```
[ ] 1 pip install matplotlib
```

```
Requirement already satisfied: matplotlib in /usr/local/lib/python3.10/dist-packages (3.7.1)
Requirement already satisfied: contourpy>=1.0.1 in /usr/local/lib/python3.10/dist-packages (from matplotlib) (1.2.0)
Requirement already satisfied: cycler>=0.10 in /usr/local/lib/python3.10/dist-packages (from matplotlib) (0.12.1)
Requirement already satisfied: fonttools>=4.22.0 in /usr/local/lib/python3.10/dist-packages (from matplotlib) (4.49.0)
Requirement already satisfied: kiwisolver>=1.0.1 in /usr/local/lib/python3.10/dist-packages (from matplotlib) (1.4.5)
Requirement already satisfied: numpy>=1.20 in /usr/local/lib/python3.10/dist-packages (from matplotlib) (1.25.2)
Requirement already satisfied: packaging>=20.0 in /usr/local/lib/python3.10/dist-packages (from matplotlib) (23.2)
Requirement already satisfied: pillow>=6.2.0 in /usr/local/lib/python3.10/dist-packages (from matplotlib) (9.4.0)
Requirement already satisfied: pyparsing>=2.3.1 in /usr/local/lib/python3.10/dist-packages (from matplotlib) (3.1.1)
Requirement already satisfied: python-dateutil>=2.7 in /usr/local/lib/python3.10/dist-packages (from matplotlib) (2.8.2)
Requirement already satisfied: six>=1.5 in /usr/local/lib/python3.10/dist-packages (from python-dateutil>=2.7->matplotlib) (1.16.0)
```

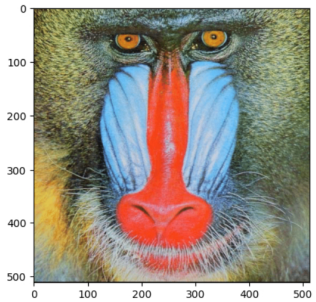
```
[ ] 1 import matplotlib.pyplot as plt
```

```
[ ] 1 import matplotlib
    2 print(matplotlib.__version__)
```

```
3.7.1
```

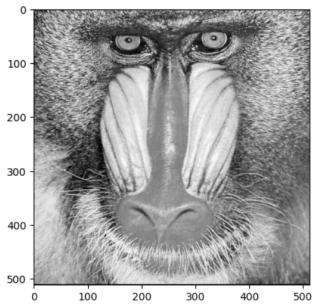
```
[ ] 1 import cv2
    2
    3 img = cv2.imread('/content/drive/MyDrive/baboon.png')
    4 img = cv2.cvtColor(img, cv2.COLOR_BGR2RGB)
    5
    6 plt.imshow(img)
```

```
<matplotlib.image.AxesImage at 0x7dd4b35c0400>
```




```
[ ] 1 img = cv2.imread('/content/drive/MyDrive/baboon.png')
    2 img = cv2.cvtColor(img, cv2.COLOR_BGR2GRAY)
    3
    4 plt.imshow(img, cmap='gray')
```

```
<matplotlib.image.AxesImage at 0x7dd4b34d9d80>
```




```
[ ] 1 kernel_edge = [
    2     [-1, -1, -1],
    3     [-1, 8, -1],
    4     [-1, -1, -1]
    5 ]
```

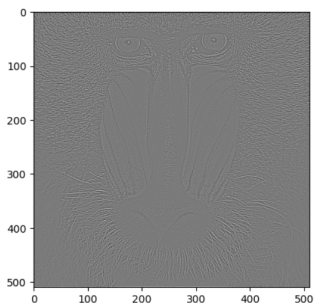
```
[ ] 1 result = []
    2
    3 for row in range(len(img) - 2):
    4     tmp = []
    5
    6     for col in range(len(img) - 2):
    7         sum = 0
    8         sum += (img[row][col] * kernel_edge[0][0])
    9         sum += (img[row + 1][col] * kernel_edge[1][0])
   10         sum += (img[row + 2][col] * kernel_edge[2][0])
   11         sum += (img[row][col + 1] * kernel_edge[0][1])
   12         sum += (img[row + 1][col + 1] * kernel_edge[1][1])
   13         sum += (img[row + 2][col + 1] * kernel_edge[2][1])
   14         sum += (img[row][col + 2] * kernel_edge[0][2])
   15         sum += (img[row + 1][col + 2] * kernel_edge[1][2])
   16         sum += (img[row + 2][col + 2] * kernel_edge[2][2])
   17         tmp.append(sum)
   18
   19     result.append(tmp)
   20
   21 result
```

```
[[20,
  -218,
  -118,
  177,
  -259,
  109,
  -271,
  99,
  -108,
  -259,
  -17,
  108,
  -198,
  -332,
  3,
  242,
```

```
-20,
251,
-205,
-121,
120,
-77,
-139,
-44,
394,
254,
-78,
-249,
-92,
388,
331,
-313,
-157,
286,
92,
129,
-232,
-29,
-25,
-390,
-127,
-330,
355,
373,
-66,
89,
-206,
-25,
450,
-316,
-15,
-179,
164,
-28,
-87,
140,
-398,
-86,
```

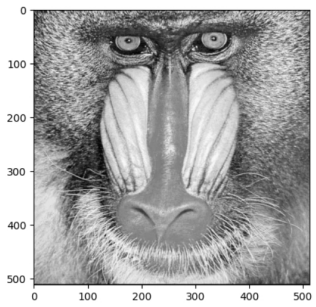
```
[ ] 1 plt.imshow(result, cmap='gray') # edge detction
```

```
<matplotlib.image.AxesImage at 0x7dd4ab003b50>
```




```
[ ] 1 img2 = cv2.imread('/content/drive/MyDrive/baboon.png')
    2 img2 = cv2.cvtColor(img2, cv2.COLOR_BGR2GRAY)
    3
    4 plt.imshow(img2, cmap='gray')
```

```
<matplotlib.image.AxesImage at 0x7dd4ab089150>
```




```
[ ] 1 kernel_edge2 = [
    2     [0, -1, 0],
    3     [-1, 5, -1],
    4     [0, -1, 0]
    5 ]
```

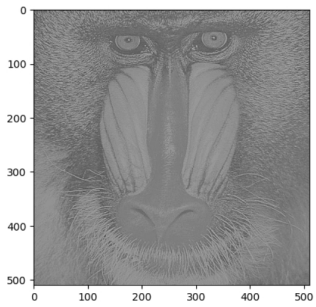
```
[ ] 1 result2 = []
    2
    3 for row in range(len(img2) - 2):
    4     tmp = []
    5
    6     for col in range(len(img2) - 2):
    7         sum = 0
    8         sum += (img2[row][col] * kernel_edge2[0][0])
    9         sum += (img2[row + 1][col] * kernel_edge2[1][0])
   10         sum += (img2[row + 2][col] * kernel_edge2[2][0])
   11         sum += (img2[row][col + 1] * kernel_edge2[0][1])
   12         sum += (img2[row + 1][col + 1] * kernel_edge2[1][1])
   13         sum += (img2[row + 2][col + 1] * kernel_edge2[2][1])
   14         sum += (img2[row][col + 2] * kernel_edge2[0][2])
   15         sum += (img2[row + 1][col + 2] * kernel_edge2[1][2])
   16         sum += (img2[row + 2][col + 2] * kernel_edge2[2][2])
   17         tmp.append(sum)
   18
   19     result2.append(tmp)
   20
   21 result2
```

```
[[98,
  -35,
  23,
  169,
  -61,
  135,
  -62,
  121,
  25,
  -44,
  93,
  139,
```

```
-8,
-99,
115,
236,
84,
266,
-51,
-16,
178,
3,
3,
96,
331,
270,
51,
-19,
46,
294,
345,
-101,
47,
256,
172,
173,
-9,
76,
82,
-102,
67,
-136,
336,
359,
41,
195,
-20,
88,
425,
-136,
120,
-10,
206,
116,
50,
249,
-90,
60,
```

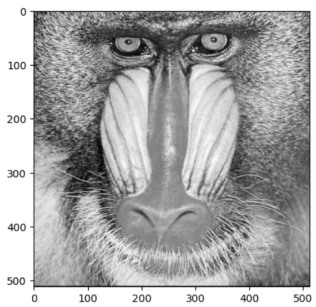
[ ]
```
plt.imshow(result2, cmap='gray') # image sharpening
```

```
<matplotlib.image.AxesImage at 0x7dd4ab0e0640>
```



[ ]
```
img3 = cv2.imread('/content/drive/MyDrive/baboon.png')
img3 = cv2.cvtColor(img3, cv2.COLOR_BGR2GRAY)

plt.imshow(img3, cmap='gray')
```

```
<matplotlib.image.AxesImage at 0x7dd4ab2ecb80>
```



```
kernel_edge3 = [
    [0.1, 0.1, 0.1],
    [0.1, 0.1, 0.1],
    [0.1, 0.1, 0.1]
]
```

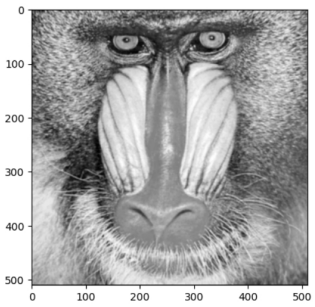
[ ]
```
result3 = []

for row in range(len(img3) - 2):
    tmp = []

    for col in range(len(img3) - 2):
        sum = 0
        sum += (img3[row][col] * kernel_edge3[0][0])
        sum += (img3[row + 1][col] * kernel_edge3[1][0])
        sum += (img3[row + 2][col] * kernel_edge3[2][0])
        sum += (img3[row][col + 1] * kernel_edge3[0][1])
        sum += (img3[row + 1][col + 1] * kernel_edge3[1][1])
        sum += (img3[row + 2][col + 1] * kernel_edge3[2][1])
        sum += (img3[row][col + 2] * kernel_edge3[0][2])
        sum += (img3[row + 1][col + 2] * kernel_edge3[1][2])
        sum += (img3[row + 2][col + 2] * kernel_edge3[2][2])
        tmp.append(sum)

    result3.append(tmp)

result3
```

```
[[76.30000000000003,
  61.400000000000006,
  67.60000000000001,
  73.2,
  73.60000000000001,
  53.900000000000006,
  59.50000000000001,
```

```
71.10000000000001,
73.60000000000001,
81.8,
80.10000000000001,
67.50000000000001,
65.60000000000001,
90.60000000000001,
109.9,
108.19999999999999,
83.8,
68.2,
59.80000000000001,
62.7,
63.500000000000014,
69.70000000000002,
95.30000000000001,
123.50000000000001,
131.2,
102.3,
79.80000000000001,
89.30000000000001,
108.80000000000003,
112.70000000000002,
100.60000000000002,
104.8,
108.2,
106.90000000000002,
89.7,
92.50000000000003,
93.80000000000001,
82.60000000000001,
68.7,
73.00000000000001,
102.30000000000001,
117.50000000000001,
115.70000000000002,
109.2,
108.10000000000001,
109.7,
108.70000000000003,
100.80000000000001,
91.90000000000002,
81.60000000000001,
87.20000000000002,
95.2,
109.0,
114.9,
114.7,
119.89999999999999,
128.29999999999998,
```

[ ] 1 plt.imshow(result3, cmap='gray')

```
<matplotlib.image.AxesImage at 0x7dd4a8d165f0>
```



[ ] 1 코딩을 시작하거나 AI로 코드를 생성하세요.