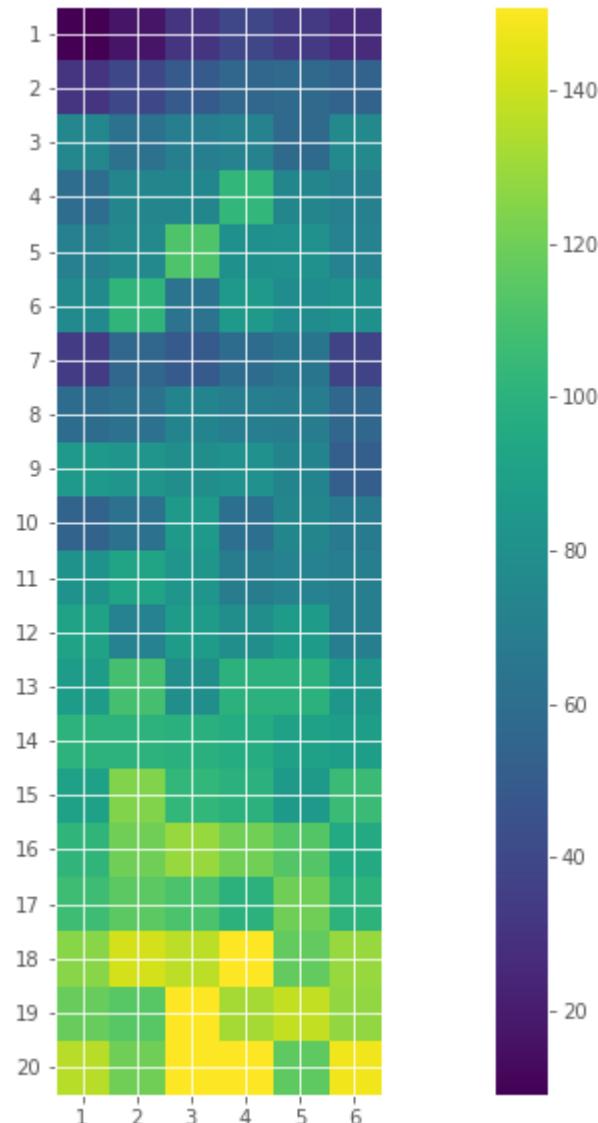
```
In [100]: plt.figure(figsize=(20,10))
plt.imshow(grid)

plt.yticks(delivery['overs'].unique(), list(range(1,21)))

plt.xticks(np.arange(0,6), list(range(1,7)))

plt.colorbar()
```

```
Out[100]: <matplotlib.colorbar.Colorbar at 0x25b50c9e100>
```

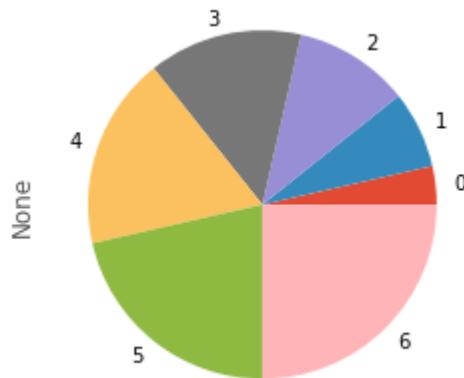


## Pandas Plot

In [101]: # on a series

```
s = pd.Series([1,2,3,4,5,6,7])
s.plot(kind='pie')
```

Out[101]: <AxesSubplot:ylabel='None'>



In [106]: # can be used on a dataframe as well

```
import seaborn as sns
tips = sns.load_dataset('tips')
tips.head()
```

Out[106]:

	total_bill	tip	sex	smoker	day	time	size	
0	16.99	1.01	Female		No	Sun	Dinner	2
1	10.34	1.66	Male		No	Sun	Dinner	3
2	21.01	3.50	Male		No	Sun	Dinner	3
3	23.68	3.31	Male		No	Sun	Dinner	2
4	24.59	3.61	Female		No	Sun	Dinner	4

In [108]: tips['size'] = tips['size'] \* 100

In [109]: `tips.head()`

Out[109]:

	total_bill	tip	sex	smoker	day	time	size
0	16.99	1.01	Female	No	Sun	Dinner	200
1	10.34	1.66	Male	No	Sun	Dinner	300
2	21.01	3.50	Male	No	Sun	Dinner	300
3	23.68	3.31	Male	No	Sun	Dinner	200
4	24.59	3.61	Female	No	Sun	Dinner	400

In [110]: `# Scatter plot -> labels -> markers -> figsize -> color -> cmap`

```
tips.plot(kind='scatter',x='total_bill',y='tip',
          title='Cost Analysis',marker='+',
          figsize=(10,6),s='size',c='sex',
          cmap='viridis')
```

Out[110]: <AxesSubplot:title={'center':'Cost Analysis'}, xlabel='total\_bill', ylabel='tip'>



## 2d plot

In [111]:

```
# dataset = 'https://raw.githubusercontent.com/m-mehdi/pandas_tutorials/main/w
stocks = pd.read_csv('https://raw.githubusercontent.com/m-mehdi/pandas_tutoria
stocks.head()
```

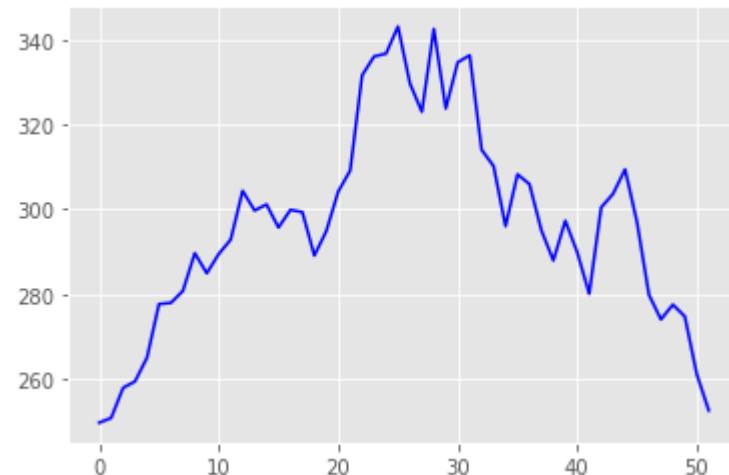
Out[111]:

	Date	MSFT	FB	AAPL
0	2021-05-24	249.679993	328.730011	124.610001
1	2021-05-31	250.789993	330.350006	125.889999
2	2021-06-07	257.890015	331.260010	127.349998
3	2021-06-14	259.429993	329.660004	130.460007
4	2021-06-21	265.019989	341.369995	133.110001

In [118]:

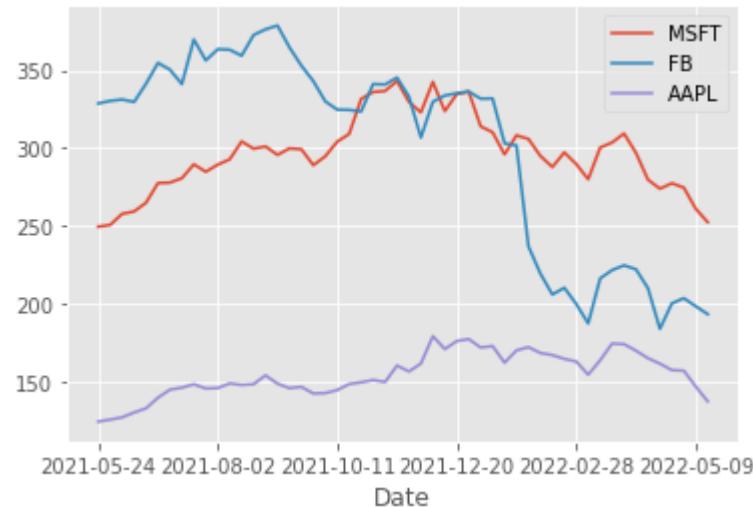
```
# Line plot
stocks['MSFT'].plot(kind='line', color ='blue')
```

Out[118]:



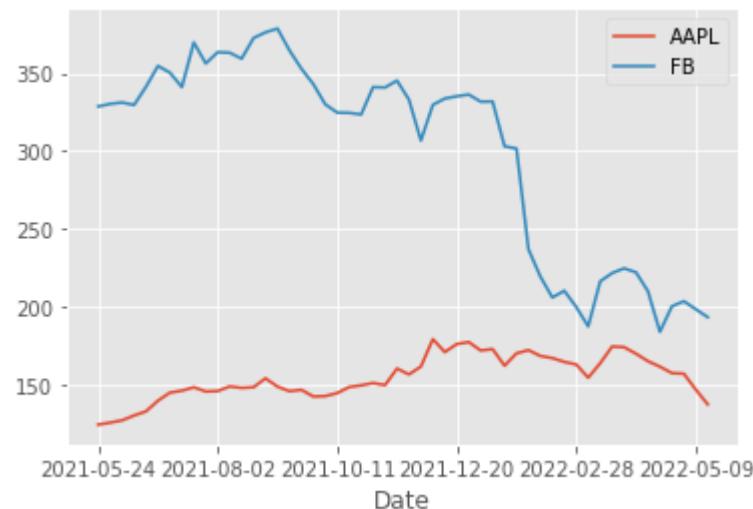
```
In [113]: stocks.plot(kind='line',x='Date')
```

```
Out[113]: <AxesSubplot:xlabel='Date'>
```



```
In [114]: stocks[['Date','AAPL','FB']].plot(kind='line',x='Date')
```

```
Out[114]: <AxesSubplot:xlabel='Date'>
```



## bar chart

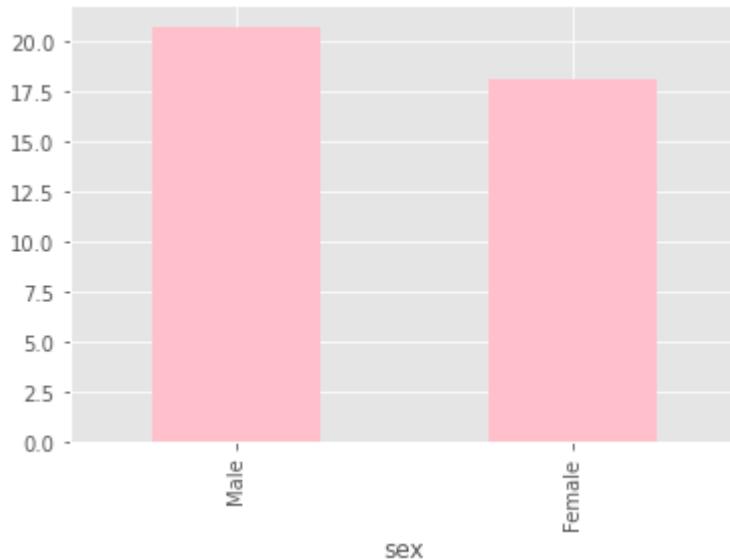
```
In [115]: # bar chart -> single -> horizontal -> multiple  
# using tips  
temp = pd.read_csv("batsman_season_record.csv")  
temp.head()
```

Out[115]:

	batsman	2015	2016	2017
0	AB de Villiers	513	687	216
1	DA Warner	562	848	641
2	MS Dhoni	372	284	290
3	RG Sharma	482	489	333
4	V Kohli	505	973	308

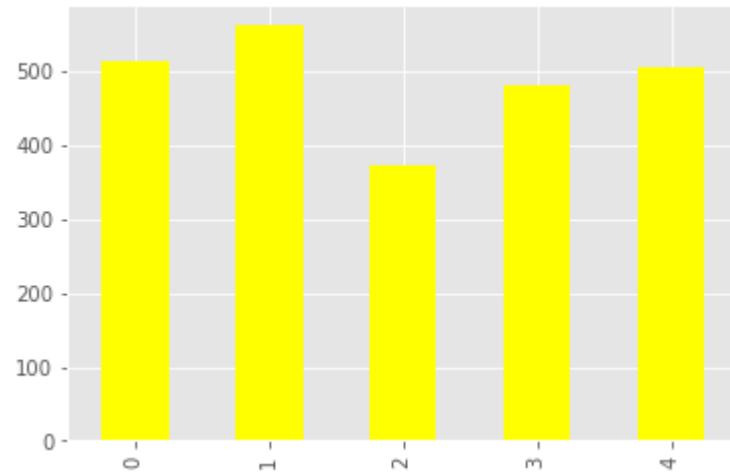
```
In [119]: tips.groupby('sex')['total_bill'].mean().plot(kind='bar', color ='pink')
```

Out[119]: <AxesSubplot:xlabel='sex'>



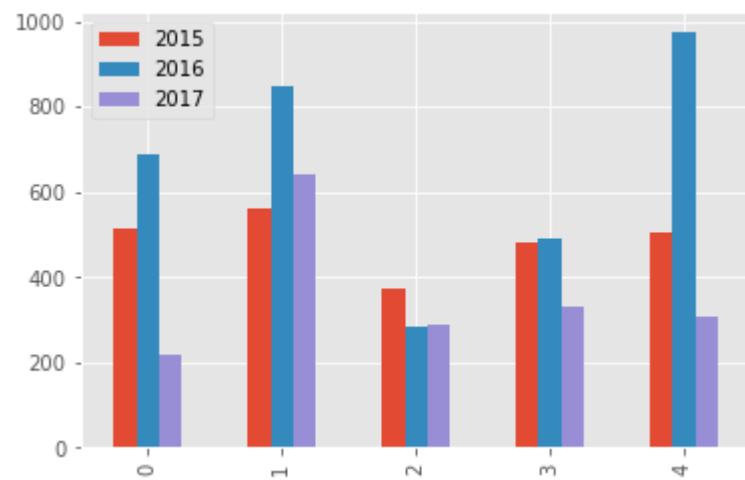
```
In [117]: temp['2015'].plot(kind='bar',color = 'yellow')
```

```
Out[117]: <AxesSubplot:>
```



```
In [120]: temp.plot(kind='bar')
```

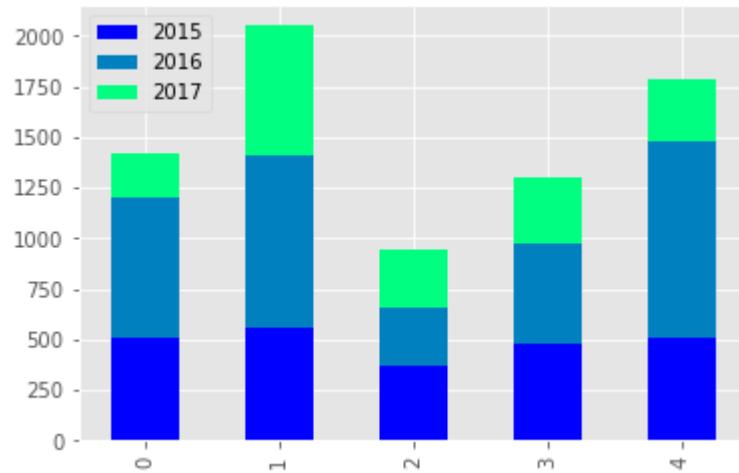
```
Out[120]: <AxesSubplot:>
```



```
In [126]: # stacked bar chart
```

```
temp.plot(kind='bar',stacked=True , colormap ='winter')
```

```
Out[126]: <AxesSubplot:>
```

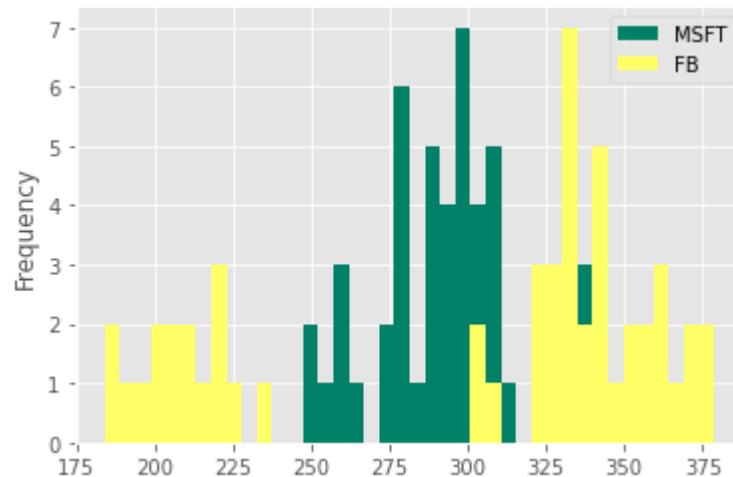


## Histogram

```
In [125]: # using stocks
```

```
stocks[['MSFT','FB']].plot(kind='hist',bins=40 , colormap ='summer')
```

```
Out[125]: <AxesSubplot:ylabel='Frequency'>
```



## Pie chart

In [127]: # single and multiple

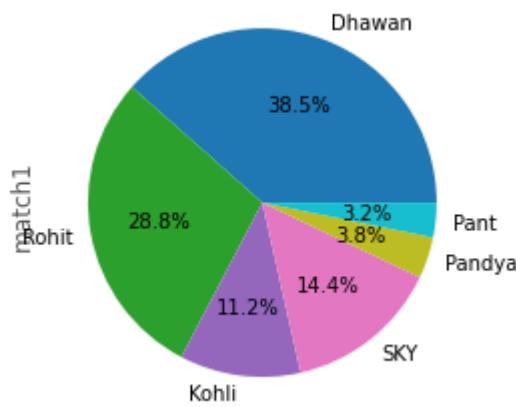
```
df = pd.DataFrame(
{
    'batsman': ['Dhawan', 'Rohit', 'Kohli', 'SKY', 'Pandya', 'Pant'],
    'match1': [120, 90, 35, 45, 12, 10],
    'match2': [0, 1, 123, 130, 34, 45],
    'match3': [50, 24, 145, 45, 10, 90]
})
df.head()
```

Out[127]:

	batsman	match1	match2	match3
0	Dhawan	120	0	50
1	Rohit	90	1	24
2	Kohli	35	123	145
3	SKY	45	130	45
4	Pandya	12	34	10

In [130]: df['match1'].plot(kind='pie',
 labels=df['batsman'].values, autopct='%0.1f%%',
 colormap= 'tab10')

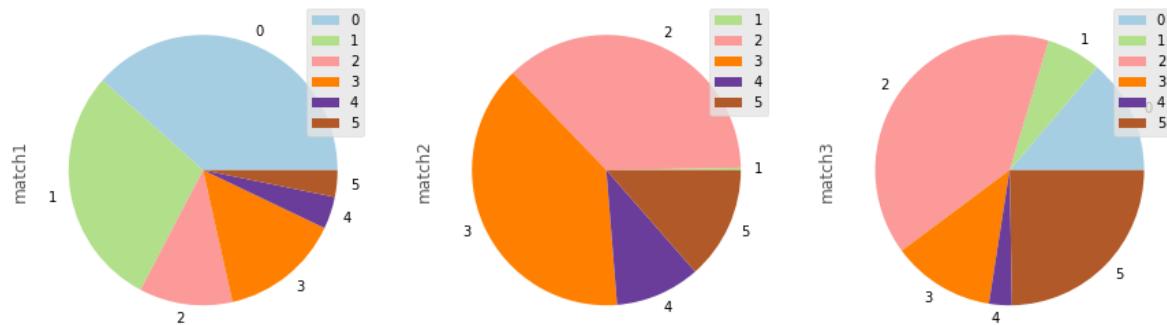
Out[130]: <AxesSubplot:ylabel='match1'>



In [132]: # multiple pie charts

```
df[['match1','match2','match3']].plot(kind='pie',
                                         subplots=True,
                                         figsize=(15,8),
                                         colormap='Paired')
```

Out[132]: array([<AxesSubplot:ylabel='match1'>, <AxesSubplot:ylabel='match2'>, <AxesSubplot:ylabel='match3'>], dtype=object)

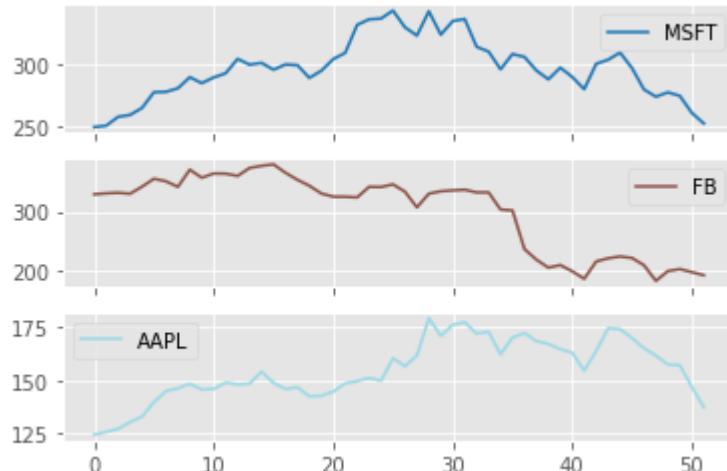


## multiple separate graphs together

In [138]: # using stocks

```
stocks.plot(kind='line',subplots=True , colormap = 'tab20')
```

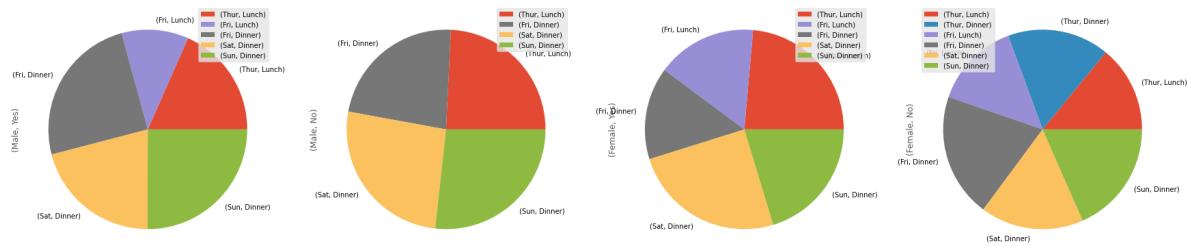
Out[138]: array([<AxesSubplot:>, <AxesSubplot:>, <AxesSubplot:>], dtype=object)



## on multiindex dataframes

In [144]: # using tips

```
tips.pivot_table(index=['day','time'],
                  columns=['sex','smoker'],
                  values='total_bill',
                  aggfunc='mean').plot(kind='pie',
                                        subplots=True,
                                        figsize=(30,20))
plt.show()
```



In [ ]: