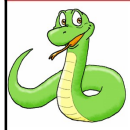


Python 3x Programing

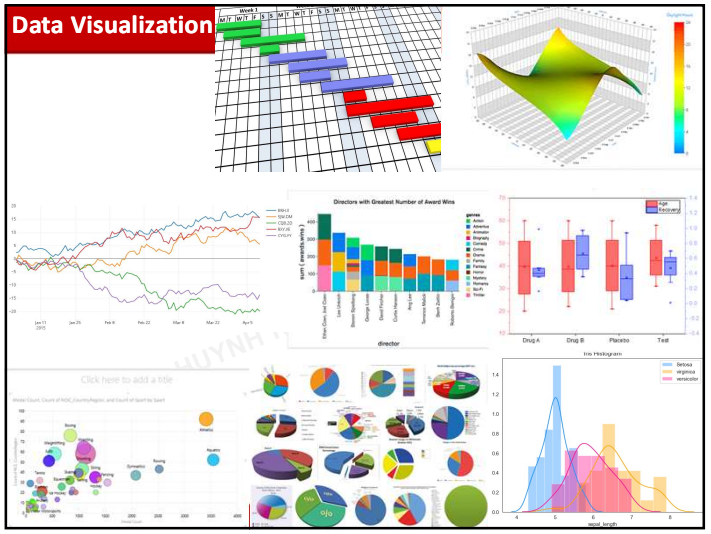
Lesson Matplotlib

Tutor MR. Huynh Nam

Time 90 mins

Ai-Edu

1



2

Content

- ***Matplotlib***
  - Introduction to Matplotlib
  - Common Components
  - Type of Chart
    - Scatter
    - Line
    - Pie
    - Bar
    - Gannt

3

Matplotlib

- Matplotlib is a plotting library for the Python programming language and its numerical mathematics extension NumPy. It provides an object-oriented API for embedding plots into applications using general-purpose GUI toolkits like Tkinter, wxPython, Qt, or GTK+. There is also a procedural "pylab" interface based on a state machine (like OpenGL), designed to closely resemble that of MATLAB, though its use is discouraged.[3] SciPy makes use of Matplotlib.
- Install with Anaconda 3 prompt:
  - ***conda install matplotlib***

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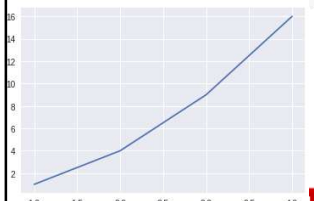
Starting with PyPlot

- Pyplot is a module of Matplotlib which provides simple functions to add plot elements like lines, images, text, etc. to the current axes in the current figure.
- Make simple chart:

```
import matplotlib.pyplot as plt
import numpy as np

plt.plot([1,2,3,4],[1,4,9,16])
plt.show()
```



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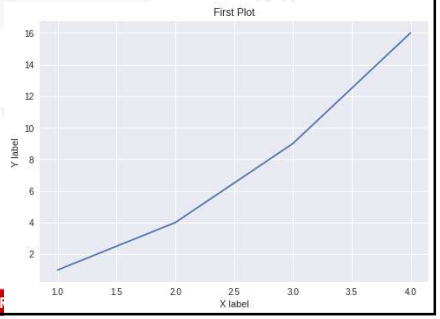
title(), xlabel() and ylabel()

```
plt.plot([1,2,3,4],[1,4,9,16])
plt.title("First Plot")
plt.xlabel("X label")
plt.ylabel("Y label")
plt.show()
```



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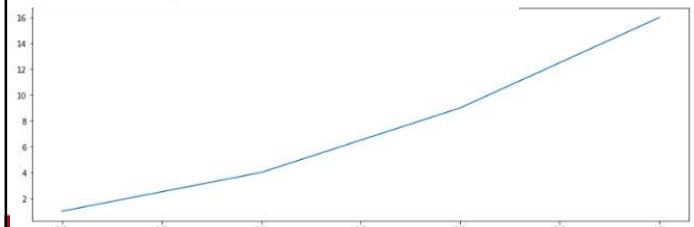
figure() and figsize

```
import matplotlib.pyplot as plt

plt.figure(figsize = (15,5))
plt.plot([1,2,3,4],[1,4,9,16])
plt.show()
```



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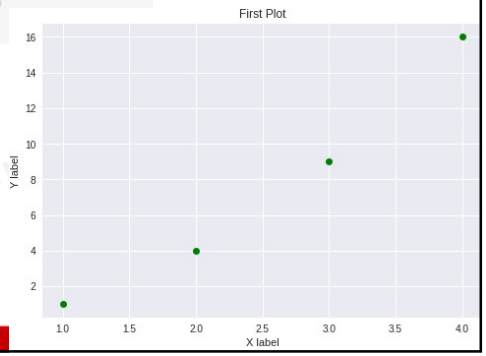
Color and Type of Dot in chart

```
plt.plot([1,2,3,4],[1,4,9,16],"go")
plt.title("First Plot")
plt.xlabel("X label")
plt.ylabel("Y label")
plt.show()
```



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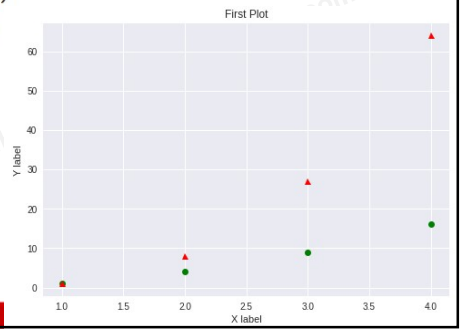
Color and Type of Dot in chart (cont)

```
x = [1,2,3,4]
y = [i**3 for i in x]
plt.plot([1,2,3,4],[1,4,9,16],'go',x,y,'r^')
plt.title('Two graphs')
plt.xlabel('X label')
plt.ylabel('Y label')
plt.show()
```



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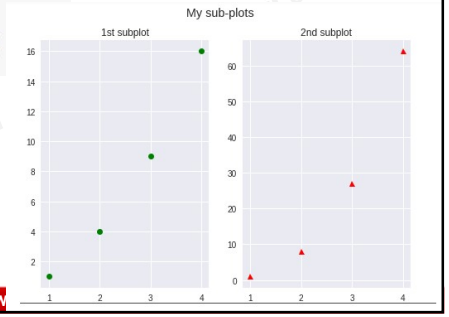
Multiple charts in figure

```
plt.subplot(1,2,1)
plt.plot([1,2,3,4],[1,4,9,16],"go")
plt.title("1st subplot")

plt.subplot(1,2,2)
plt.plot(x,y,"r^")
plt.title("2nd subplot")

plt.suptitle("My sub-plots")
plt.show()
```



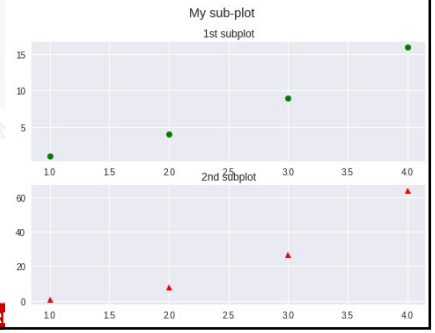
11

Multiple charts in figure (cont)

```
plt.subplot(2,1,1)
plt.plot([1,2,3,4],[1,4,9,16],'go')
plt.title('1st subplot')

plt.subplot(2,1,2)
plt.plot(x,y,'r^')
plt.title('2nd subplot')

plt.suptitle("My sub-plot")
plt.show()
```



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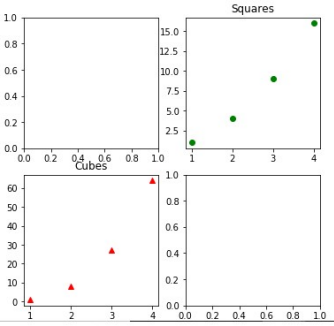
Multiple charts in figure (cont)

```
x = [1,2,3,4]
y = [i**3 for i in x]
fig,ax = plt.subplots(nrows=2,ncols=2,figsize=(6,6))
ax[0,1].plot([1,2,3,4],[1,4,9,16],'go')
ax[1,0].plot(x,y,'r^')
ax[0,1].set_title('Green Oval')
ax[1,0].set_title('Red Rectangle')
plt.show()
```



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Data Visualization

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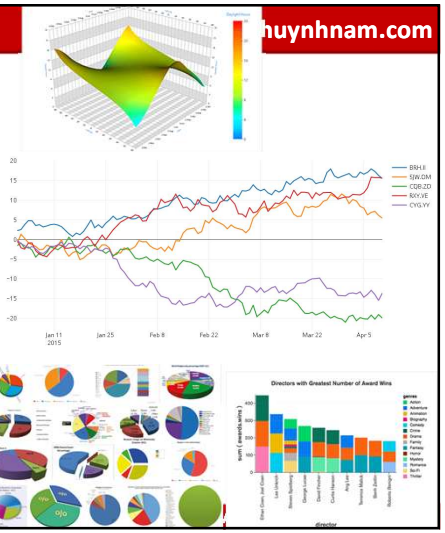
Type of Chart

- Scatter chart
- Line chart
- Pie
- Bar
- Gannt



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Data Visualization

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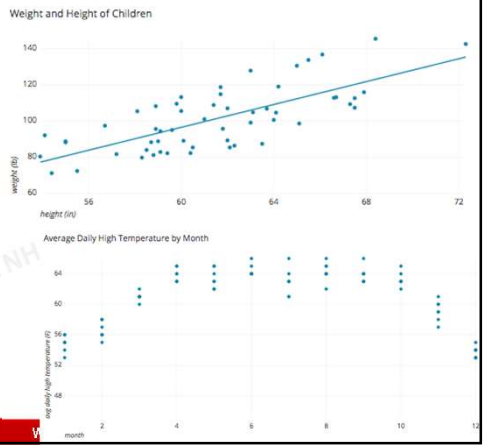
Scatter Chart

- A scatter plot, also known as a scatter graph or a scatter chart, is a two-dimensional data visualization that uses dots to represent the values obtained for two different variables - one plotted along the x-axis and the other plotted along the y-axis.



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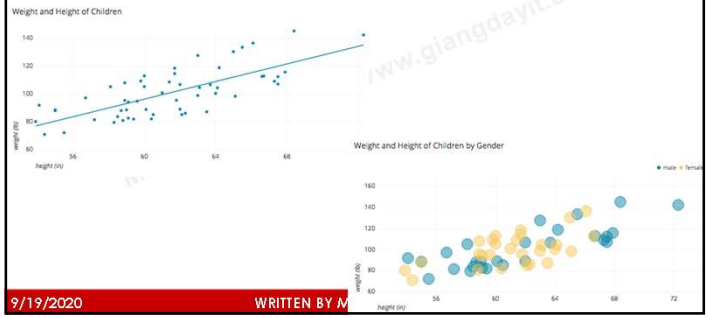
Common Extensions of Scatter Plots

- Several advanced visualization tools allow for more complex visualizations.
- Often scatter plots will include a trendline to help make the relationship more clear, as we do in the following graph.



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Data Visualization

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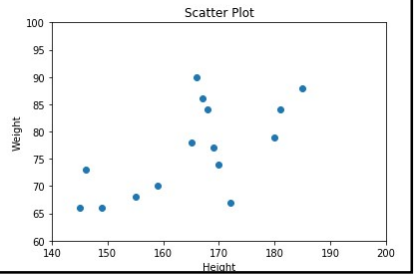
Scatter Chart Demo

```
height = [167,170,149,165,155,180,166,146,159,185,145,168,172,181,169]
weight = [86,74,66,78,68,79,90,73,70,88,66,84,67,84,77]
plt.xlim(140,200)
plt.ylim(60,100)
plt.scatter(height,weight)
plt.title('Line Plot')
plt.xlabel('Height')
plt.ylabel('Weight')
plt.show()
```



9/19/2020

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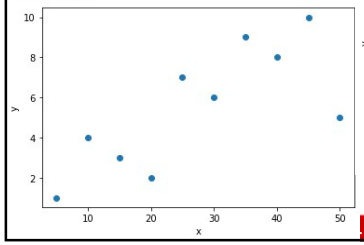
Scatter Chart Demo – xticks & yticks

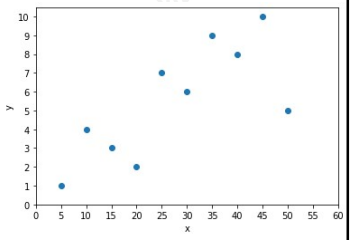
- Default

```
# values of x and y axes
x = [5, 10, 15, 20, 25, 30, 35, 40, 45, 50]
y = [1, 4, 3, 2, 7, 6, 9, 8, 10, 5]

plt.scatter(x, y)
plt.xlabel('x')
plt.ylabel('y')

plt.show()
```



- Using xticks and yticks

```
plt.xticks(range(0, 61, 5))
plt.yticks(range(0, 11, 1))
```



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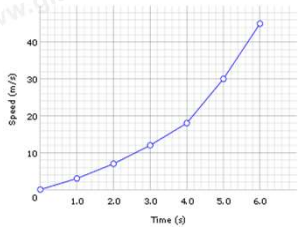
Line Chart

- A line chart or line plot or line graph or curve chart is a type of chart which displays information as a series of data points called 'markers' connected by straight line segments.
- It is a basic type of chart common in many fields. It is similar to a scatter plot except that the measurement points are ordered (typically by their x-axis value) and joined with straight line segments.
- A line chart is often used to visualize a trend in data over intervals of time – a time series – thus the line is often drawn chronologically. In these cases they are known as run charts

Elapsed Time (s)	Speed ($m\ s^{-1}$)
0	0
1	3
2	7
3	12
4	20
5	30
6	45.6



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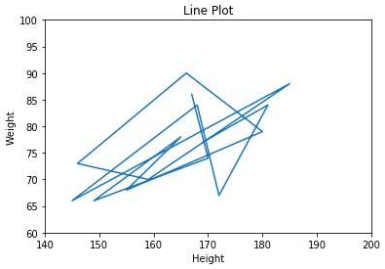
Line Chart Demo

```
height = [167,170,149,165,155,180,166,146,159,185,145,168,172,181,169]
weight = [86,74,66,78,68,79,90,73,70,88,66,84,67,84,77]
plt.xlim(140,200)
plt.ylim(60,100)
plt.plot(height,weight)
plt.title('Line Plot')
plt.xlabel('Height')
plt.ylabel('Weight')
plt.show()
```



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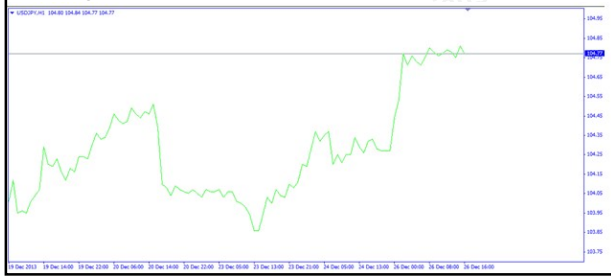
Line Chart - Type of Forex Chart

- Three most popular types of Forex charts:
  - Line Chart
  - Bar Chart (OHCL)
  - Candlestick Chart
- A simple line chart draws a line from **one closing price to the next closing price.**



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Line Chart for Trend Line

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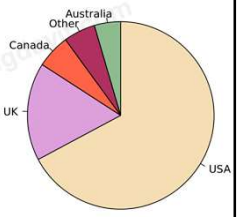
Pie Chart

- A pie chart (or a circle chart) is a circular statistical graphic, which is divided into slices to illustrate numerical proportion. In a pie chart, the arc length of each slice (and consequently its central angle and area), is proportional to the quantity it represents. While it is named for its resemblance to a pie which has been sliced, there are variations on the way it can be presented. The earliest known pie chart is generally credited to William Playfair's Statistical Breviary of 1801.

- Pie charts are very widely used in the business world and the mass media. However, they have been criticized, and many experts recommend avoiding them, pointing out that research has shown it is difficult to compare different sections of a given pie chart, or to compare data across different pie charts. Pie charts can be replaced in most cases by other plots such as the bar chart, box plot, dot plot, etc.



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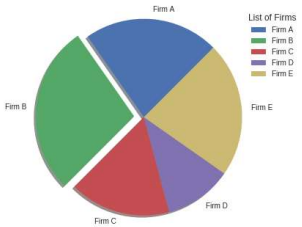
Pie Chart Demo

```
firms = ["Firm A", "Firm B", "Firm C", "Firm D","Firm E"]
market_share = [20, 25, 15, 10, 20]
Explode = [0,0.1,0,0,0]
plt.pie(market_share,explode=Explode,labels=firms,shadow=True,startangle=45)
plt.axis('equal')
plt.legend(title="List of Firms")
plt.show()
```



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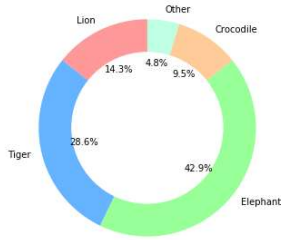
Pie Chart Demo

Animals	Amount (Thounds)
Lion	15
Tiger	30
Elephant	45
Crocodile	10



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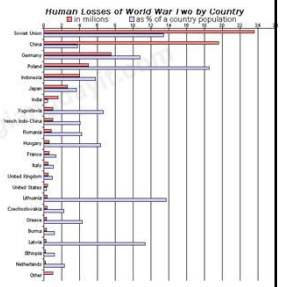
Bar chart

- A bar chart or bar graph is a chart or graph that presents categorical data with rectangular bars with heights or lengths proportional to the values that they represent. The bars can be plotted vertically or horizontally. A vertical bar chart is sometimes called a line graph.

- A bar graph shows comparisons among discrete categories. One axis of the chart shows the specific categories being compared, and the other axis represents a measured value. Some bar graphs present bars clustered in groups of more than one, showing the values of more than one measured variable.



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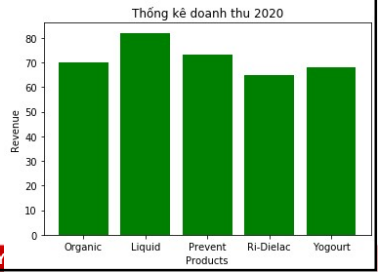
Bar chart Demo

```
# Các sản phẩm của Vinamilk
products = ['Organic','Liquid','Prevent','Ri-Dielac','Yogourt']

# Doanh số từng loại sản phẩm tại tphcm (đơn vị: tỷ đồng)
revenue_hcmc = [70,82,73,65,68]

plt.bar(products, revenue_hcmc, color='green')

plt.title('Thống kê doanh thu 2020')

plt.xlabel('Products')

plt.ylabel('Revenue')

plt.show()
```



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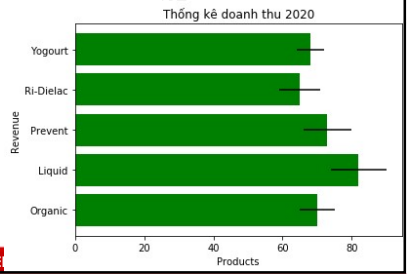
Bar chart Demo

```
# Các sản phẩm của Vinamilk
products = ['Organic','Liquid','Prevent','Ri-Dielac','Yogourt']

# Doanh số từng loại sản phẩm tại tphcm (đơn vị: tỷ đồng)
revenue_hcmc = [70,82,73,65,68]

#khoảng sai
error_hcmc = [5,8,7,6,4]

plt.barh(products, revenue_hcmc, xerr=error_hcmc, color='green')

plt.title('Thống kê doanh thu 2020')

plt.xlabel('Products')

plt.ylabel('Revenue')

plt.show()
```



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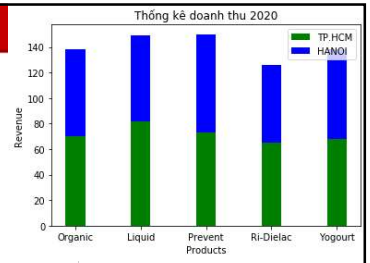
Bar chart Demo

```
import matplotlib.pyplot as plt

# Các sản phẩm của Vinamilk
products = ['Organic','Liquid','Prevent','Ri-Dielac','Yogourt']

# Doanh số từng loại sản phẩm tại tphcm (đơn vị: tỷ đồng)
revenue_hcmc = [70,82,73,65,68]

# Doanh số từng loại sản phẩm tại hanoi (đơn vị: tỷ đồng)
revenue_hanoi = [68,67,77,61,70]

index_lst = range(5)
width = 0.3

plt.bar(index_lst, revenue_hcmc,width, color='green',label='TP.HCM')

plt.bar(index_lst, revenue_hanoi,width, color='blue',label='HANOI', bottom=revenue_hcmc)

plt.title('Thống kê doanh thu 2020')

plt.xlabel('Products')

plt.ylabel('Revenue')

plt.xticks(index_lst,products)

#loc: location, best=tự con vị trí tốt nhất
plt.legend(loc='best')

plt.show()
```



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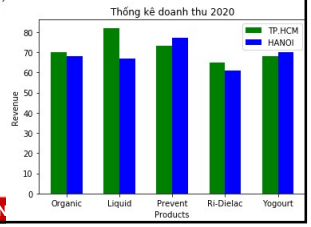
Bar chart Demo

```
# Các sản phẩm của Vinamilk
products = ['Organic','Liquid','Prevent','Ri-Dielac','Yogourt']

# Doanh số từng loại sản phẩm tại tphcm (đơn vị: tỷ đồng)
revenue_hcmc = [70,82,73,65,68]

# Doanh số từng loại sản phẩm tại hanoi (đơn vị: tỷ đồng)
revenue_hanoi = [68,67,77,61,70]

index_1st = range(5)
width = 0.3

plt.bar(index_1st, revenue_hcmc,width, color='green',label='TP.HCM')

index_2nd = [i+width for i in index_1st]
plt.bar(index_2nd, revenue_hanoi,width, color='blue',label='HANOI')

plt.title('Thống kê doanh thu 2020')

plt.xlabel('Products')

plt.ylabel('Revenue')

index_3rd = [i+width/2 for i in index_1st]
plt.xticks(index_3rd,products)

#loc: location, best=tự con vị trí tốt nhất
plt.legend(loc='best')

plt.show()
```



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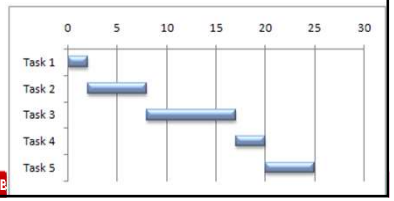
Gantt Chart

- A Gantt chart is a graphical depiction of a project schedule or task schedule (In OS). It's is a type of bar chart that shows the start and finish dates of several elements of a project that include resources or deadline. The first Gantt chart was devised in the mid-1890s by Karol Adamiecki, a Polish engineer who ran a steelworks in southern Poland and had become interested in management ideas and techniques. Some 15 years after Adamiecki, Henry Gantt, an American engineer, and project management consultant, devised his own version of the chart which became famous as "Gantt Charts".
- Some Uses of Gantt Charts :
  - Project Scheduling.
  - Task Scheduling on Processors



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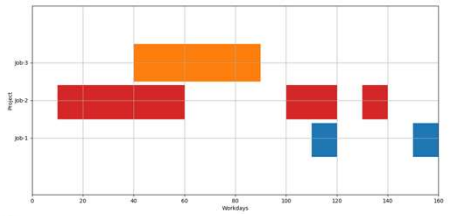
Gantt Chart - Demo

```
# Importing the matplotlib.pyplot
import matplotlib.pyplot as plt

# Declaring a figure "gnt"
fig, gnt = plt.subplots()

# Setting Y-axis limits
gnt.set_ylim(0, 50)

# Setting X-axis limits
gnt.set_xlim(0, 160)

# Setting labels for x-axis and y-axis
gnt.set_xlabel('Workdays')
gnt.set_ylabel('Project')

# Setting ticks on y-axis
gnt.set_yticks([15, 25, 35])
# Labelling ticks of y-axis
gnt.set_yticklabels(['Job-1', 'Job-2', 'Job-3'])

# Setting graph attribute
gnt.grid(True)

# Declaring a bar in schedule
gnt.broken_barh([(40, 50)], (30, 10), facecolors =('tab:orange'))

# Declaring multiple bars in at same level and same width
gnt.broken_barh([(110, 10), (150, 10)], (10, 9),
                facecolors ='tab:blue')

gnt.broken_barh([(10, 50), (100, 20), (130, 10)], (20, 9),
                facecolors =('tab:red'))

plt.show()
```



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Conclusion

- plot(x-axis values, y-axis values)
- show()
- title("string")
- xlabel("string")
- ylabel("string")
- figure()
- subplot(nrows, ncols, index)
- suptitle("string")
- subplots(nrows, ncols, figsize)
- set_title("string")
- bar(categorical variables, values, color)
- barh(categorical variables, values, color)
- legend(loc)
- xticks(index, categorical variables) and xtickslabel
- yticks and ytickslabel
- pie(value, categorical variables)
- hist(values, number of bins)
- xlim(start value, end value)
- ylim(start value, end value)
- scatter(x-axis values, y-axis values)
- axes()
- set_xlabel("string")
- set_ylabel("string")
- scatter3D(x-axis values, y-axis values)
- plot3D(x-axis values, y-axis values)

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THANK YOU
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