

Artificial Intelligence

Lecture 5. Data Visualization

Spring 2022

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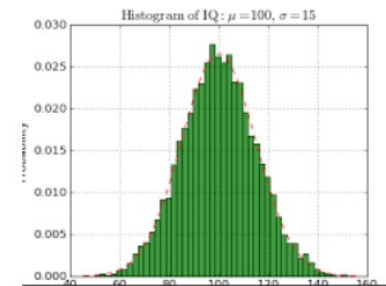
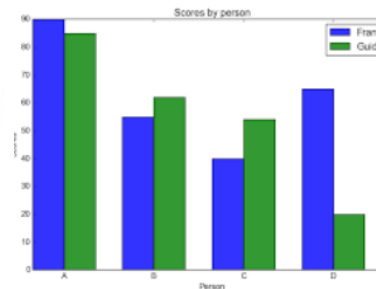
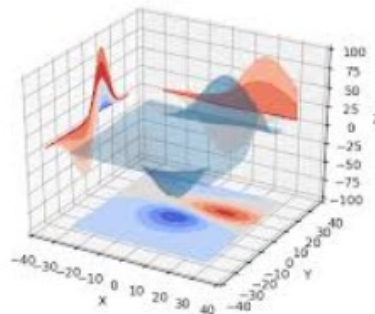
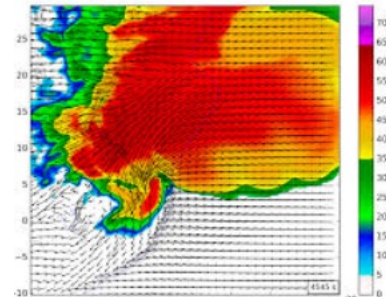
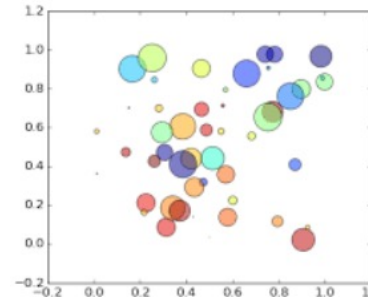
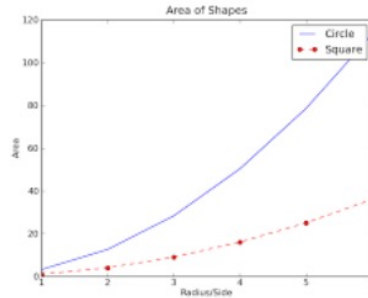
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Lecture Note : <https://lms.mju.ac.kr>

Matplotlib

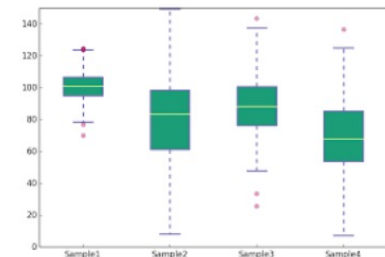
- 데이터를 chart나 plot으로 시각화하는 Python package

- line plot
- scatter plot
- contour plot
- surface plot
- bar chart
- histogram
- box plot

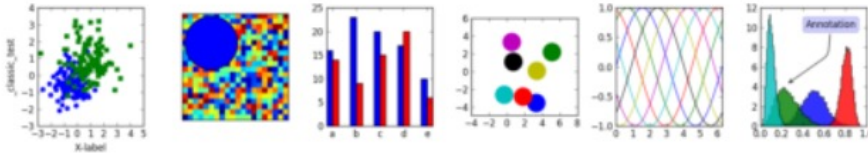


- 설치

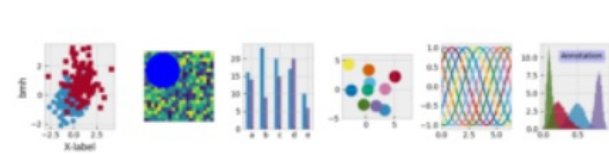
- pip install matplotlib



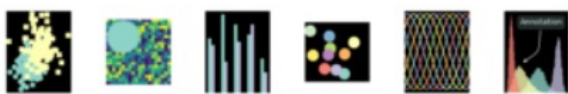
다양한 예제



style_sheets_reference



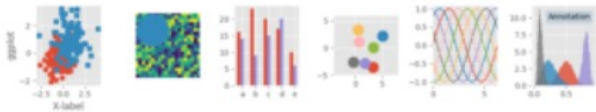
style_sheets_reference



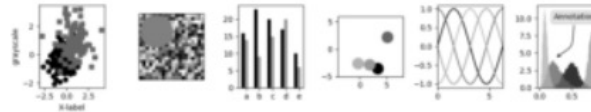
style_sheets_reference



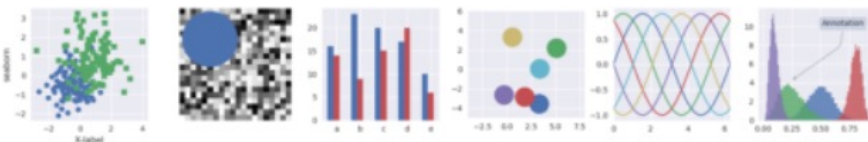
style_sheets_reference



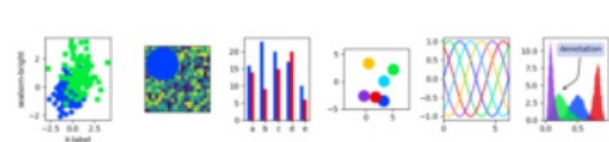
style_sheets_reference



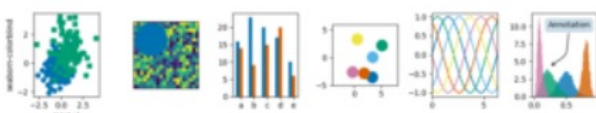
style_sheets_reference



style_sheets_reference



style_sheets_reference



style_sheets_reference



style_sheets_reference

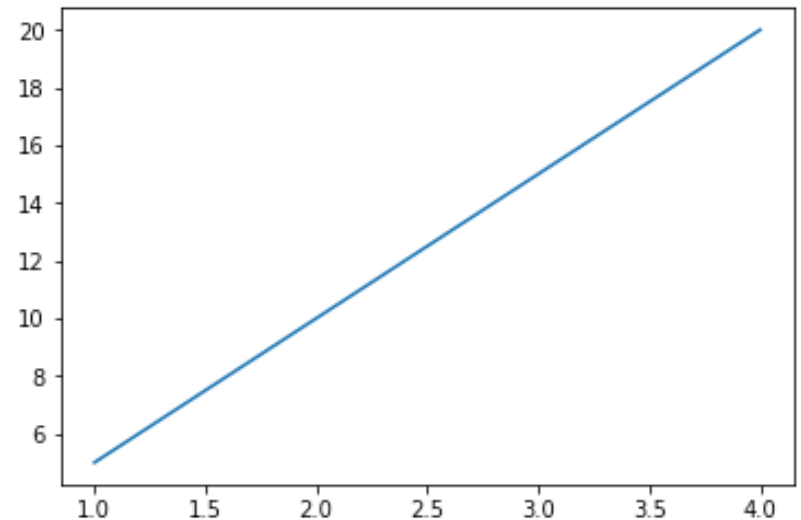
Line plot

```
from matplotlib import pyplot as plt
.....
plt.plot()
plt.show()
```

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

```
x = np.array([1, 2, 3, 4])
y = x * 5
print(x, y)
plt.plot(x,y)
plt.show()
```

```
[1 2 3 4] [ 5 10 15 20]
```

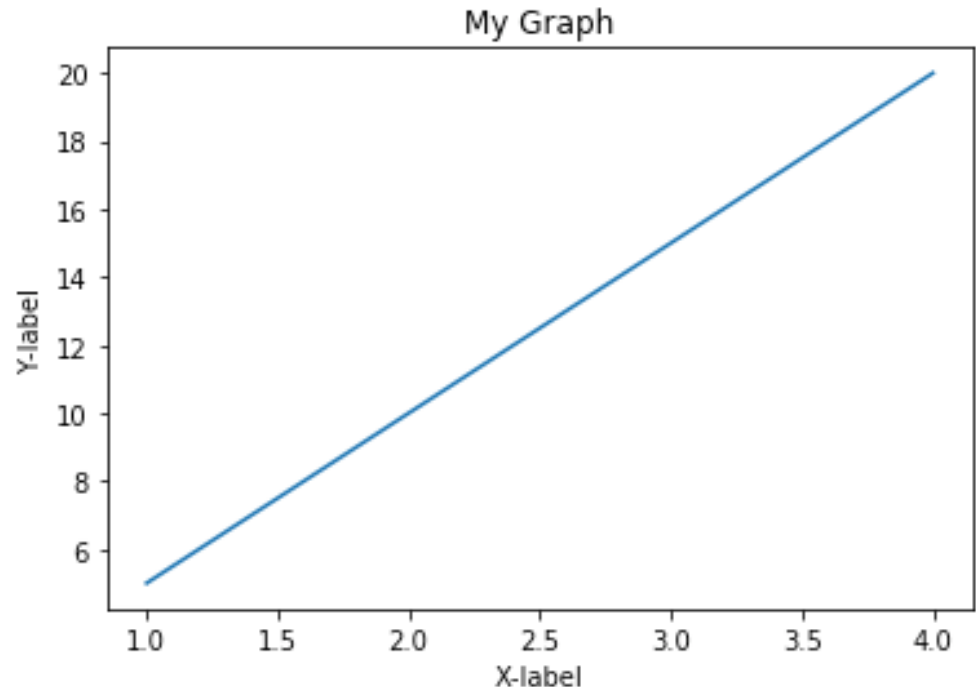


Line plot

- 그래프 이름과 축 라벨 추가하기

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

x = np.array([1, 2, 3, 4])
y = x * 5
plt.title('My Graph')
plt.xlabel('X-label')
plt.ylabel('Y-label')
plt.plot(x,y)
plt.show()
```



Line plot

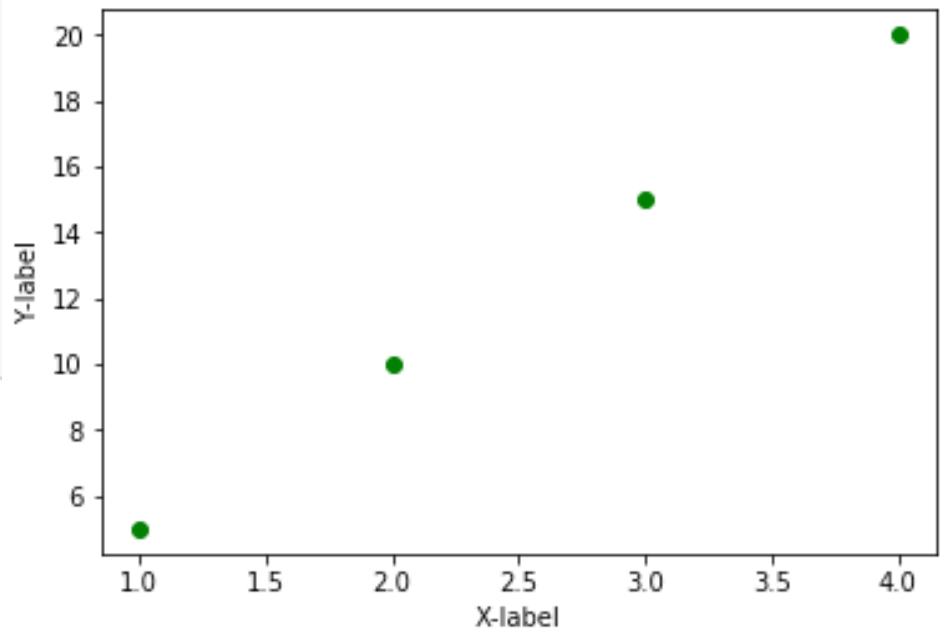
- 선대신 점으로 데이터 표현

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

```
x = np.array([1, 2, 3, 4])
y = x * 5
```

```
plt.xlabel('X-label')
plt.ylabel('Y-label')
```

```
# default는 'b-' b:blue, -:line
# go 사용 g:green, o: 'o'로 표현
plt.plot(x, y, 'go')
plt.show()
```



Multiple plotting

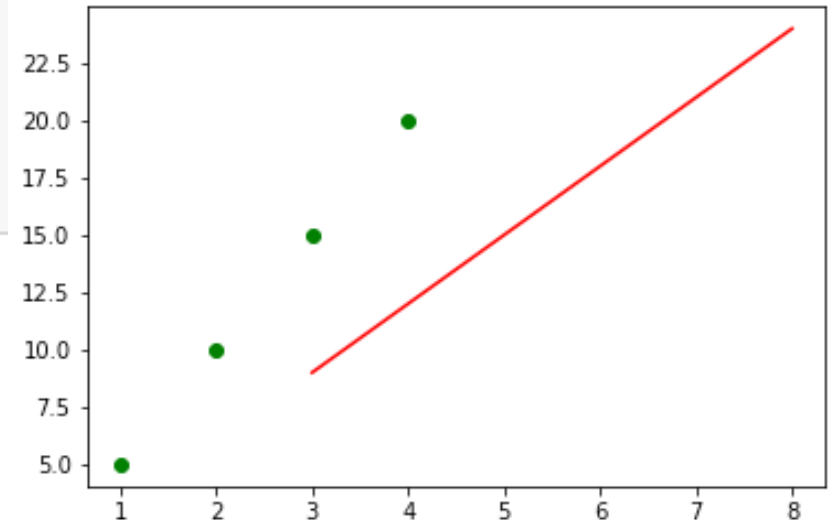
- 여러 세트의 데이터를 동일한 좌표상에 그리기

```
# 여러개의 그래프 그리기
from matplotlib import pyplot as plt
import numpy as np

x1 = np.array([1, 2, 3, 4])
y1 = x1 * 5

x2 = np.array([3, 4, 6, 8])
y2 = x2 * 3

plt.plot(x1, y1, 'go', x2, y2, 'r-')
plt.show()
```



Graph shape & color

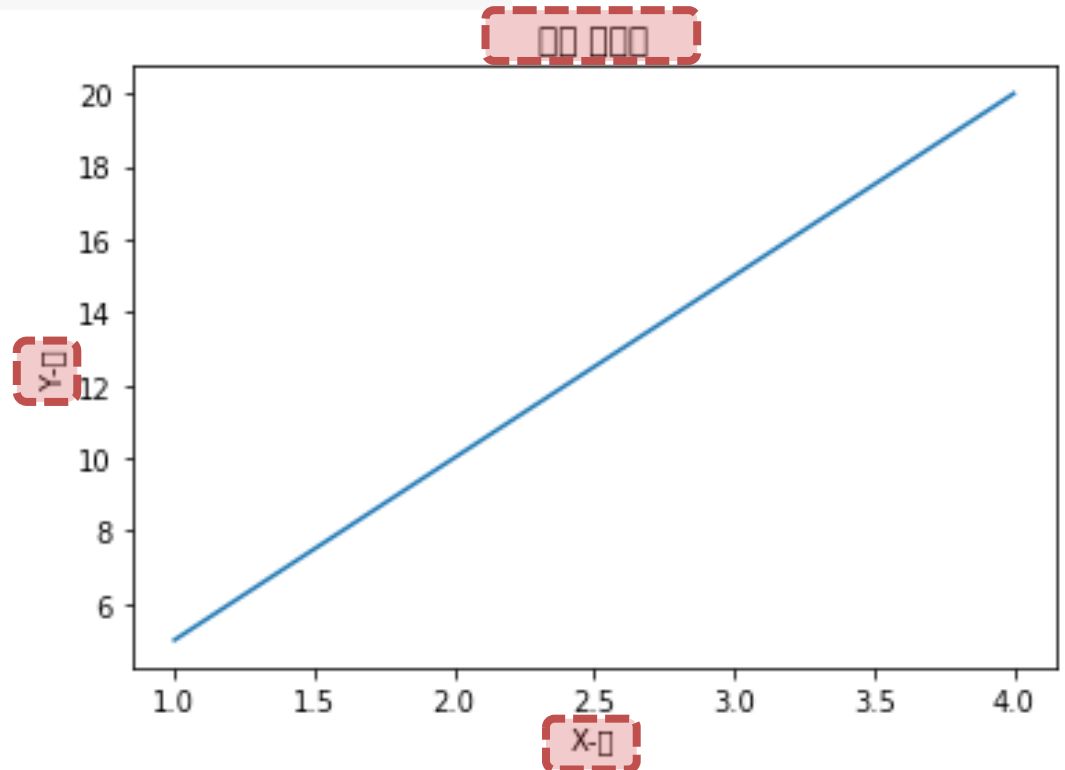
Character	Color
'b'	Blue
'g'	Green
'r'	Red
'c'	Cyan
'm'	Magenta
'y'	Yellow
'k'	Black
'w'	White

Character	Description
'_'	Solid line style
'--'	Dashed line style
'-.'	Dash-dot line style
':'	Dotted line style
'.'	Point marker
','	Pixel marker
'o'	Circle marker
'v'	Triangle_down marker
'^'	Triangle_up marker
'<'	Triangle_left marker
'>'	Triangle_right marker
'1'	Tri_down marker
'2'	Tri_up marker
'3'	Tri_left marker
'4'	Tri_right marker
's'	Square marker
'p'	Pentagon marker
'*'	Star marker

한글 입력

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

x = np.array([1, 2, 3, 4])
y = x * 5
plt.title('나의 그래프')
plt.xlabel('X-축')
plt.ylabel('Y-축')
plt.plot(x,y)
plt.show()
```



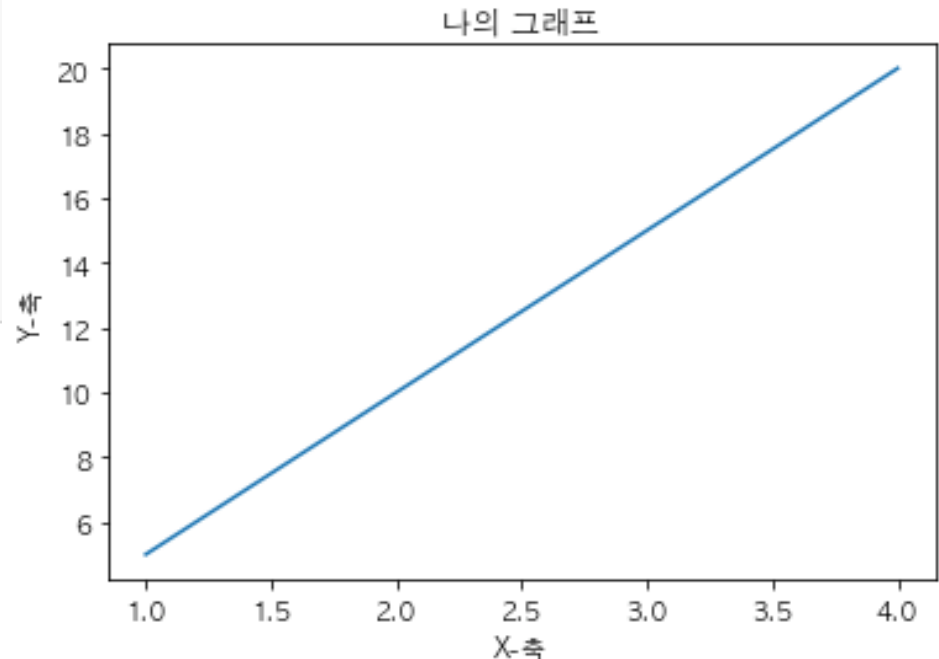
한글 입력

- 설치된 폰트 파일 위치 확인 후 사용

```
import matplotlib
from matplotlib import font_manager, rc
from matplotlib import pyplot as plt
import numpy as np

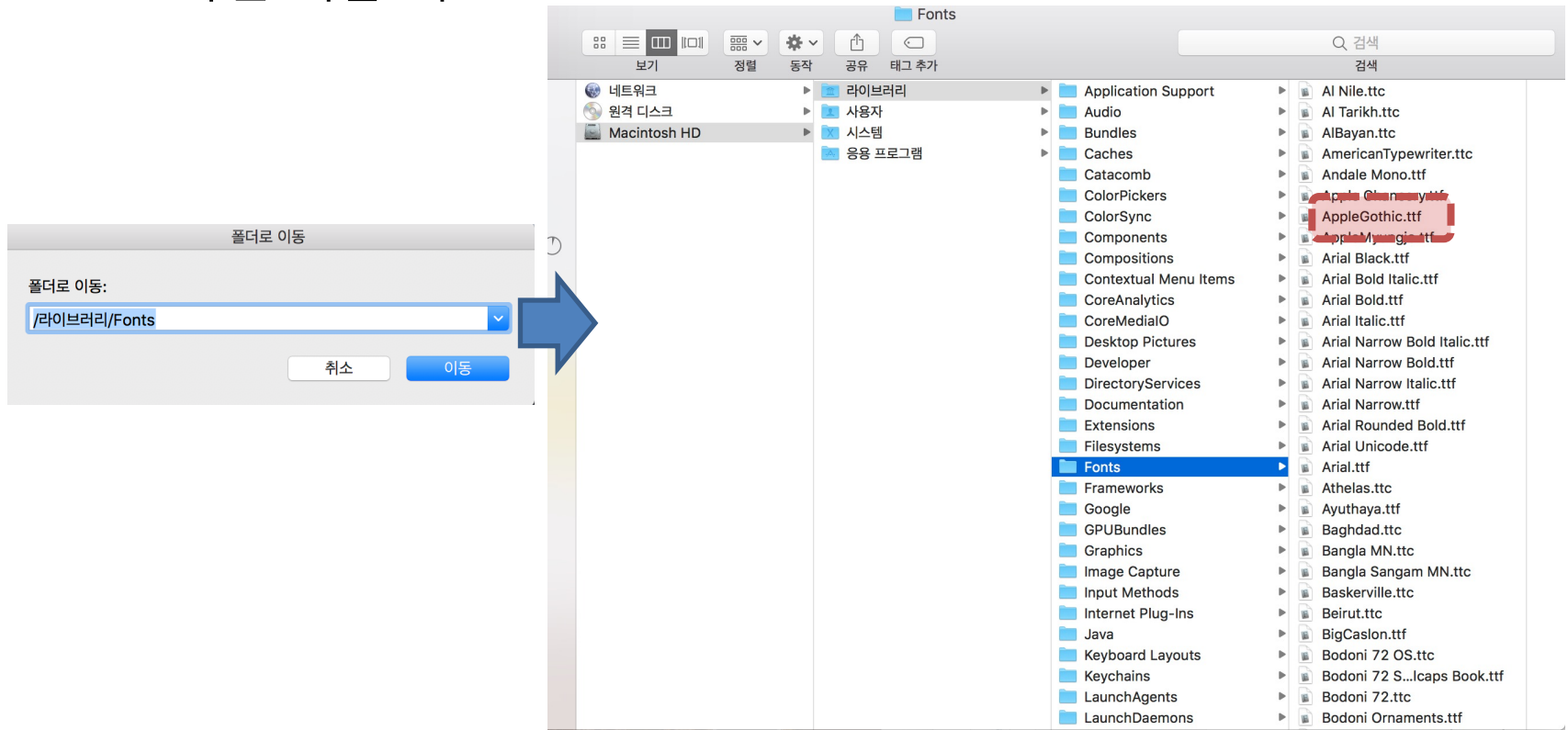
font_location = "/Library/Fonts/AppleGothic.ttf"
font_name = font_manager.FontProperties(fname = font_location).get_name()
matplotlib.rc('font', family = font_name)

x = np.array([1, 2, 3, 4])
y = x * 5
plt.title('나의 그래프')
plt.xlabel('X-축')
plt.ylabel('Y-축')
plt.plot(x,y)
plt.show()
```



MacBook 환경 한글 입력

- Finder 이동 -> 폴더로 이동 -> /Library/Fonts -> 폰트 파일 선택
-> 파일 이름 확인



Windows 환경 한글 입력

- Windows fonts folder 열기 -> font 파일 선택 (열기) -> font파일 선택(속성) -> 파일 이름 확인



- `font_location = "c:/windows/fonts/malgun.ttf"`

Subplot을 이용한 multiple graph

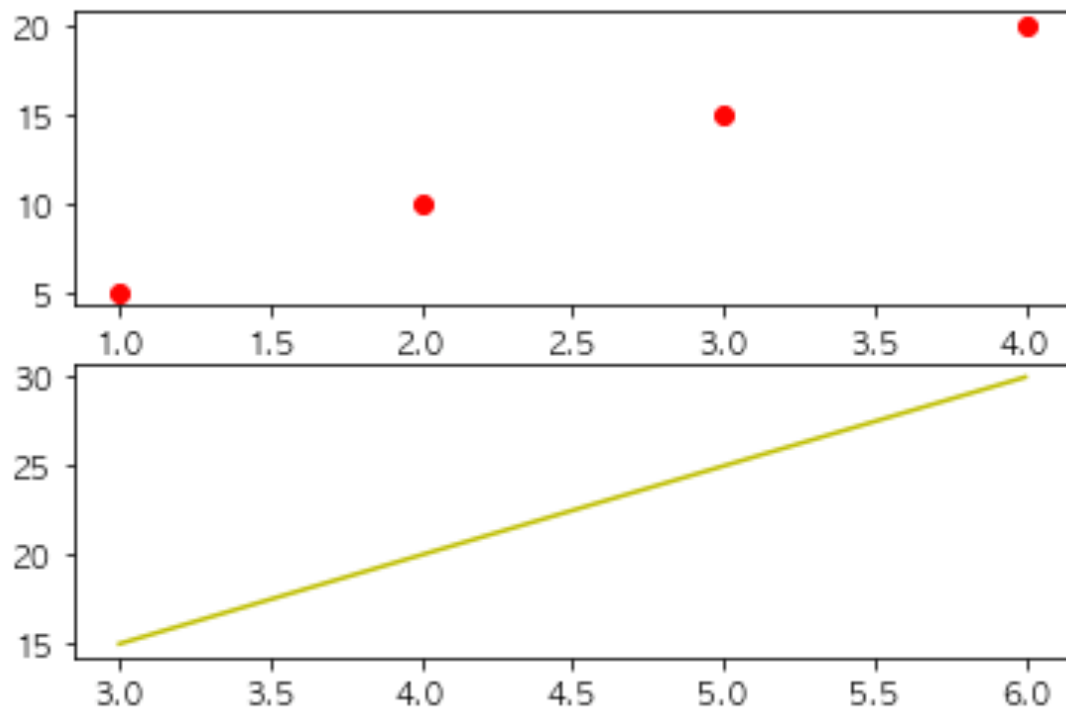
```
# 여러개의 그래프 그리기
from matplotlib import pyplot as plt
import numpy as np

plt.figure() # 캔버스 생성

plt.subplot(2, 1, 1) # 2 * 1개의 그래프 중 1번째
x1 = np.array([1, 2, 3, 4])
y1 = x1 * 5
plt.plot(x1, y1, 'ro')

plt.subplot(2, 1, 2)
x2 = np.array([3, 4, 5, 6])
y2 = x2 * 5
plt.plot(x2, y2, 'y-')

plt.show()
```



Grid와 문자 삽입

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

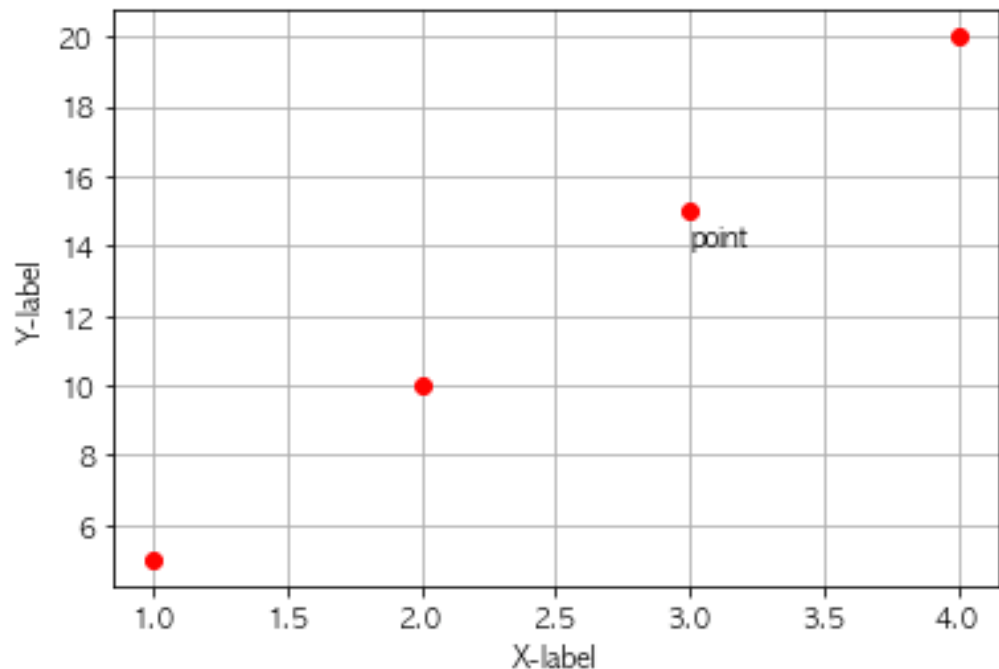
x = np.array([1, 2, 3, 4])
y = x * 5

plt.xlabel('X-label')
plt.ylabel('Y-label')

plt.text(3, 14, 'point') # (3, 14) 위치에 'point' 문자 삽입

plt.grid(True) # 격자 그리기
plt.plot(x, y, 'ro')

plt.show()
```



Scatter plot

```
from matplotlib import pyplot as plt
import numpy as np
from matplotlib import font_manager, rc

# 폰트에 따라서 음수인 경우, '-' 사인이 표출되지 않는 경우가 있음
# 이를 해결하기 위해서 다른 폰트를 적용
font_location = "/Library/Fonts/Arial Unicode.ttf"
font_name = font_manager.FontProperties(fname = font_location).get_name()
matplotlib.rc('font', family = font_name)

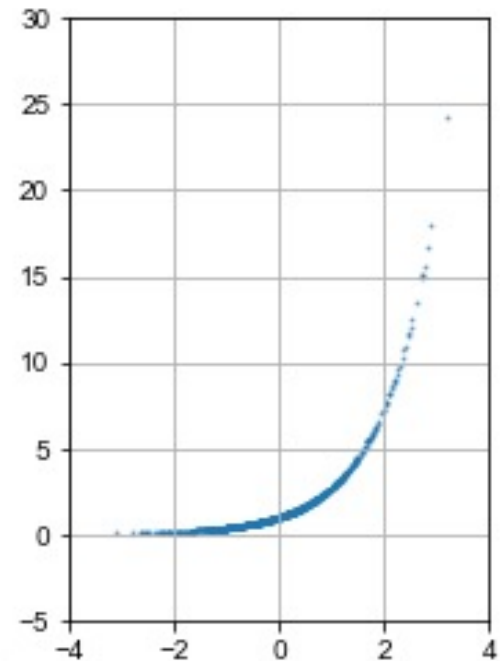
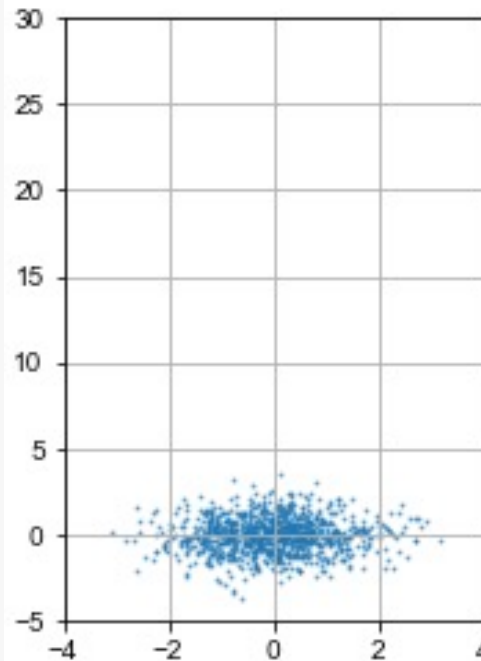
# 정규분포를 가지는 1차원 array 실수 1000개를 생성
# np.random.randn(n, m)일 경우 n * m개의 2차원 실수 생성
x = np.random.randn(1000)
y1 = np.random.randn(len(x))
y2 = np.exp(x)

plt.subplot(1, 2, 1)
plt.scatter(x, y1, s = 1, alpha = 0.5)
# s: size in points, alphah: 투명도

plt.xlim(-4.0, 4.0) # x축과 y축의 범위
plt.ylim(-5, 30)
plt.grid()

plt.subplot(1, 2, 2)
plt.scatter(x, y2, s = 1, alpha = 0.5)
plt.xlim(-4.0, 4.0)
plt.ylim(-5, 30)
plt.grid()

plt.show()
```

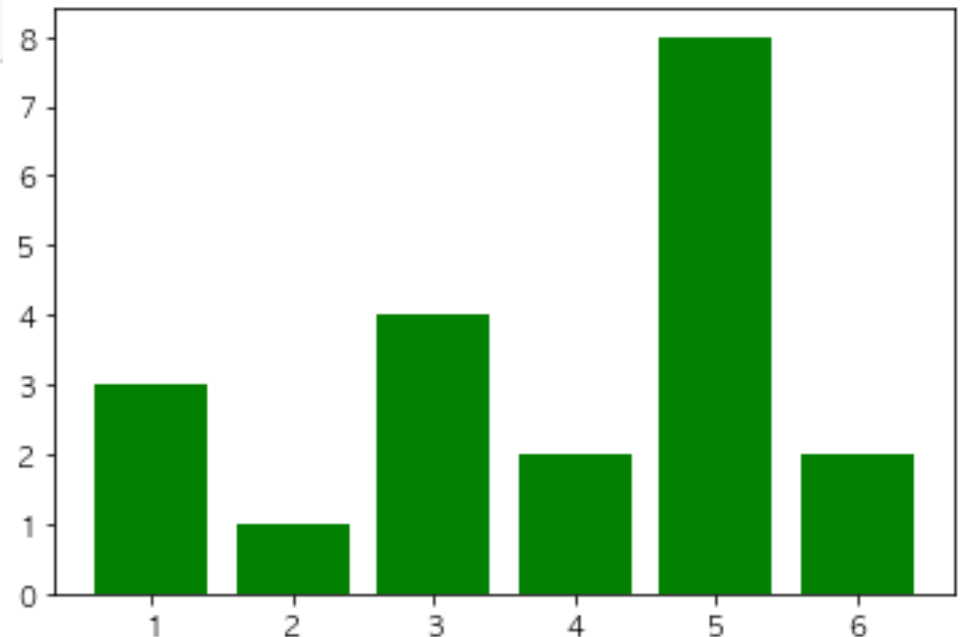


Bar plot

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

x = np.array([1, 2, 3, 4, 5, 6])
y = np.array([3, 1, 4, 2, 8, 2])

plt.bar(x, y, color = "green")
plt.show()
```

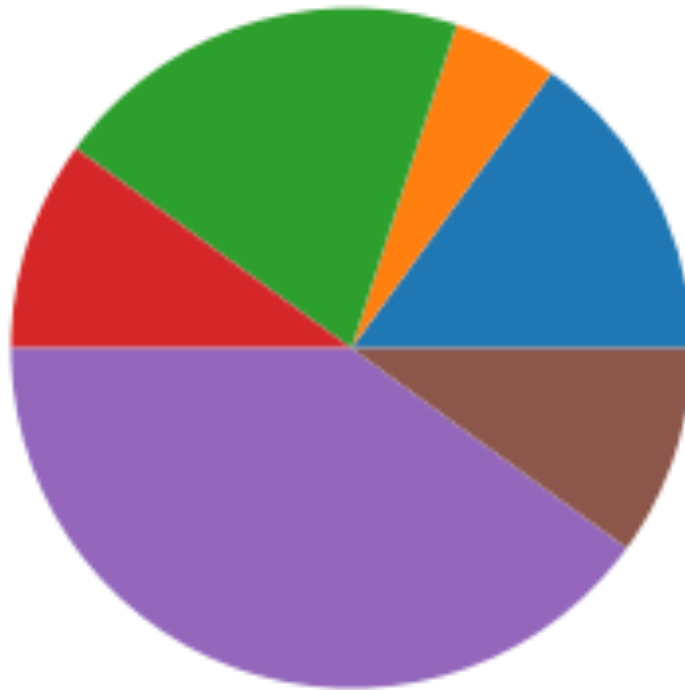


Pie plot

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

y = np.array([3, 1, 4, 2, 8, 2])

plt.pie(y)
plt.show()
```



END