Problem 1

(a)
```
x = np.random.permutation(1000)
```

The result **x** are integers from 1 to 1000 in random order.

(b)
```
a = np.array([[1,2,3],[4,5,6],[7,8,9]]
b = x[2,:]
```

The result **a** is a 3 by 3 array `[[1,2,3],[4,5,6],[7,8,9]]`
The result `b` is `[7,8,9]`, the 3rd row of two-dimensional array `a`

(c)
```
a = np.array([[1,2,3],[4,5,6],[7,8,9]]
b = a.reshape(-1)
```

The result **a** is a 3 by 3 array `[[1,2,3],[4,5,6],[7,8,9]]`
The result **b** is `[1,2,3,4,5,6,7,8,9]`
x.reshape(-1) will cause it changing from a 2D array to 1D array.

(d)
```
x = np.random.randn(5,1)
y = x[x > 0]
```

The result **x** will be a 5-by-1 array with randomly distributed value.
The result **y** will be a 1-D array of values in **x** that are larger than 0.

(e)
```
x = np.zeros(10) + 0.5
y = 0.5 * np.ones(len(x))
z = x + y
```

The result **x** is a 1-D array with 10 elements, each of which has a value of 0.5. i.e. an array of constant 0.5 of size 10
The result **y** is an array of 0.5 of the same length of **x**, essentially y is the same as x
The result of **z** is an array of size 10 composed of 1.0 . The reason the terms are float number is that each term in x and y are float number, their sum will be float as well. Notice the addition only works when x and y has same dimension.

(f)
```
a = np.arange(1,100)
b = a[::  -1]
```

The result **a** is a 1-d array of [1, 2, 3, ... 99]. The start is 1 and the stop is 100 (not include 100). The default step is 1.
The result **b** is the reverse of **a**, which is [99,98, ..., 2,1]

Problem 2

(a) Section a

```
import numpy as np
def random_dice(N):
    x = np.random.rand(N)*6 + 1
    y = np.floor(x).astype(int)
    return y
```

(b) Section b

```
import numpy as np
def reshape_vector(y):
    x =  y.reshape(-1,2)
    return x
```

(c) Section c

```
import numpy as py
def max_value(z):
    x = np.max(z)
    y = np.where(z == x)
    return y
```

(d) Section d

```
import numpy as np
def count_ones(vec):
    x = vec.count(1)
    return x
```

Problem 3

(a) Section a

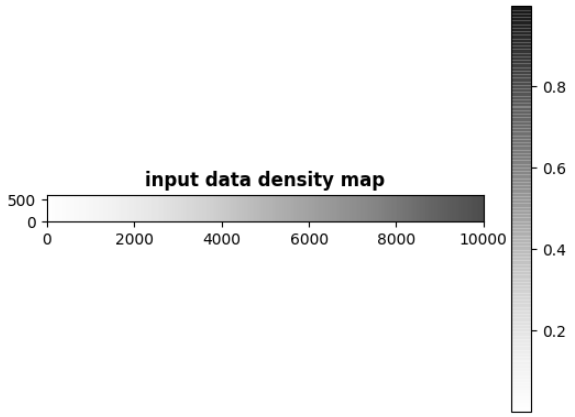

Figure 1: Sorted intensities of A

(b) Section b

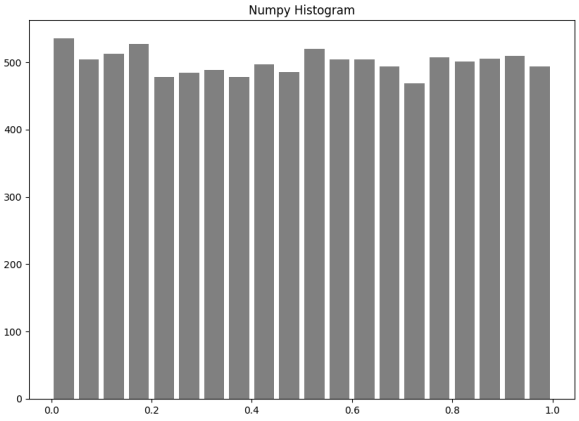

Figure 2: Histogram of A

(c) Section c

(d) Section d

(e) Section e

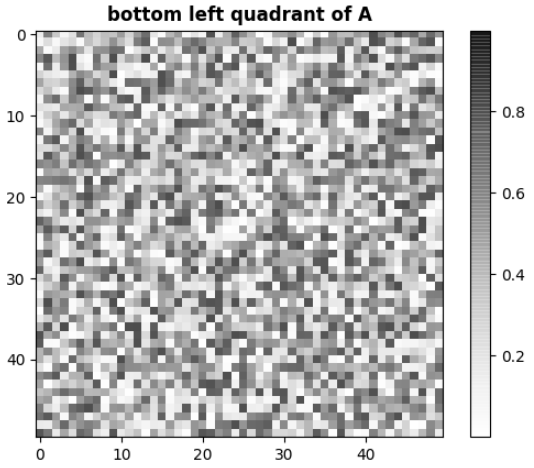

Figure 3: Bottom quadrant of A

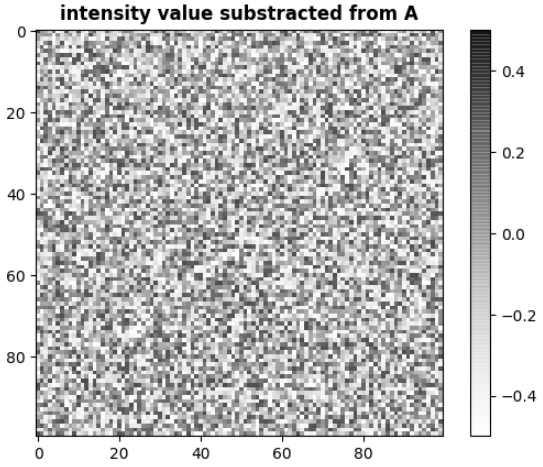

Figure 4: Subtract mean from A

Problem 3

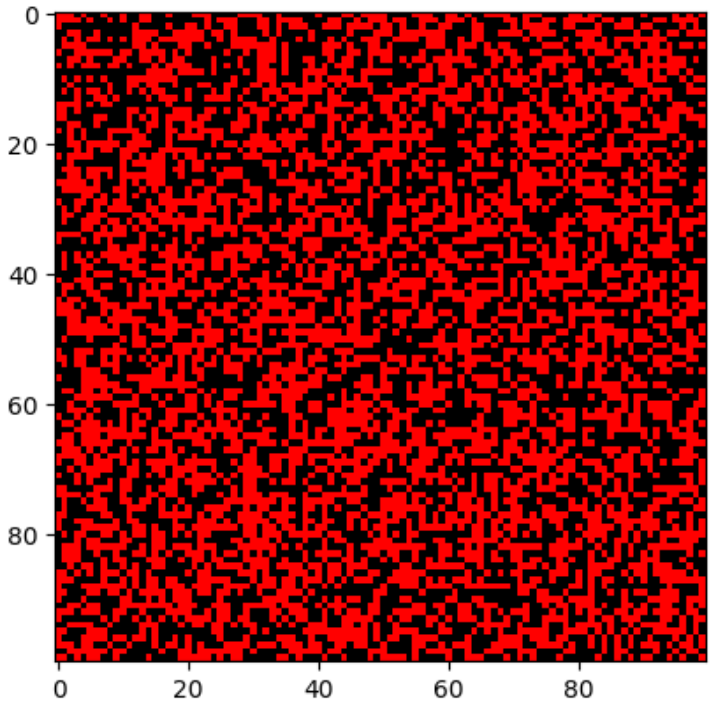

Figure 5: Red represent the value larger than average, black otherwise

Figure 6: original photo of question 4

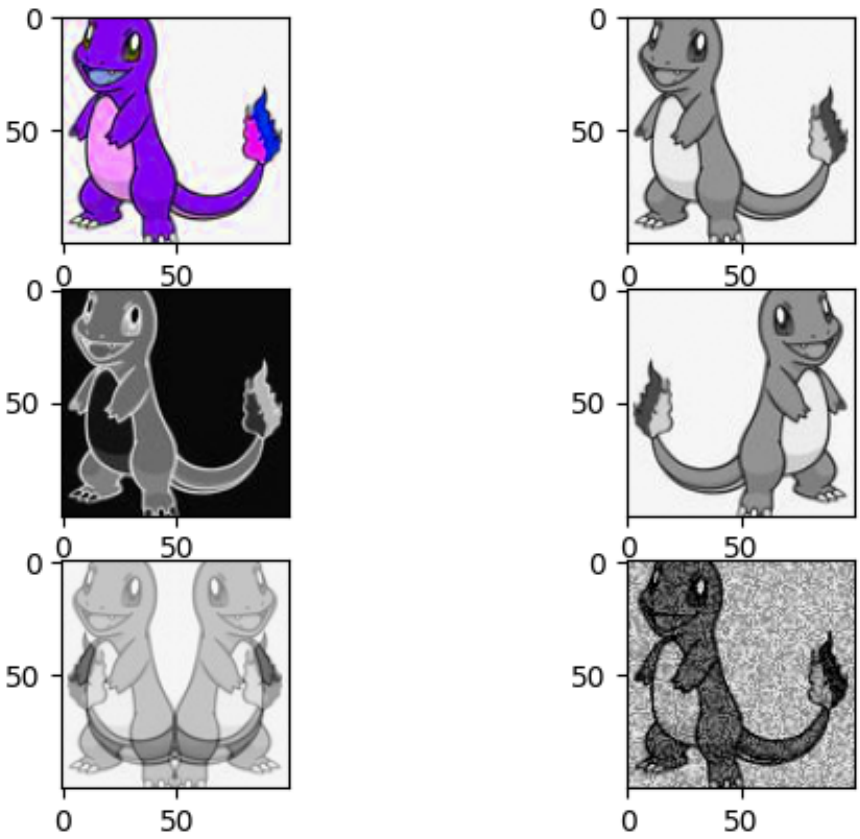

Figure 7: subplot of question 4