Matplotlib Tutorial

Matplotlib?

In [ ]:
```
• Matplotlib is a low level graph plotting library in python that serves as a visuali
• Matplotlib was created by John D. Hunter.
• Matplotlib is open source and we can use it freely.
• Matplotlib is mostly written in python, a few segments are written in C, Objective-C
  Platform compatibility.
```

Import Matplotlib

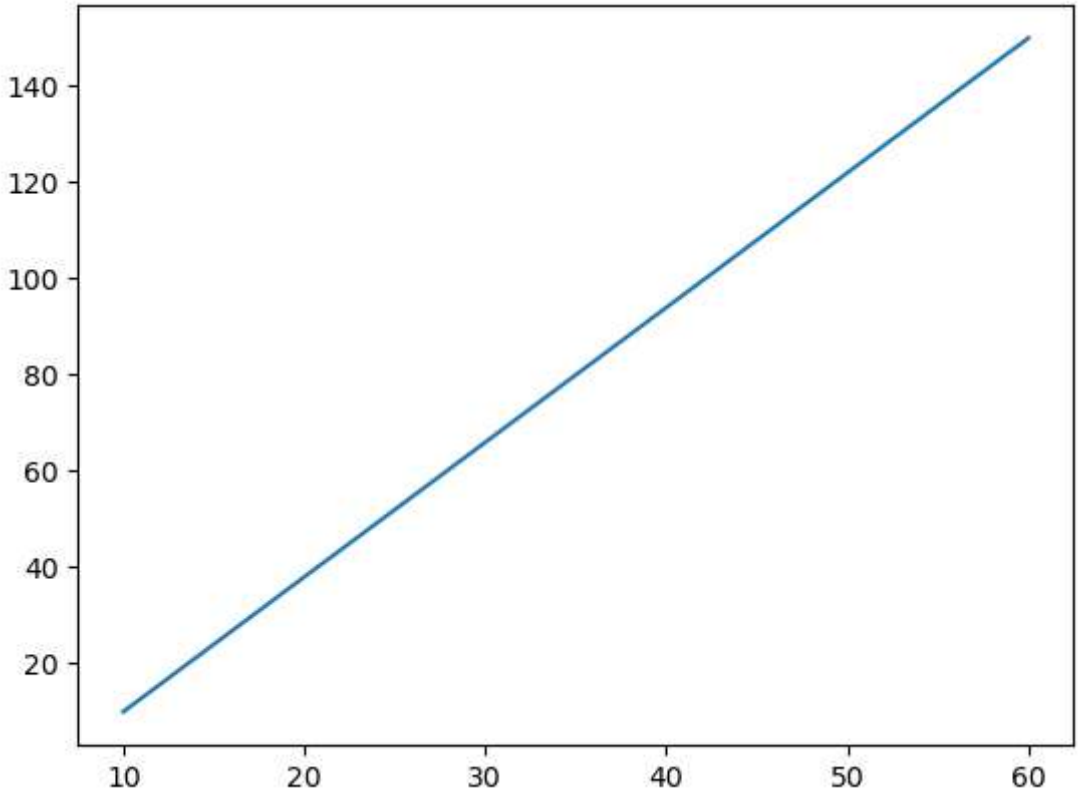
In [ ]:
```
■ Pyplot
Most of the Matplotlib utilities lies under the pyplot submodule, and are usually impo
Pyplot package can be referred to as plt:

import matplotlib.pyplot as plt
```

In [2]:
```
import matplotlib.pyplot as plt
import numpy as np
```

Matplotlib Line

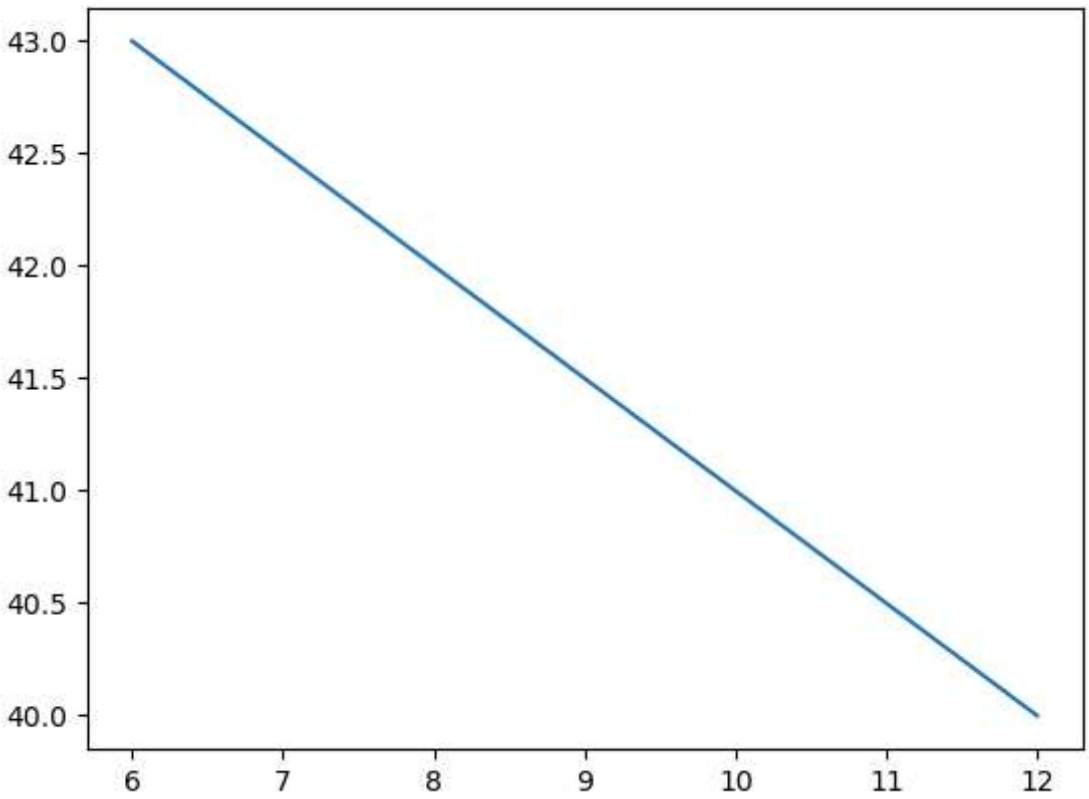
In [ ]:
```
# Draw a line in a diagram from position (10,10) to position (60,150):

plot() : Function used to draw points (markers) in a diagram.

By default, the plot() function draws a line from point to point.
```

In [3]:
```
#Draw a line chart
x = np.array([10,60])
y = np.array([10,150])
plt.plot(x,y)
plt.show()
```



In [ ]:
```
#Draw a line in a diagram from position (6,43) to position (12,40):
```

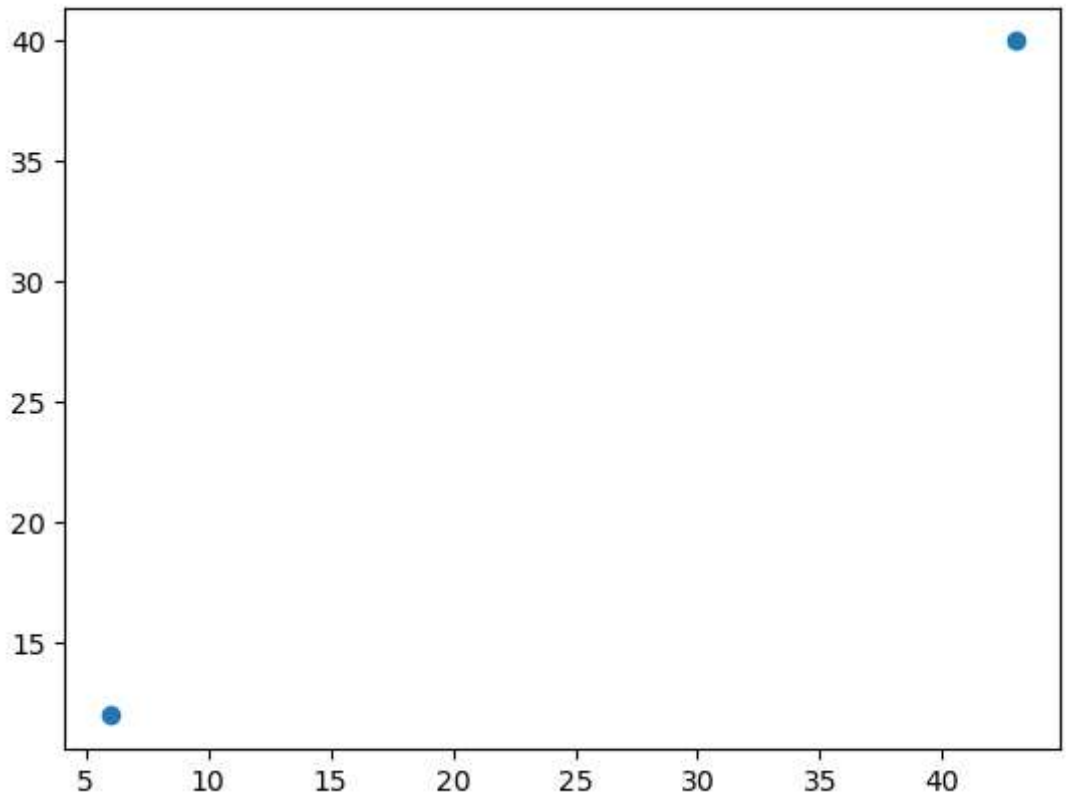
In [13]:
```
x =np.array([6,12])
y =np.array([43,40])
plt.plot(x,y)
plt.show()
```



Plotting Without Line (use - markers)

To plot only the markers, you can use shortcut string notation parameter 'o', which means 'rings'.

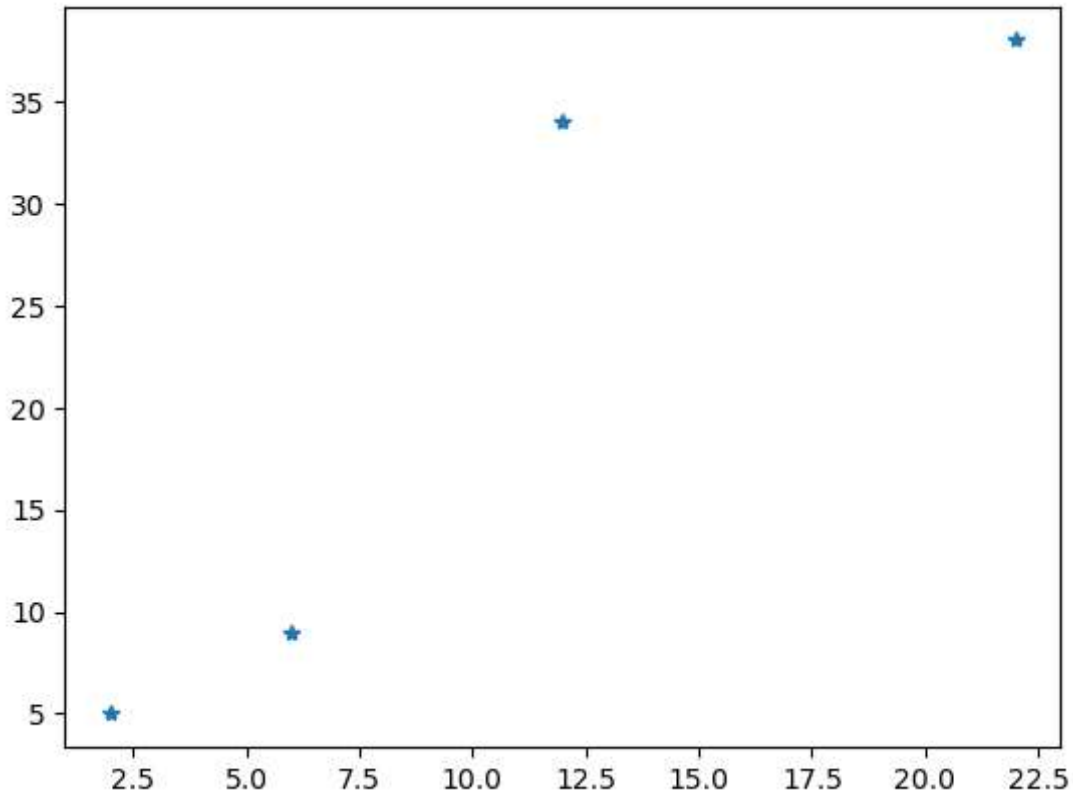
In [12]:
```
x =np.array([6,43])
y =np.array([12,40])
plt.plot(x,y,'o')
plt.show()
```



Multiple Points

You can plot as many points as you like, just make sure you have the same number of points in both axis.

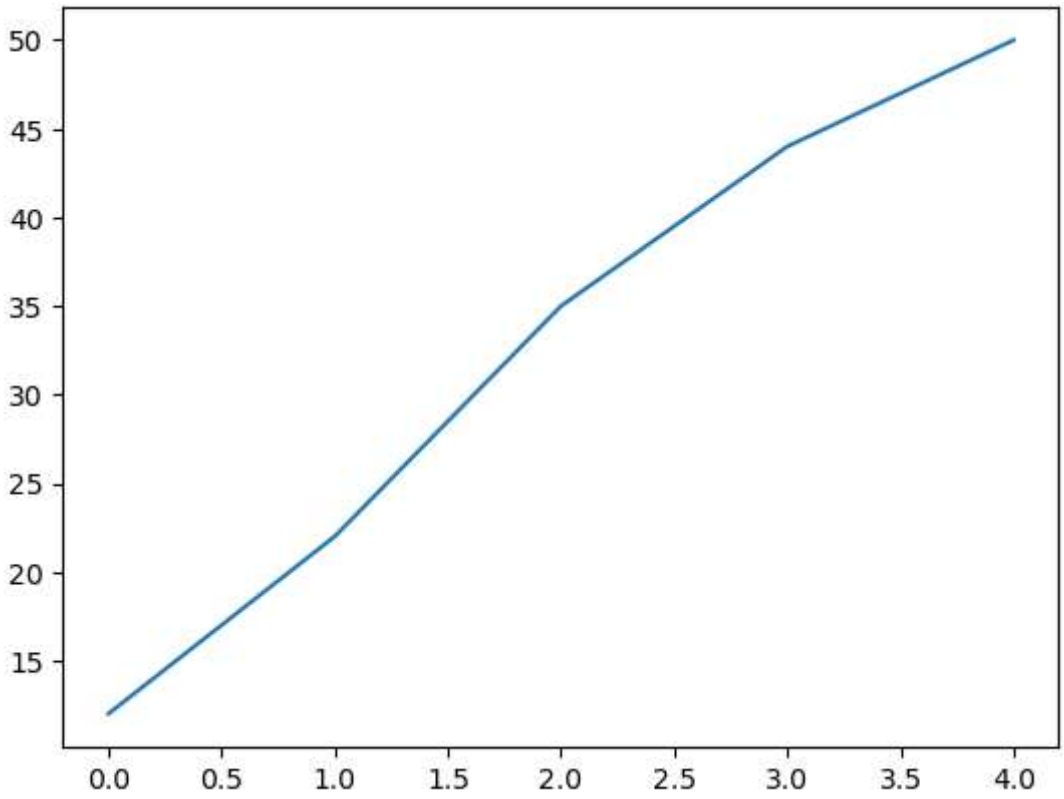
In [16]:
```
# Draw a line in a diagram from position (2,5) to (6,9) then to (12,34) and finally to
x = np.array([2,6,12,22])
y = np.array([5,9,34,38])
#plt.plot(x,y) # line chart
plt.plot(x,y,'*') # with marker
plt.show()
```



Default X-Points

If we do not specify the points on the x-axis, they will get the default values 0, 1, 2, 3 (etc., depending on the length of the y-points.

In [20]:
```
y = np.array([12,22,35,44,50])
plt.plot(y)
plt.show()
```



Markers

In [ ]:
```
Use the keyword argument marker to emphasize each point with a specified marker:
arguments:

marker - To visualize each point with specified marker
ms     - Use the keyword argument markersize or the shorter version, ms to set the siz
mec    - Use the keyword argument markeredgecolor or the shorter version, mec to set t
mfc    - Use the keyword argument markerfacecolor or the shorter version, mfc to set t
```

Marker Description

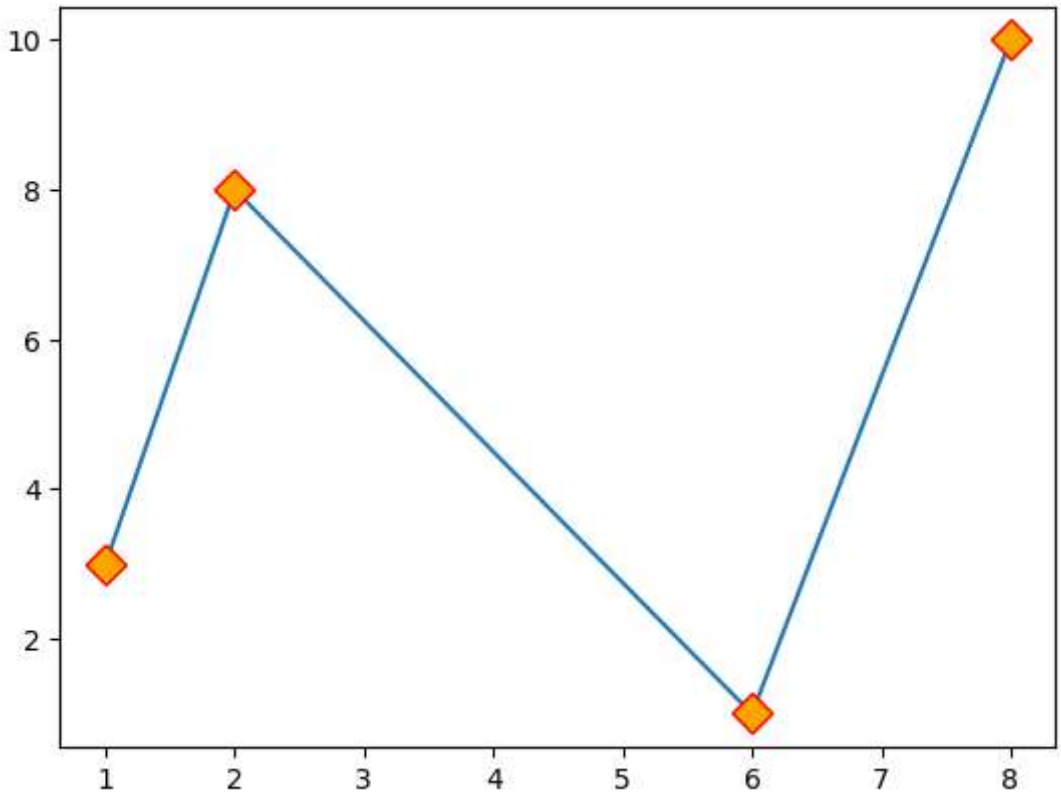
In [ ]:
```
'o'        Circle
'*'        Star
'.'        Point
','        Pixel
'x'        X
'X'        X (filled)
'+'        Plus
'P'        Plus (filled)
's'        Square
'D'        Diamond
'd'        Diamond (thin)
'p'        Pentagon
'H'        Hexagon
'h'        Hexagon
'v'        Triangle Down
'^'        Triangle Up
'<'        Triangle Left
```

```
'>'        Triangle Right
'1'        Tri Down
'2'        Tri Up
'3'        Tri Left
'4'        Tri Right
'|'        Vline
'_'        Hline
```

Hexadecimal Colors

In [ ]:
```
We can also use Hexadecimal color values:

Hexadecimal color values are supported in all browsers.

A hexadecimal color is specified with:  #rrggbb

Where rr (red), gg (green) and bb (blue) are hexadecimal integers between 00 and ff, s

For example, #ff0000 is displayed as red, because red is set to its highest value (ff)

To display black, set all color parameters to 00 :  #000000

To display white, set all color parameters to ff : #ffffff

All modern browsers support 140 color names.
```

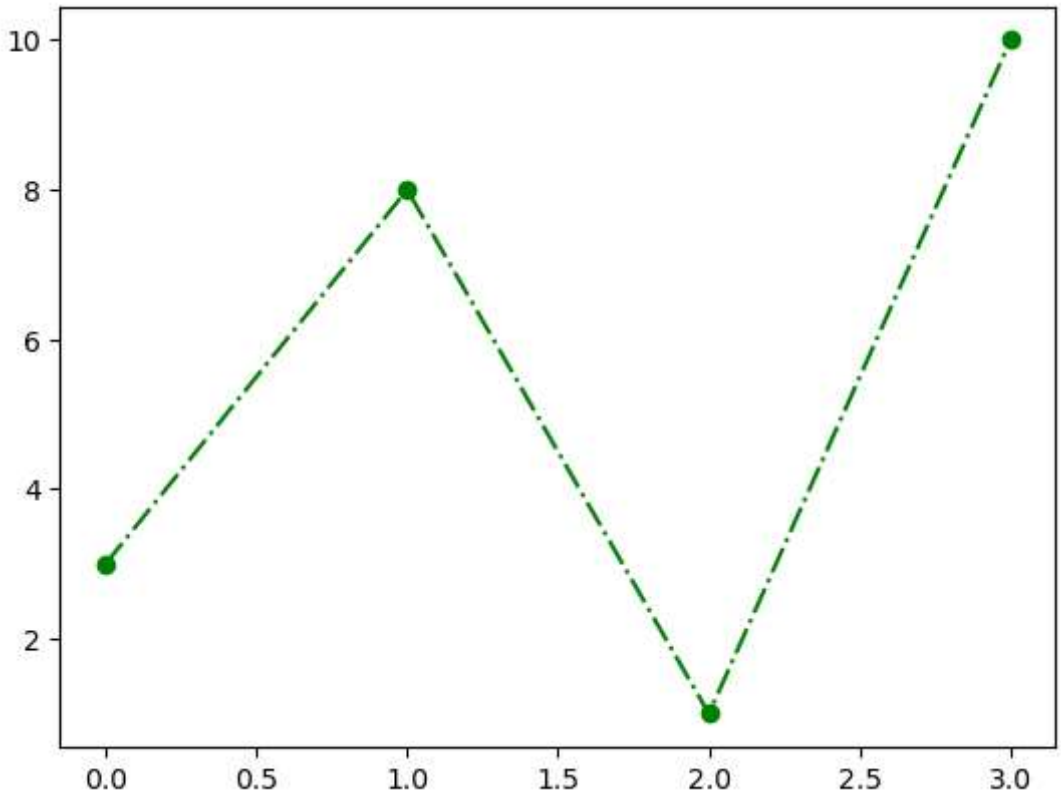
In [34]:
```
#Mark each point with a circle:

x=np.array([1,2,6,8])
y=np.array([3,8,1,10])
#plt.plot(x,y,marker='o',ms=20,mec='red',mfc='green')
plt.plot(x,y,marker='D',ms=10,mec ='red',mfc='orange')
plt.show()
```



Format Strings - fmt

In [ ]:
```
We can use the shortcut string notation parameter to specify the marker.
This parameter is also called fmt.

shortcut string notation parameter (fmt) :
  Syntax :   marker|line|color

  eg: 'o:r'
  o - marker
  : - dotted Line
  r - red color
```

In [41]:
```
# Using fmt
ypoints = np.array([3, 8, 1, 10])
#plt.plot(ypoints, '*:b')
plt.plot(ypoints, 'o-.g')
plt.show()
```



Line Reference

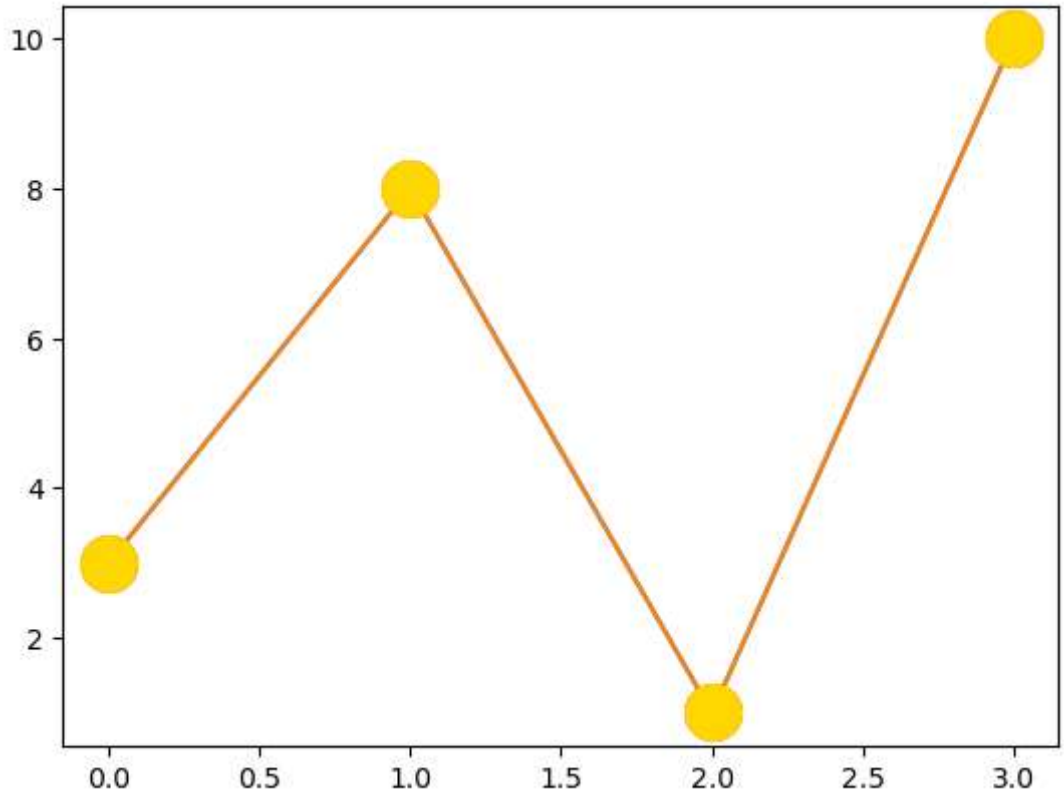
In [ ]:
```
The line value can be one of the following:

Line    Syntax
'-'    Solid line
':'    Dotted line
'--'   Dashed line
'-.'   Dashed/dotted line
If you leave out the line value in the fmt parameter, no line will be plotted.
```

Color Reference

In [ ]:
```
The short color value can be one of the following:

Color  Syntax
'r'     Red
'g'     Green
'b'     Blue
'c'     Cyan
'm'     Magenta
'y'     Yellow
'k'     Black
'w'     White
```

In [7]:
```
#Hexadecimal color names(all browsers support 140 colour names):

y=np.array([3,8,1,10])
#plt.plot(y, marker = 'o', ms = 20, mec = 'DeepPink', mfc = 'DeepPink')
```

```
plt.plot(y, marker = 'o', ms = 20, mec = 'Gold', mfc = 'gold')
plt.show()
```

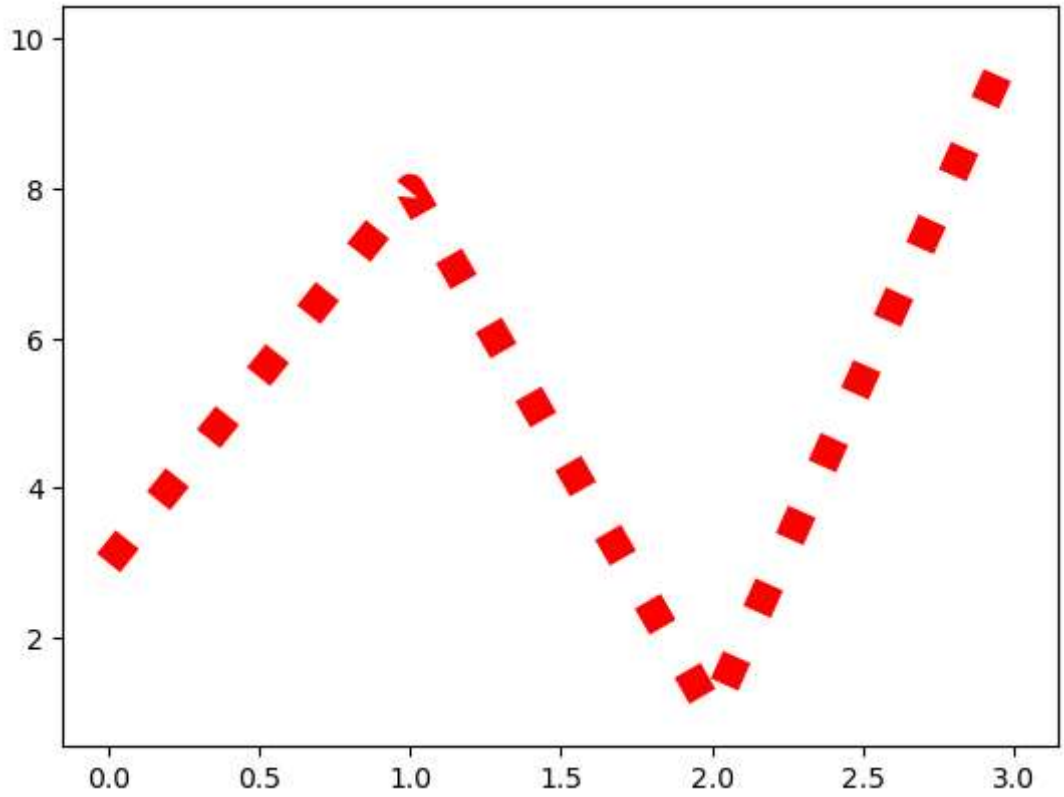


Matplotlib Line

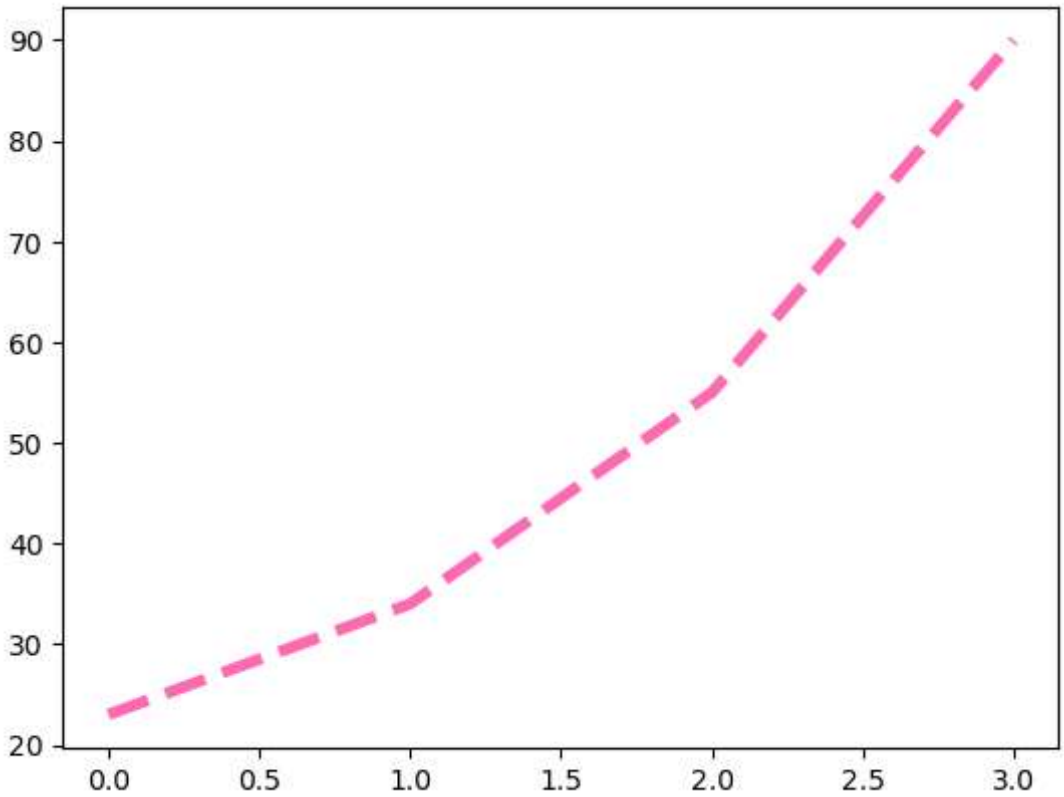
In [ ]:
```
Linestyle :
Use the keyword argument linestyle, or shorter ls, to change the style of the plotted

Syntax:
linestyle or ls

You can choose any of these styles:

'solid'      '-'(default)
'dotted'     ':'
'dashed'     '--'
'dashdot'    '-.'
'None'       ' '

Line Color (color or c)

You can use the keyword argument color or the shorter c to set the color of the line:

Line Width (linewidth or lw)

You can use the keyword argument linewidth or the shorter lw to change the width of th
The value is a floating number, in points:
```

In [13]:
```
# linestyle (ls), linewidth(lw) ,color(c)

y=np.array([3,8,1,10])
```

```
plt.plot(y,linestyle=':',c="red", lw='10.8')
plt.show()
```



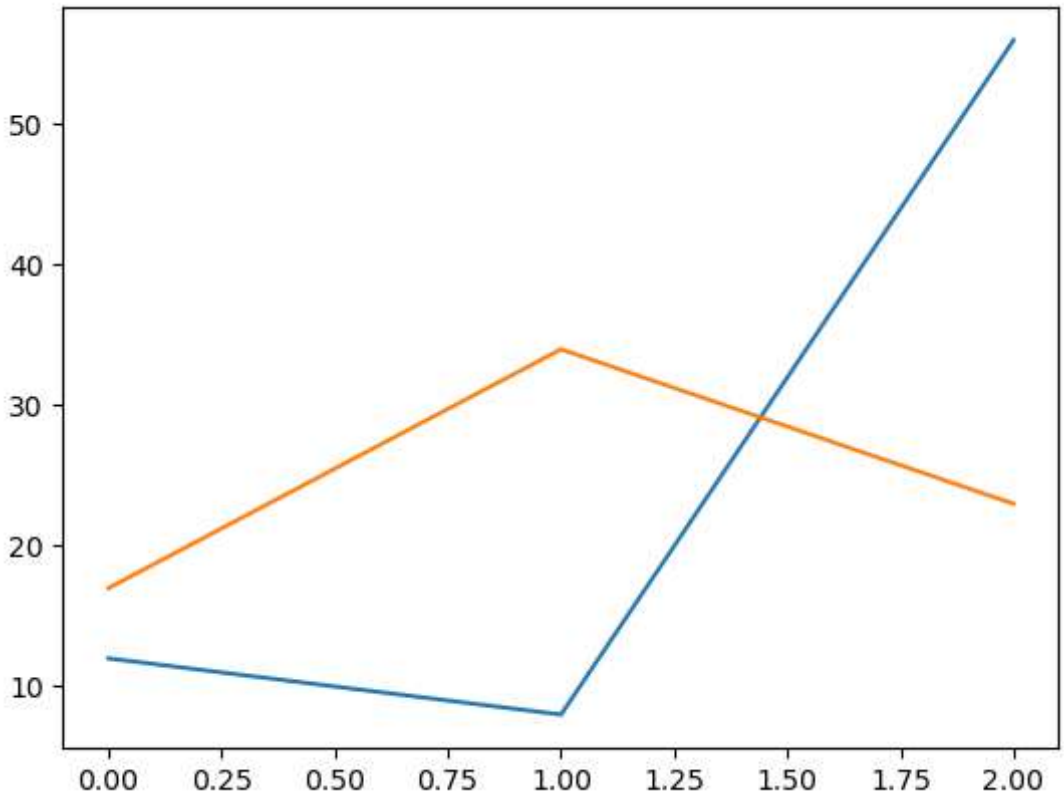
In [16]:
```
y = np.array([23,34,55,90])
plt.plot(y,ls='--',lw='4.1',c="HotPink")
plt.show()
```



Multiple Lines

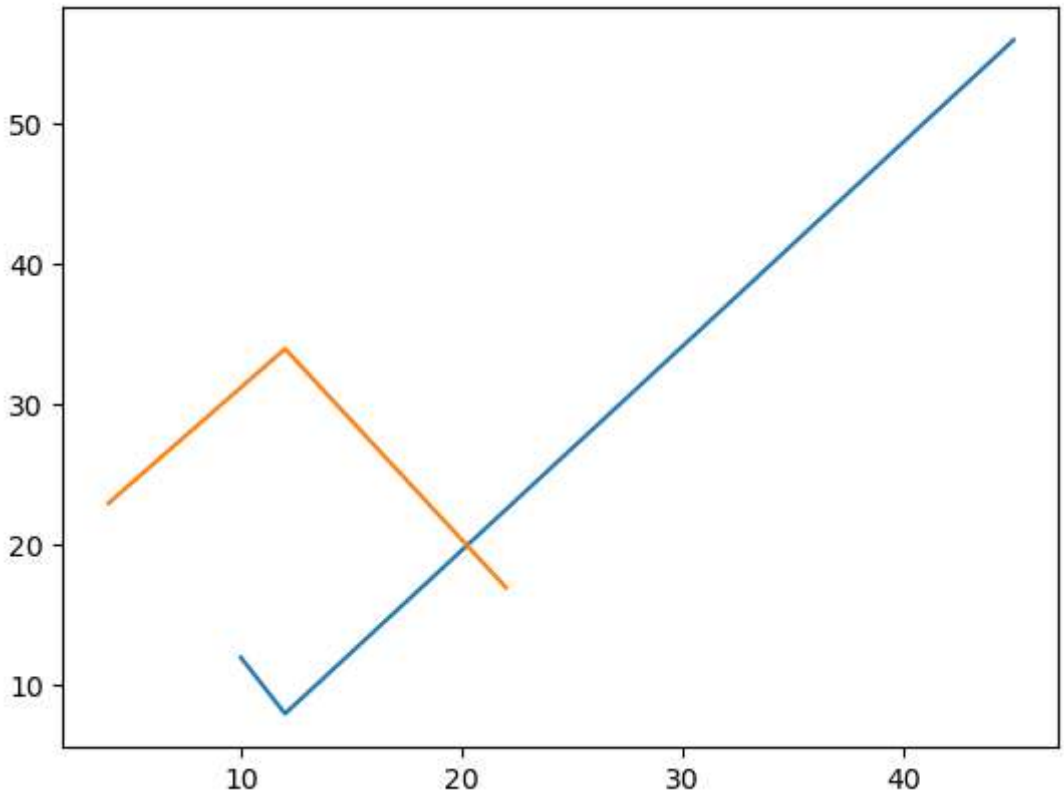
You can plot as many lines as you like by simply adding more plt.plot() functions:

In [21]:
```
#Multiple lines
y1 = np.array([12,8,56])
y2 = np.array([17,34,23])
plt.plot(y1)
plt.plot(y2)
plt.show()
```



In [ ]:
```
You can also plot many lines by adding the points for the x- and y-axis for each line

(In the examples above we only specified the points on the y-axis, meaning that the po
 the default values (0, 1, 2, 3).)

The x- and y- values come in pairs:
```

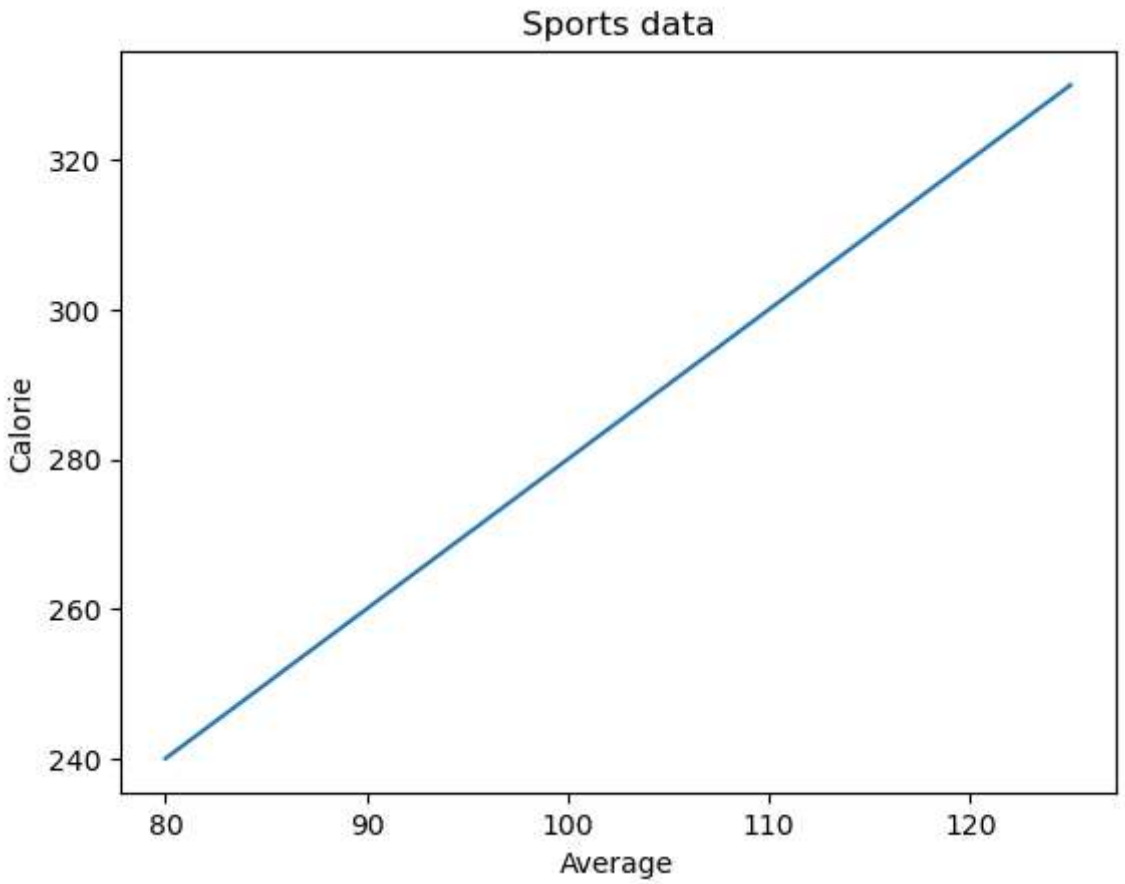
In [22]:
```
x1 = np.array([10,12,45])
y1 = np.array([12,8,56])
x2 = np.array([22,12,4])
y2 = np.array([17,34,23])
plt.plot(x1,y1,x2,y2)
plt.show()
```



Matplotlib Labels and Title

In [ ]:
```
With Pyplot, you can use the functions :
xlabel()  - set label for x-axis
ylabel()  - set label for y-axis
title()   - set a title for the plot.

loc
You can use the loc parameter in title() to position the title.
Legal values are: 'left', 'right', and 'center'. Default value is 'center'.
```

In [23]:
```
#Create Labels for a Plot
# Add labels to the x- and y-axis:
x = np.array([80, 85, 90, 95, 100, 105, 110, 115, 120, 125])
y = np.array([240, 250, 260, 270, 280, 290, 300, 310, 320, 330])
plt.plot(x,y)
plt.xlabel("Average")
plt.ylabel("Calorie")
plt.title("Sports data",loc='center')
plt.show()
```

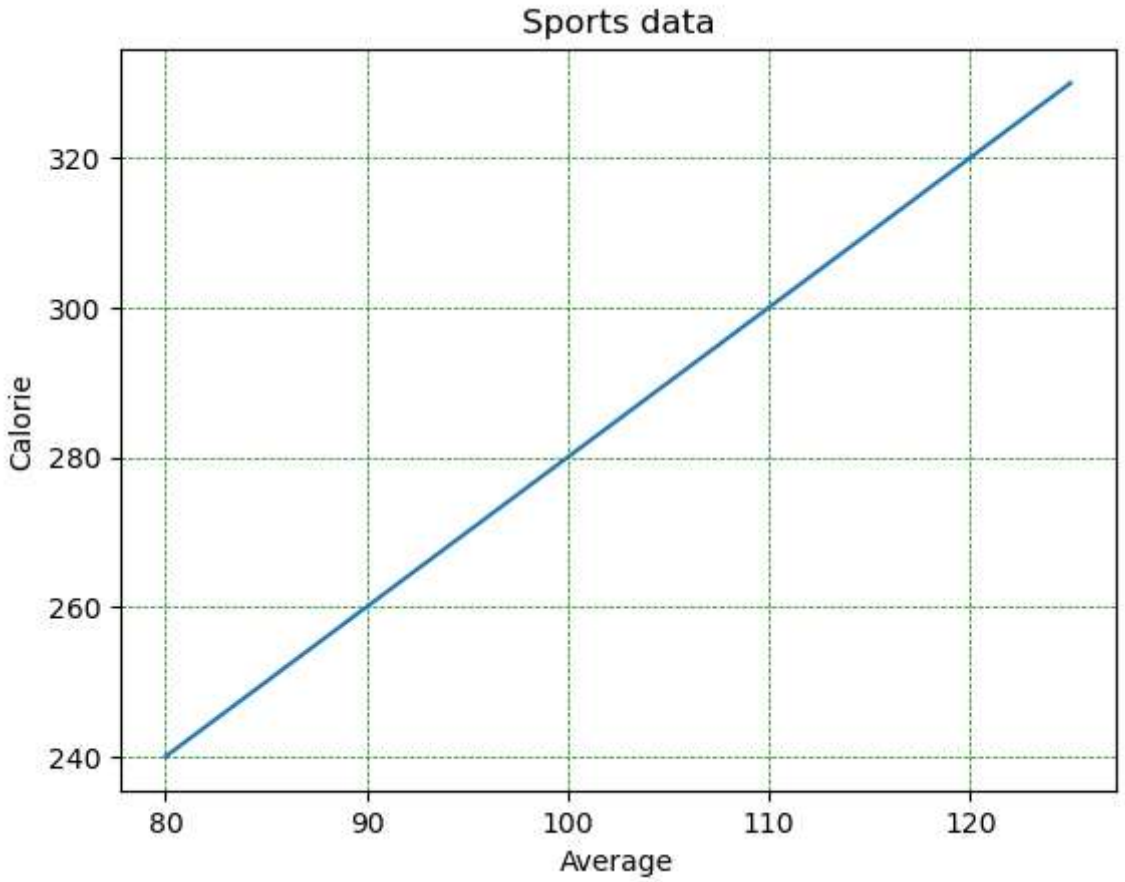


In [ ]:
```
#set font properties for title and labels
x = np.array([80, 85, 90, 95, 100, 105, 110, 115, 120, 125])
y = np.array([240, 250, 260, 270, 280, 290, 300, 310, 320, 330])
font1 = {'family':'serif','color':'blue','size':20}
font2 = {'family':'serif','color':'darkred','size':15}
plt.title("Sports Data", fontdict=font1)
plt.xlabel("Average", fontdict=font2)
plt.ylabel("Calorie",fontdict=font2)
plt.plot(x,y)
plt.show()
```

Add Grid Lines to a Plot

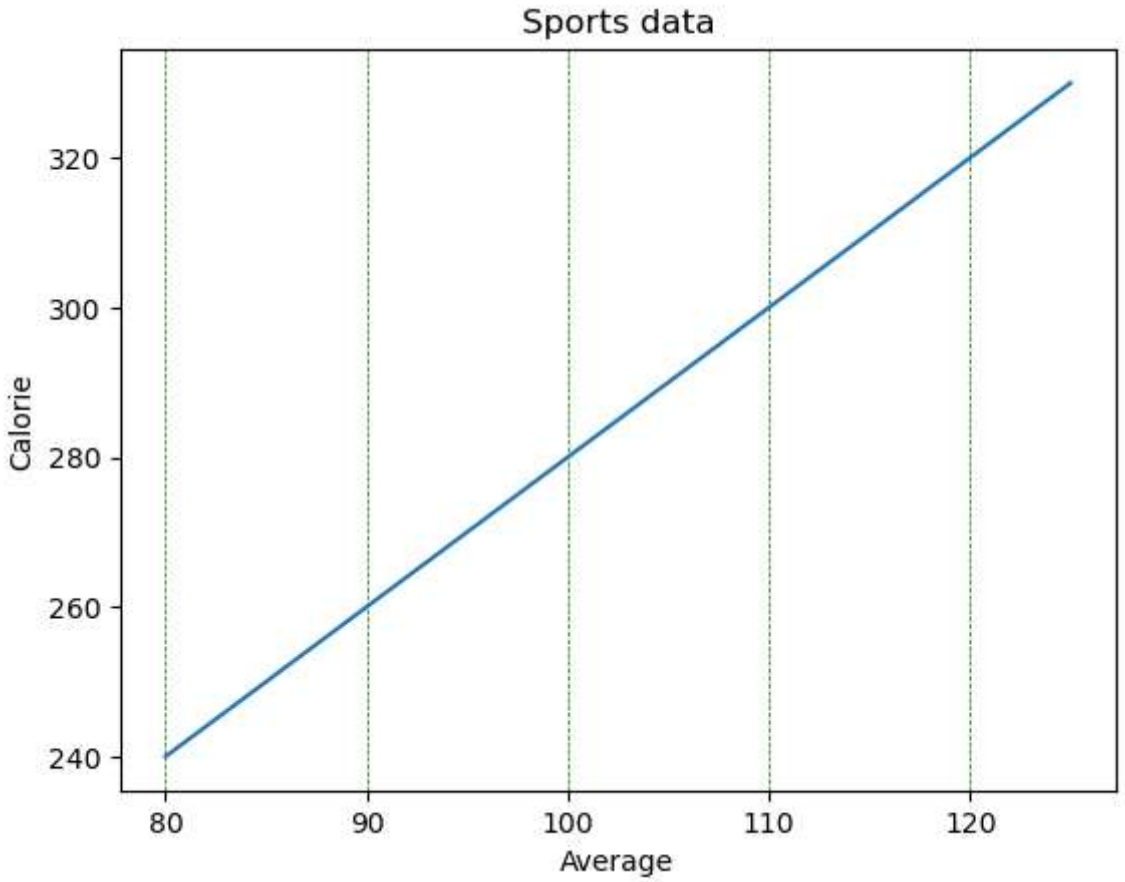
In [ ]:
```
grid() function to add grid lines to the plot.

Set the line properties of the grid, like this:

    grid(color = 'color', linestyle = 'linestyle', linewidth = number).
```

In [28]:
```
#Add Grid Lines to a Plot
x = np.array([80, 85, 90, 95, 100, 105, 110, 115, 120, 125])
y = np.array([240, 250, 260, 270, 280, 290, 300, 310, 320, 330])
plt.plot(x,y)
plt.xlabel("Average")
plt.ylabel("Calorie")
plt.title("Sports data",loc='center')
plt.grid(c='green',ls='--',lw='0.5')
plt.show()
```



In [ ]:
```
### Specify Which Grid Lines to Display
You can use the axis parameter in the grid() function to specify which grid lines to d

Legal values are: 'x', 'y', and 'both'. Default value is 'both'.
eg: grid(axis='x')
```

In [34]:
```
#Display only grid lines for the x-axis:
x = np.array([80, 85, 90, 95, 100, 105, 110, 115, 120, 125])
y = np.array([240, 250, 260, 270, 280, 290, 300, 310, 320, 330])
plt.plot(x,y)
plt.xlabel("Average")
plt.ylabel("Calorie")
plt.title("Sports data",loc='center')
#plt.grid(c='green',ls='--',lw='0.5',axis='y')
plt.grid(c='green',ls='--',lw='0.5',axis='x')
#plt.grid(c='green',ls='--',lw='0.5',axis='both')
plt.show()
```

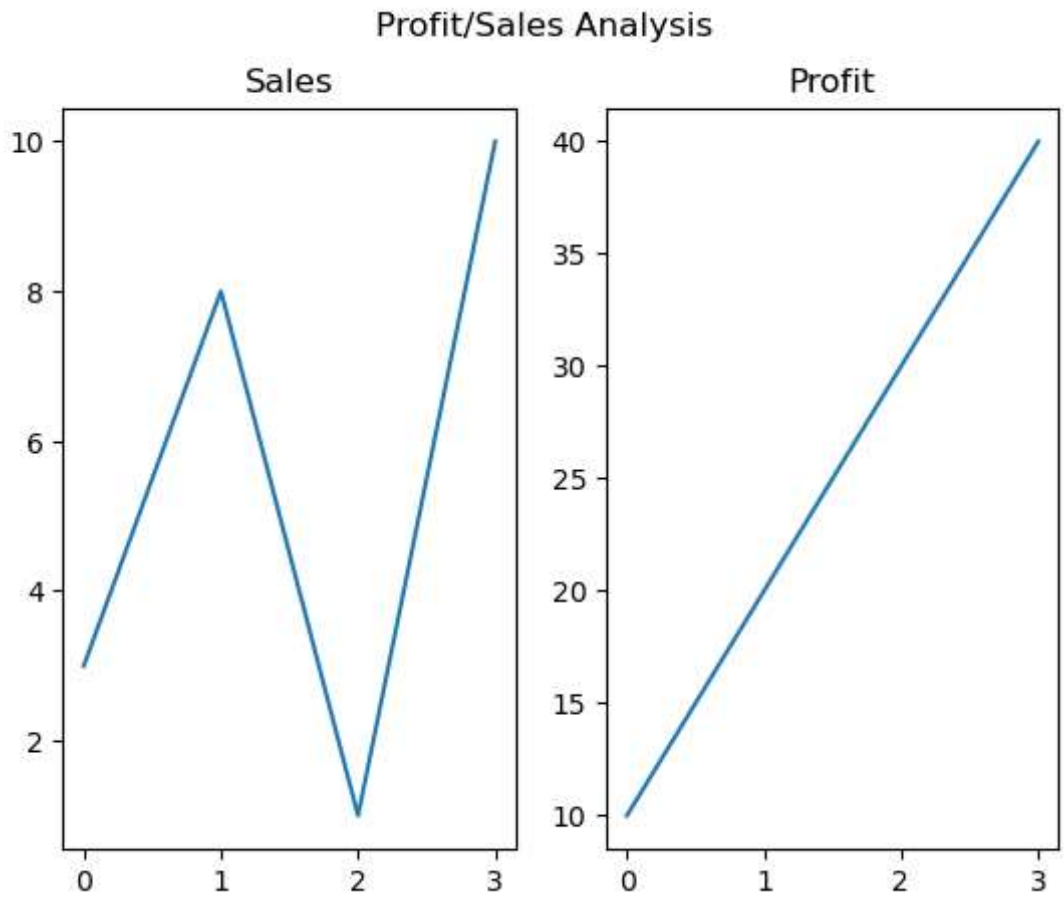


Matplotlib Subplot

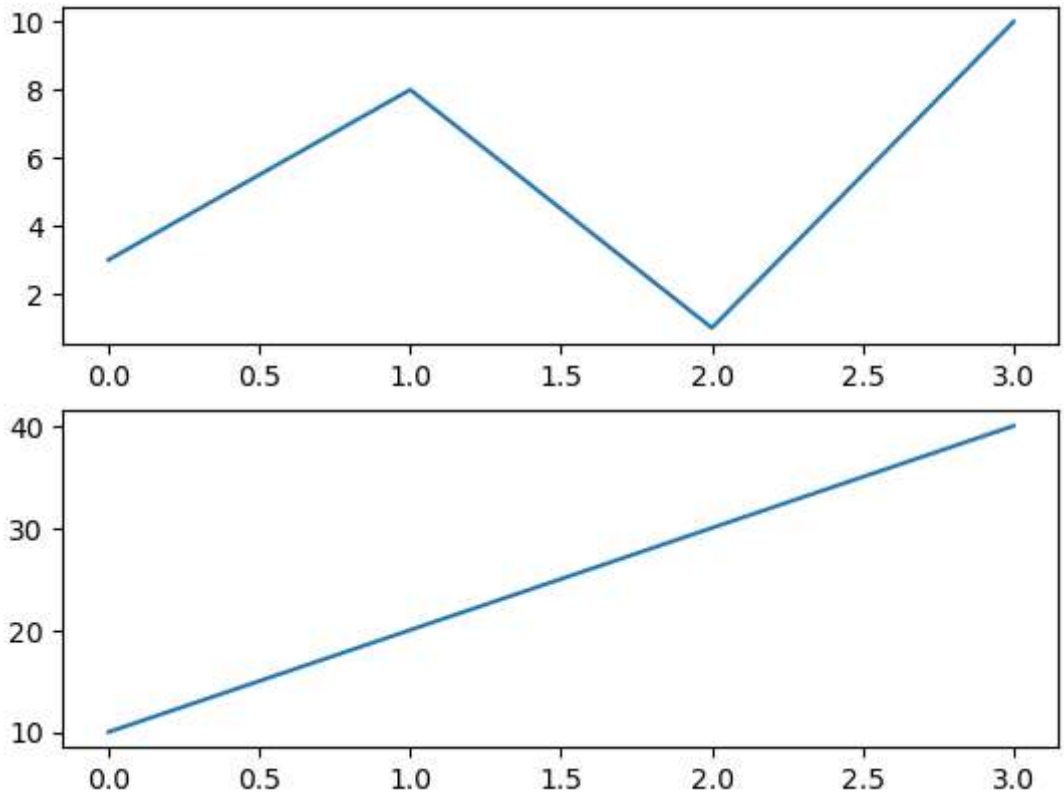
In [ ]:
```
subplot() :  you can draw multiple plots in one figure.
             Takes three arguments that describes the layout of the figure.
The layout is organized in rows and columns, which are represented by the first and se
The third argument represents the index of the current plot.
 eg:
plt.subplot(1, 2, 1)
#the figure has 1 row, 2 columns, and this plot is the first plot.

plt.subplot(1, 2, 2)
#the figure has 1 row, 2 columns, and this plot is the second plot.

You can draw as many plots you like on one figure, just descibe the number of rows, co

 title()    : add a title to each plot
 suptitle() : add a title to the entire figure
```

In [43]:
```
#Display 2 Plots (1 row and 2 column)

#plot1
x = np.array([0, 1, 2, 3])
y = np.array([3, 8, 1, 10])
plt.subplot(1,2,1)
plt.title("Sales")


#plot2
```

```
plt.plot(x,y)
x = np.array([0, 1, 2, 3])
y = np.array([10, 20, 30, 40])
plt.subplot(1,2,2)
plt.title("Profit")

plt.suptitle("Profit/Sales Analysis")
plt.plot(x,y)
plt.show()
```



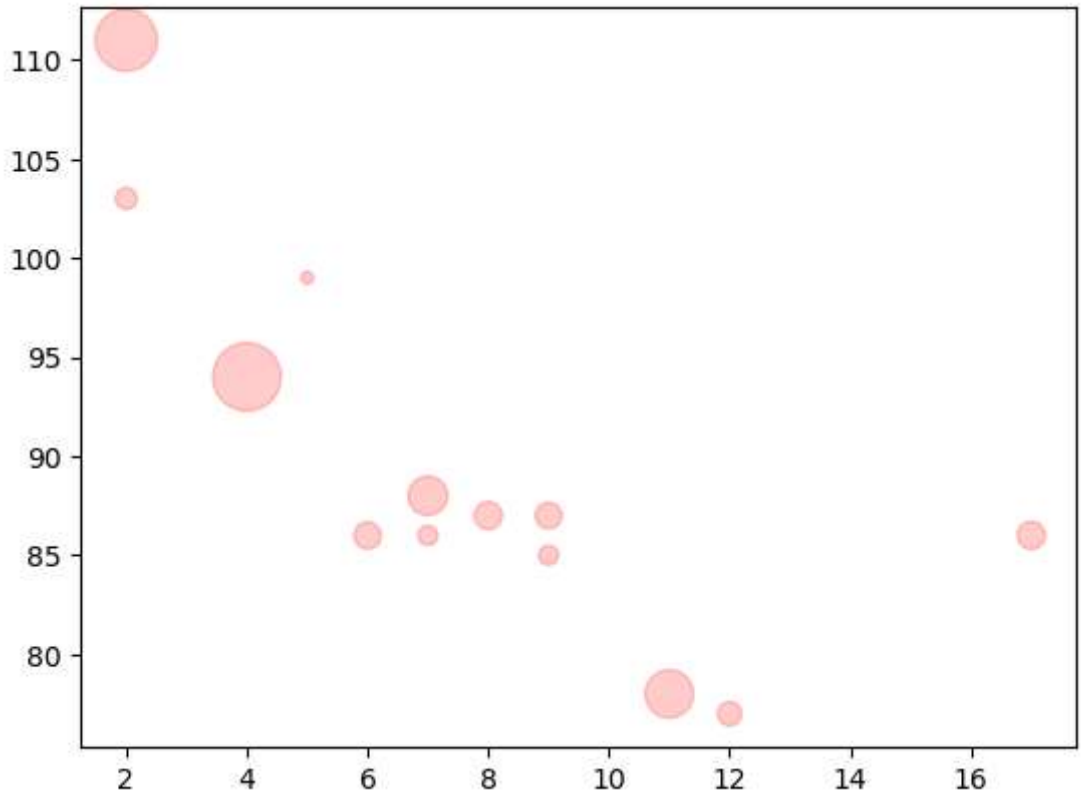
In [37]:
```
#Display 2 Plots (2 row 1 column)

#plot1
x = np.array([0, 1, 2, 3])
y = np.array([3, 8, 1, 10])
plt.subplot(2,1,1)

#plot2
plt.plot(x,y)
x = np.array([0, 1, 2, 3])
y = np.array([10, 20, 30, 40])
plt.subplot(2,1,2)


plt.plot(x,y)
plt.show()
```



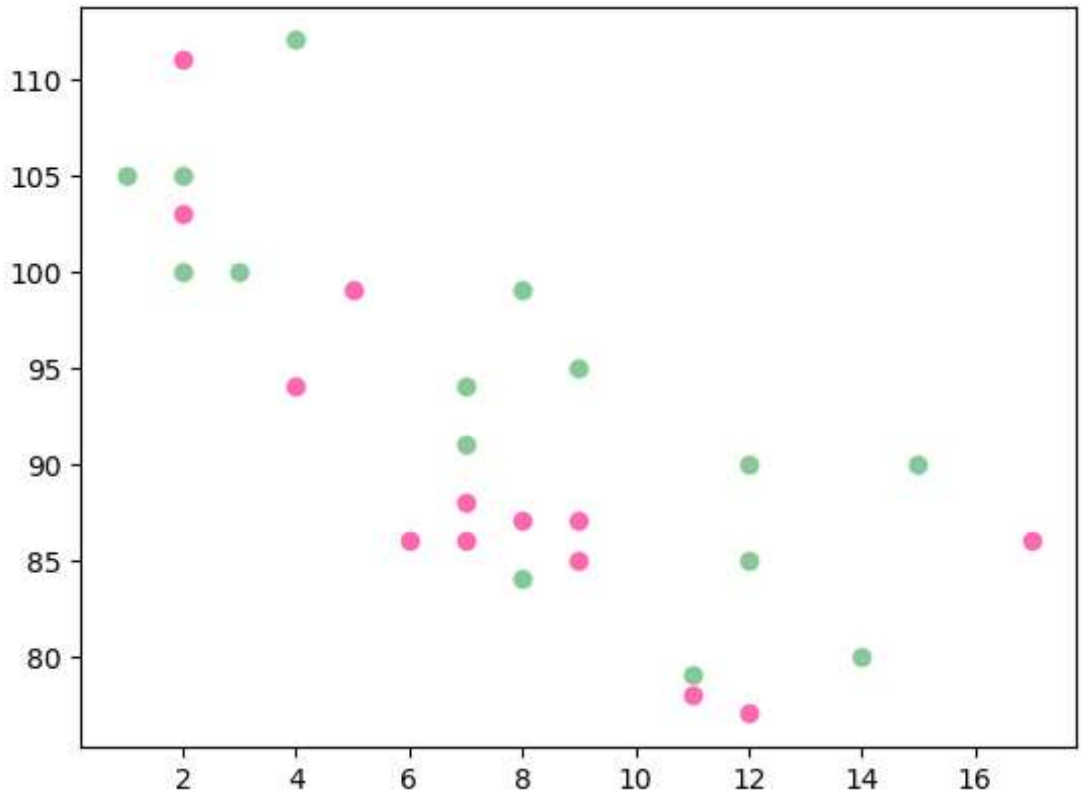
Creating Scatter Plots

In [ ]:
```
With Pyplot, you can use the scatter() function to draw a scatter plot.

The scatter() function plots one dot for each observation. It needs two arrays of the
one for the values of the x-axis, and one for values on the y-axis:
```

In [44]:
```
#Creating Scatter Plots
x = np.array([5,7,8,7,2,17,2,9,4,11,12,9,6])
y = np.array([99,86,87,88,111,86,103,87,94,78,77,85,86])
sizes=np.array([20,50,100,200,500,100,60,90,600,300,75,50,95])
plt.scatter(x,y,color='red',s=sizes,alpha=0.2) # alpha = set the opacity(transparency)
plt.show()
```

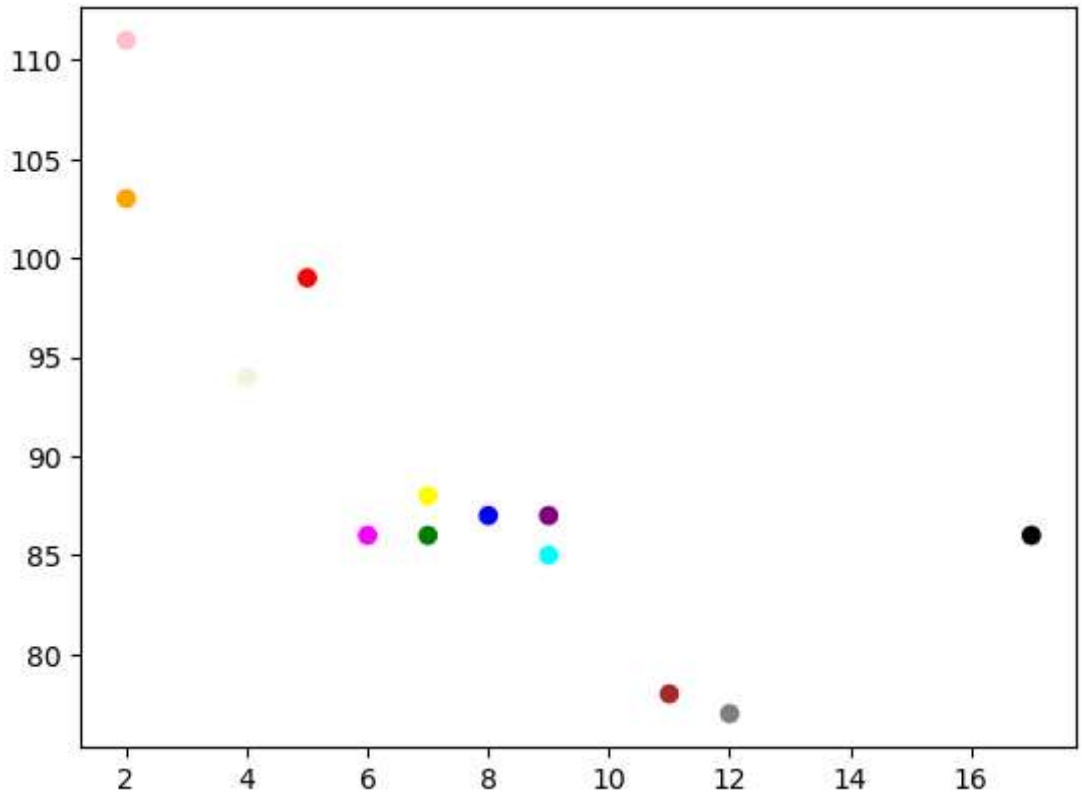


In [45]:
```
#Creating multiple plot and set color your own color for the marker

import matplotlib.pyplot as plt
import numpy as np

x = np.array([5,7,8,7,2,17,2,9,4,11,12,9,6])
y = np.array([99,86,87,88,111,86,103,87,94,78,77,85,86])
plt.scatter(x, y, color = 'hotpink')

x = np.array([2,2,8,1,15,8,12,9,7,3,11,4,7,14,12])
y = np.array([100,105,84,105,90,99,90,95,94,100,79,112,91,80,85])
plt.scatter(x, y, color = '#88c999')

plt.show()
```



In [ ]:
```
### Color Each Dot
You can even set a specific color for each dot by using an array of colors as value fo

 You cannot use the color argument for this, only the c argument.
```

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

x = np.array([5,7,8,7,2,17,2,9,4,11,12,9,6])
y = np.array([99,86,87,88,111,86,103,87,94,78,77,85,86])
colors = np.array(["red","green","blue","yellow","pink","black","orange","purple","bei
plt.scatter(x, y, c= colors)
plt.show()
```



ColorMap

In [ ]:
```
The Matplotlib module has a number of available colormaps.
A colormap is like a list of colors, where each color has a value that ranges from 0 t
This colormap is called 'viridis' and as you can see it ranges from 0, which is a purp
which is a yellow color.
```

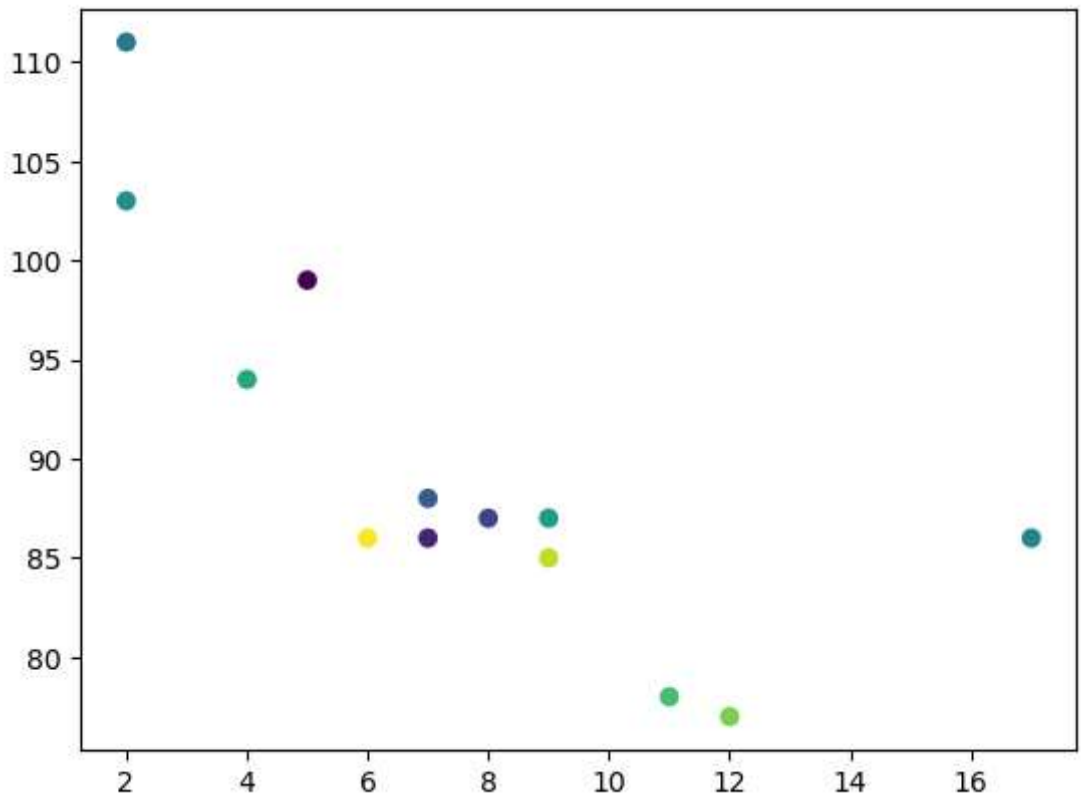
In [ ]:
```
### How to Use the ColorMap

You can specify the colormap with the keyword argument cmap with the value of the colo
'viridis' which is one of the built-in colormaps available in Matplotlib.
In addition you have to create an array with values (from 0 to 100), one value for eac
```

In [ ]:
```
### Available ColorMaps

These are some examples of availale built-in color maps:

Name          Reverse color

Accent        Accent_r
Blues         Blues_r
BrBG          BrBG_r
BuGn          BuGn_r
BuPu          BuPu_r
CMRmap        CMRmap_r
Dark2         Dark2_r
GnBu          GnBu_r
Greens        Greens_r
Greys         Greys_r
OrRd           OrRd_r
Oranges        Oranges_r
```

```
PRGn         PRGn_r
Paired       Paired_r
Pastel1      Pastel1_r
Pastel2      Pastel2_r
PiYG         PiYG_r
PuBu         PuBu_r
PuBuGn       PuBuGn_r
PuOr         PuOr_r
PuRd         PuRd_r
Purples      Purples_r
RdBu          RdBu_r
RdGy          RdGy_r
RdPu          RdPu_r
RdYlBu        RdYlBu_r
RdYlGn        RdYlGn_r
Reds          Reds_r
Set1         Set1_r
Set2         Set2_r
Set3         Set3_r
Spectral     Spectral_r

etc...
```

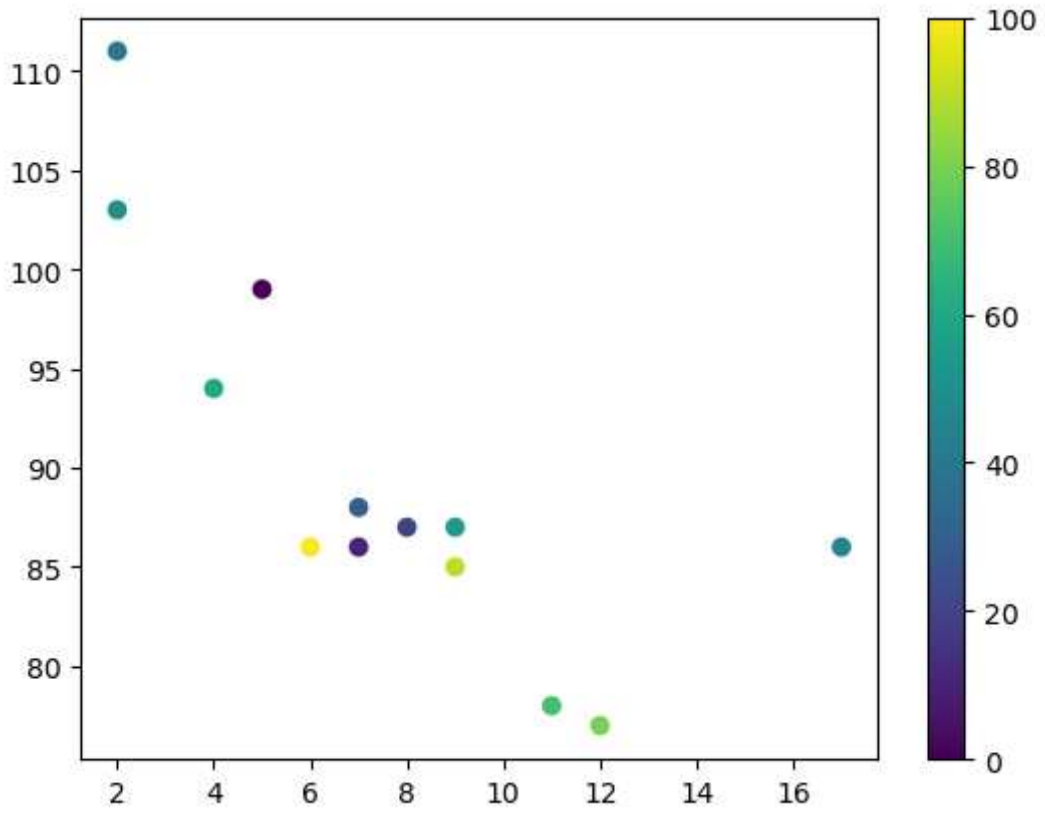
In [2]:

```
#Create a color array, and specify a colormap in the scatter plot:
import matplotlib.pyplot as plt
import numpy as np

x = np.array([5,7,8,7,2,17,2,9,4,11,12,9,6])
y = np.array([99,86,87,88,111,86,103,87,94,78,77,85,86])
colors = np.array([0, 10, 20, 30, 40, 45, 50, 55, 60, 70, 80, 90, 100])
plt.scatter(x,y,c=colors,cmap='viridis')
plt.show()
```



plt.colorbar() : To include the colormap in the drawing

In [3]:
```
#Create a color array, and specify a colormap in the scatter plot:
import matplotlib.pyplot as plt
import numpy as np

x = np.array([5,7,8,7,2,17,2,9,4,11,12,9,6])
y = np.array([99,86,87,88,111,86,103,87,94,78,77,85,86])
colors = np.array([0, 10, 20, 30, 40, 45, 50, 55, 60, 70, 80, 90, 100])
plt.scatter(x,y,c=colors,cmap='viridis')
plt.colorbar()
plt.show()
```



To change Size of each point in scatter plot

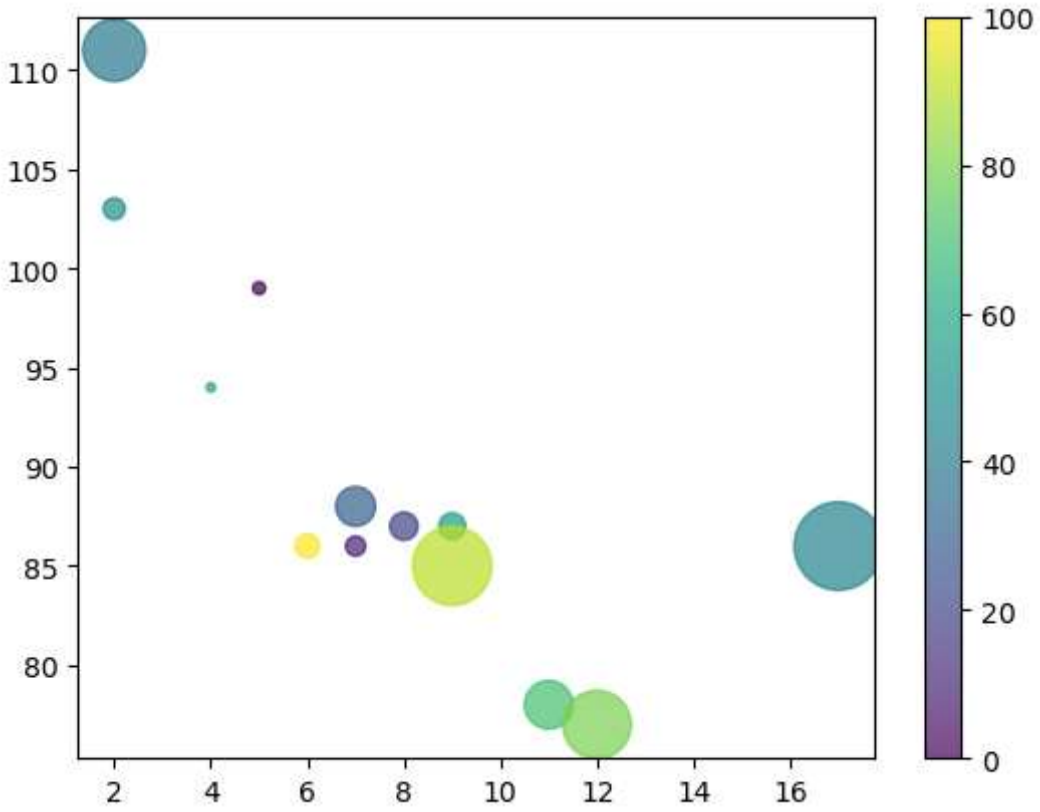
You can change the size of the dots with the s argument. Just like colors, make sure the array for sizes has the same length as the arrays for the x- and y-axis:

Alpha

You can adjust the transparency of the dots with the alpha argument.

In [11]:
```
#Create a color array, and specify a colormap in the scatter plot:
import matplotlib.pyplot as plt
import numpy as np

x = np.array([5,7,8,7,2,17,2,9,4,11,12,9,6])
y = np.array([99,86,87,88,111,86,103,87,94,78,77,85,86])
```

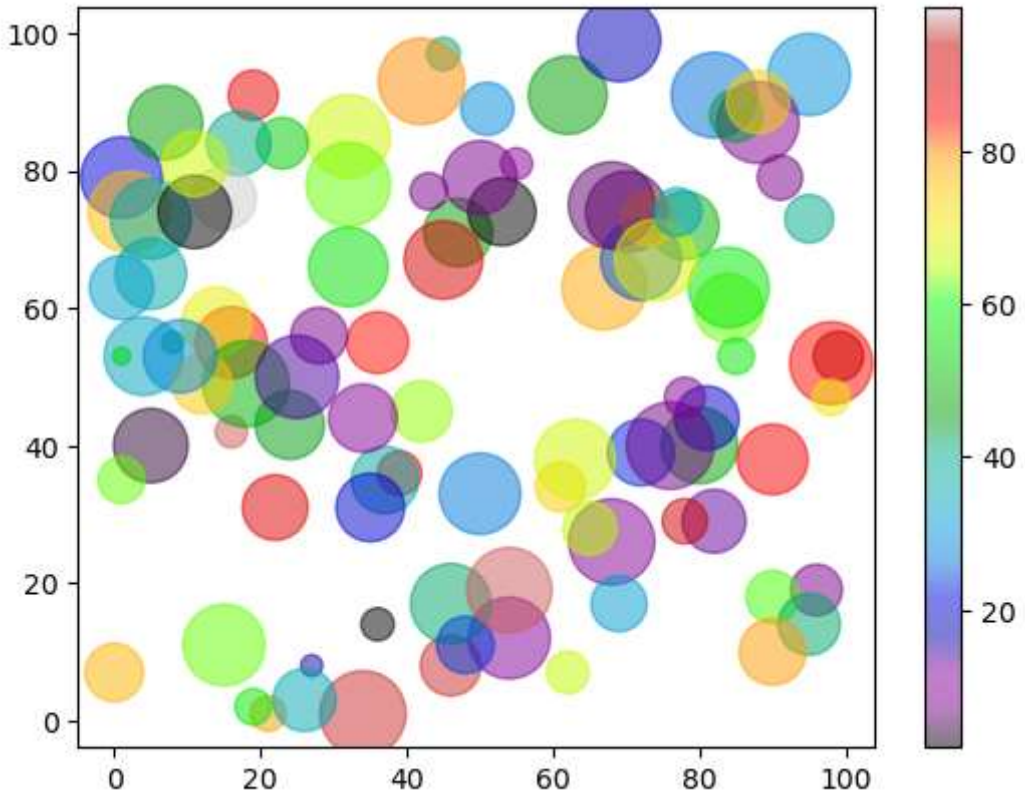
```
colors = np.array([0, 10, 20, 30, 40, 45, 50, 55, 60, 70, 80, 90, 100])
sizes = np.array([20,50,100,200,500,1000,60,90,10,300,600,800,75])
plt.scatter(x,y,c=colors,cmap='viridis',s=sizes,alpha=0.7)
plt.colorbar()
plt.show()
```



Combine Color Size and Alpha

You can combine a colormap with different sizes of the dots. This is best visualized if the dots are transparent:

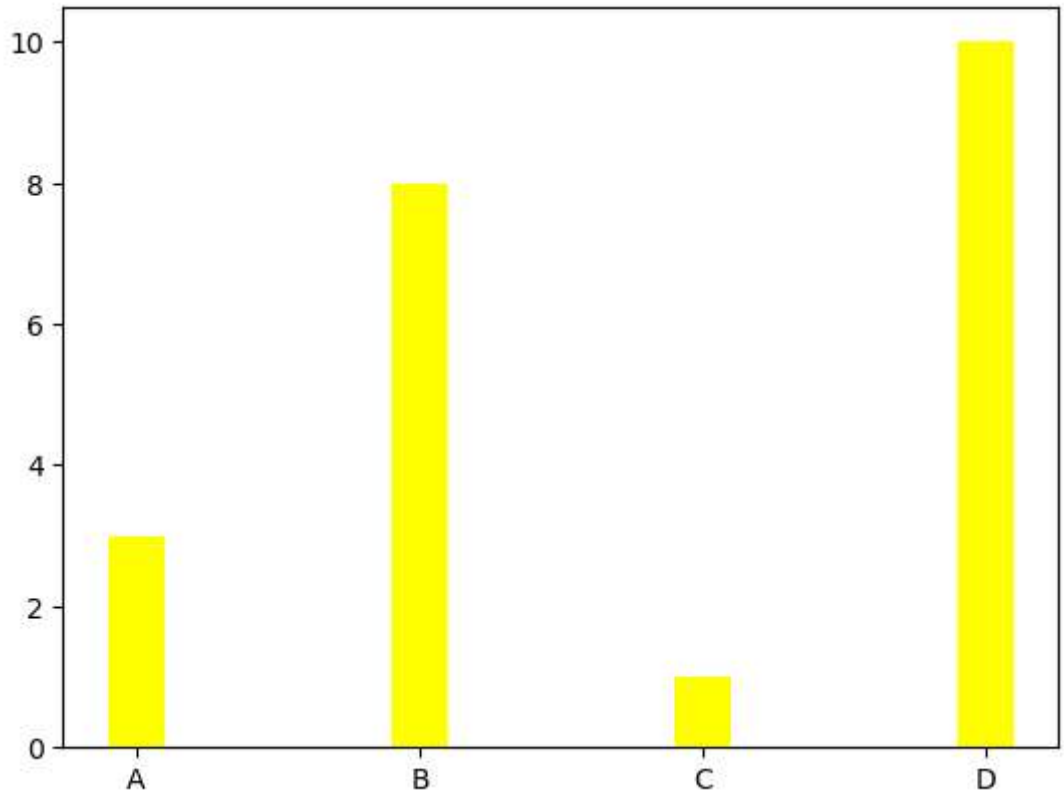
In [13]:
```
#Create random arrays with 100 values for x-points, y-points, colors and sizes:
import matplotlib.pyplot as plt
import numpy as np

x = np.random.randint(100, size=(100))
y = np.random.randint(100, size=(100))
colors = np.random.randint(100, size=(100))
sizes = 10 * np.random.randint(100, size=(100))

plt.scatter(x, y, c=colors, s=sizes, alpha=0.5, cmap='nipy_spectral')

plt.colorbar()

plt.show()
```



Matplotlib Bars

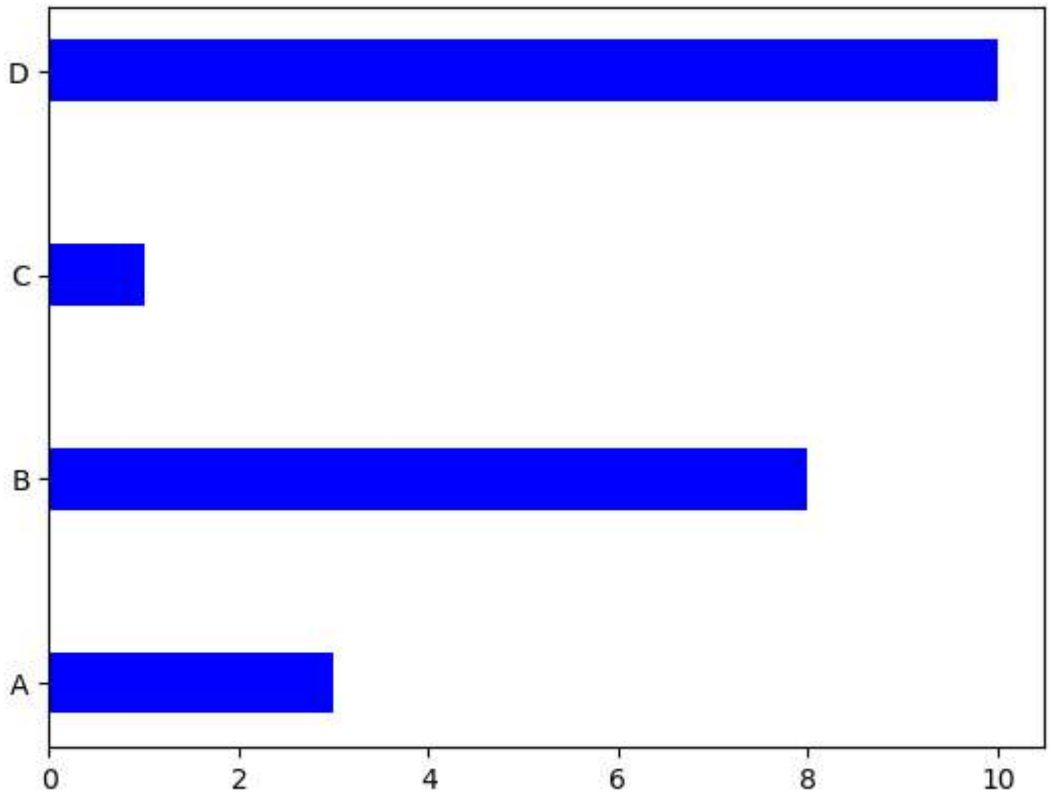
In [ ]:
```
bar() : function to draw bar graphs

The bar() function takes arguments that describes the layout of the bars.
arguments:
color    -  to set the color of the bars
width    -  to set the width of the bars

The default width value is 0.8
```

In [4]:
```
#Creating Bars
x = np.array(["A", "B", "C", "D"])
y = np.array([3, 8, 1, 10])
plt.bar(x,y,color="yellow",width=0.2)
plt.show()
```



In [ ]:
```
### Horizontal Bars
barh()  :If you want the bars to be displayed horizontally instead of vertically.
arguments:

color    -  to set the color of the bars
height    -  to set the width of the bars
The default height value is 0.8
```

In [5]:
```
x = np.array(["A", "B", "C", "D"])
y = np.array([3, 8, 1, 10])
plt.barh(x,y,color="blue",height=0.3)
plt.show()
```



Matplotlib Histograms

A histogram is a graph showing frequency distributions. It is a graph showing the number of observations within each given interval.

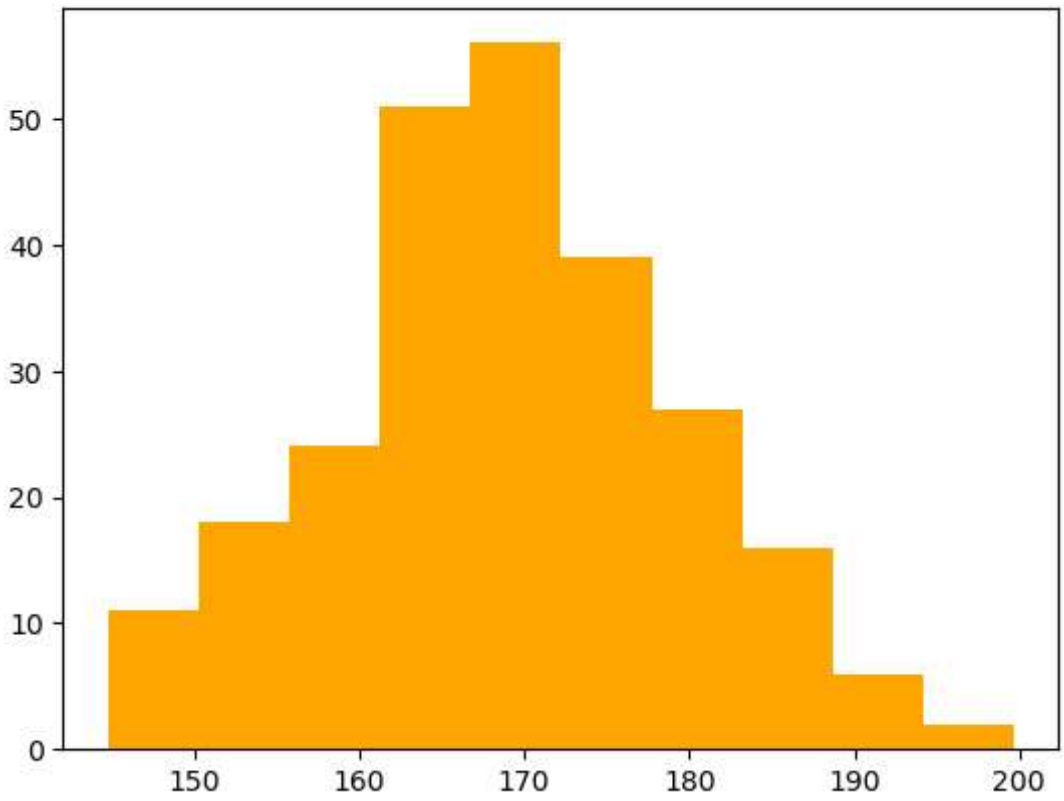
In [ ]:
```
### Create Histogram

hist() : Function to create histograms.

x=np.random.normal(170,10,250)  - For simplicity we use NumPy to randomly generate an
where the values will concentrate around 170, and the standard deviation is 10.
```

In [24]:
```
#A Normal Data Distribution by NumPy:
x=np.random.normal(170,10,250)
x
```

Out[24]:
```
array([149.40984156, 172.20070137, 182.9825461 , 160.01629785,
       176.37062242, 154.81384488, 156.34181739, 168.96183924,
       182.10927525, 161.3148854 , 173.61579562, 178.38917689,
       185.08803301, 157.36922626, 178.77196659, 182.15528275,
       175.87898964, 172.11882993, 161.2085065 , 161.96483925,
       170.89600639, 176.36523919, 169.66685858, 176.21736014,
       174.90555096, 172.26790753, 155.69966784, 172.34704686,
       151.02141614, 166.21432287, 157.62067683, 165.70995922,
       160.70515073, 152.35829313, 175.53122496, 154.12898471,
       176.65331354, 169.0977088 , 193.27993461, 166.31327322,
       163.30469878, 166.61218706, 161.24598764, 167.395348  ,
       154.09518328, 168.15596491, 186.68538725, 187.97084984,
       178.38292037, 176.38470834, 152.53630323, 194.2066996 ,
       171.91109451, 176.01981051, 166.47759272, 176.11298804,
       173.1154006 , 157.93635071, 185.92016578, 176.03189202,
       159.12310952, 163.88045872, 159.79106996, 163.25688143,
       169.8942413 , 167.83210379, 177.96283374, 172.7871974 ,
       181.48940516, 170.59849588, 164.31484649, 171.7071571 ,
       185.67480648, 167.41363232, 170.71623178, 170.93483208,
       167.2271047 , 165.70887638, 196.1598835 , 176.61071181,
       161.22187639, 149.26682445, 172.52784895, 162.48860003,
       162.80840426, 180.47031873, 174.72529991, 167.08215839,
       163.46230334, 179.13211322, 196.49919045, 167.07802945,
       175.21880432, 169.16221753, 180.7358291 , 175.97954131,
       159.51737313, 173.85307462, 168.49449885, 157.53328   ,
       166.21000269, 165.26533832, 154.97113662, 185.3216149 ,
       164.88646587, 160.9930798 , 169.77887991, 177.28812451,
       176.89011354, 157.69895066, 183.36523731, 162.74602948,
       173.8089871 , 197.19779051, 183.31040258, 162.81846124,
       170.96412207, 161.19143707, 192.59773793, 175.86052451,
       185.62136077, 157.29718082, 170.55385429, 162.3632044 ,
       170.53284382, 152.18482716, 167.15523102, 176.7752647 ,
       158.7306299 , 174.64446533, 182.89550758, 175.95762605,
       169.8065228 , 172.42910273, 168.94388681, 169.84928465,
       162.41353817, 165.65817992, 175.20382808, 190.18713572,
       153.16655711, 176.92939333, 161.24610379, 186.5037073 ,
       170.04592301, 168.73810767, 158.90563409, 177.59629083,
       152.19812591, 160.84202192, 169.53621394, 144.65980683,
       164.59462457, 177.31609348, 176.58617121, 194.41873642,
       173.44676735, 174.76379947, 183.41699968, 173.893927  ,
       178.24738564, 179.85777337, 193.28814015, 156.13063574,
       157.52443894, 158.72903419, 179.34333749, 189.56355356,
       184.96501702, 175.95624024, 169.55285931, 175.6456961 ,
       185.06839624, 177.56850178, 167.99177286, 176.30887846,
       180.392496  , 158.86011632, 180.05261905, 178.25827999,
       172.61269905, 181.81153026, 163.76320173, 177.52191965,
       190.49690673, 170.49275519, 160.38738428, 186.79713057,
       170.80070972, 173.11554995, 172.29916559, 160.67739243,
       169.23211219, 166.2337565 , 158.10995182, 165.0015334 ,
       152.00686398, 164.64347268, 170.20562455, 159.132724  ,
       141.73079518, 163.83998393, 158.39650916, 162.00630963,
       193.34124791, 147.88520027, 144.31157996, 179.01346468,
       169.4643758 , 168.18547279, 172.33903597, 183.97264103,
       164.60420952, 166.25686   , 183.35995494, 173.71196173,
       170.85334784, 169.02973608, 167.36633248, 171.12028343,
       181.71234651, 178.69538492, 169.90728597, 176.82079898,
       169.40321002, 171.91883193, 168.22823517, 154.73059476,
       175.10020451, 188.45769881, 166.51943569, 168.06052995,
       170.55328534, 169.18283863, 180.20958887, 179.82334677,
       168.23093642, 143.12784714, 172.78027548, 171.97454958,
```

```
       158.16601619, 172.1732723 , 187.83841031, 156.77193663,
       171.0019862 , 175.00143941, 162.81718772, 159.64994263,
       170.44018167, 181.71912705])
```

In [25]:
```
#17.Histogram for frequency distribution

x=np.random.normal(170,10,250) #Normal data Distribution
plt.hist(x,color="orange") #The hist() function will read the array and produce a hist
plt.show()
```

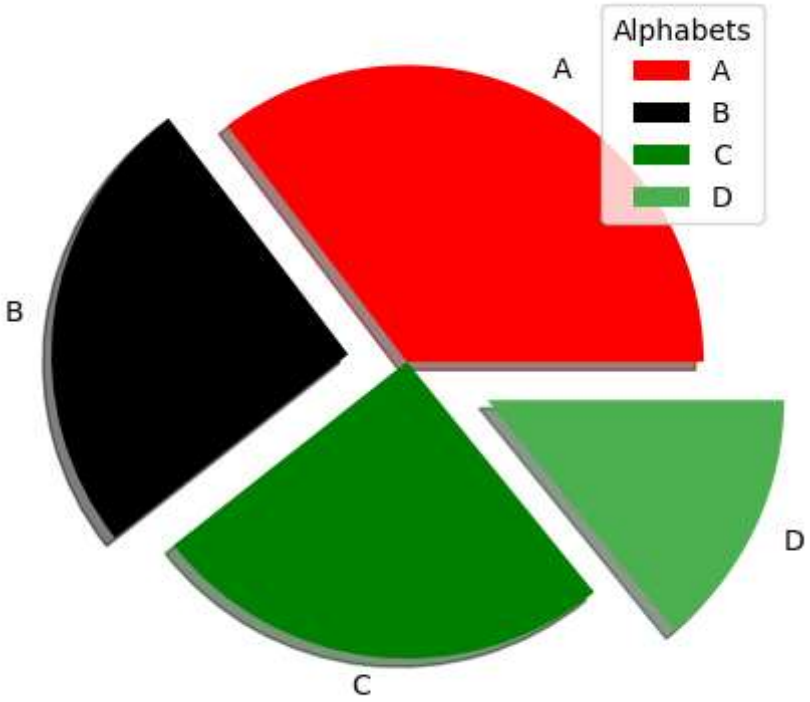


Pie chart

In [ ]:
```
### Matplotlib Pie Charts
pie() : Function to draw pie charts.
As you can see the pie chart draws one piece (called a wedge) for each value in the ar
By default the plotting of the first wedge starts from the x-axis and moves counterclo

The size of each wedge is determined by comparing the value with all the other values,
The value divided by the sum of all values: x/sum(x)

Arguments:
label          - Add labels to the pie chart with the label parameter.
                 The label parameter must be an array with one label for each wedge.

startangle     - As mentioned the default start angle is at the x-axis, but you can cha
                 by specifying a startangle parameter.The startangle parameter is defir
                 an angle in degrees, default angle is 0:

explode        - The explode parameter allows you to the wedges to stand out.
                 The explode parameter, if specified, and not None, must be an array wi
                 Each value represents how far from the center each wedge is displayed.
shadow         - Add a shadow to the pie chart by setting the shadows parameter to True
```

```
color         - set the color of each wedge with the colors parameter.
                The colors parameter, if specified, must be an array with one value fo
```

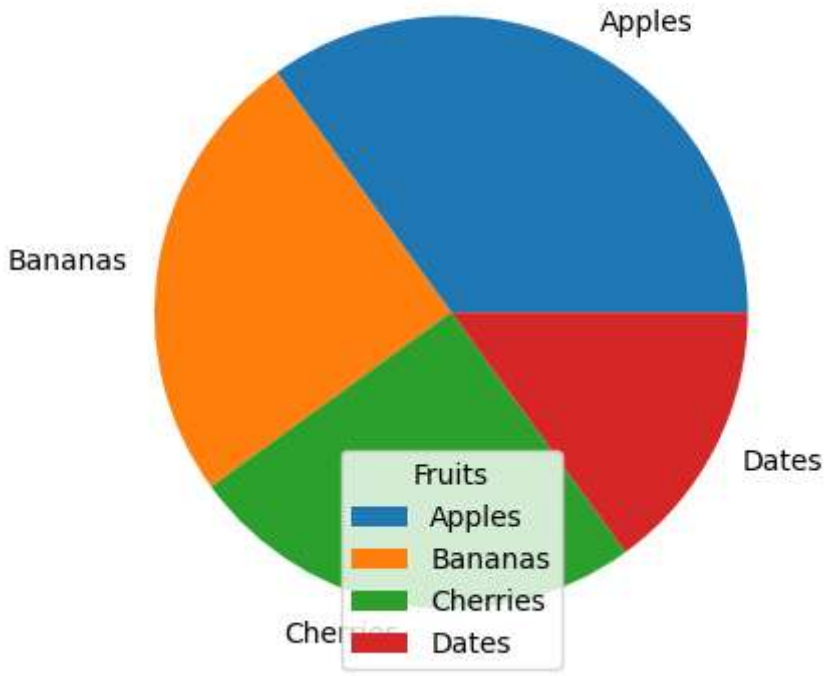
In [30]:
```
#Creating Pie Charts
y = np.array([35, 25, 25, 14])
myexplode=[0,0.2,0,0.3]
mylabels=["A","B","C","D"]
mycolors=["red","black","green","#4CAF50"]
#plt.pie(y,explode=myexplode,labels=mylabels,colors=mycolors,shadow= True,startangle=9
plt.pie(y,explode=myexplode,labels=mylabels,colors=mycolors,shadow= True,startangle=0)
#plt.legend(title="Alphabets")
plt.show()
```



Legend

In [ ]:
```
 legend()  -To add a list of explanation for each wedge in pie chart.
 Arguments:
  title    - add a header to the legend.
```

In [32]:
```
import matplotlib.pyplot as plt
import numpy as np

y = np.array([35, 25, 25, 15])
mylabels = ["Apples", "Bananas", "Cherries", "Dates"]

plt.pie(y, labels = mylabels)
plt.legend(title="Fruits")
plt.show()
```


Apples
Bananas
Dates
Fruits
Apples
Bananas
Cherries
Dates

```
# THANK YOU...
```