PS0

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Short answer problems (Python)

1.

(a) Stores a numpy array of length 1000 (shape $(1000,)$) of the integer values $[0, 999]$ (inclusive), which has a randomized order into the variable `x`. In other words, it is a permutation of $[0, 999]$.

(b) The first line stores a numpy array of shape $(3, 3)$ into the variable `a` with the values

$$\begin{bmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \\ 7 & 8 & 9 \end{bmatrix}$$

The second line slices the third row of the array `a` and stores this row as a numpy array into a variable `b`. Note: `b` does not copy the row as a new numpy array, rather is a pointer to the row within `a`. The numpy array stored at `a` is essentially unaffected.

(c) The first line does the same thing as the first line in b).
The second line takes the the numpy array `a` and flattens the shape into $(9,)$, which it then stores into the variable `b`. Note: `b` does not copy the array a new numpy array, rather is a pointer to the array at `a` with a different shape. The shape of `a` is unaffected.

(d) The first line produces a numpy array of shape $(5, 1)$ of values sampled from the standard normal distribution $N(0, 1)$ and stores the result into a variable `f`.
The second line slices the array `f` and keeps all strictly positive values while ignoring all non-positive values and storing it in `g`. This *should* actually be producing a new array and storing it in `g`.

(e) The first line produces a numpy array of shape $(10,)$ in which all values are 0.5 and stores it in a variable `x`.
The second line produces a numpy array of shape $(10,)$ in which all values are 0.5 and stores it in a variable `y`. This does so by first producing an array of shape $(10,)$ with values of 1 then multiplying it 0.5
The third line produces a numpy array of shape $(10,)$ in which all values are 1. and stores it in a variable `z`. This is done so by adding `x` and `y` which results in all ones of shape $(10,)$.

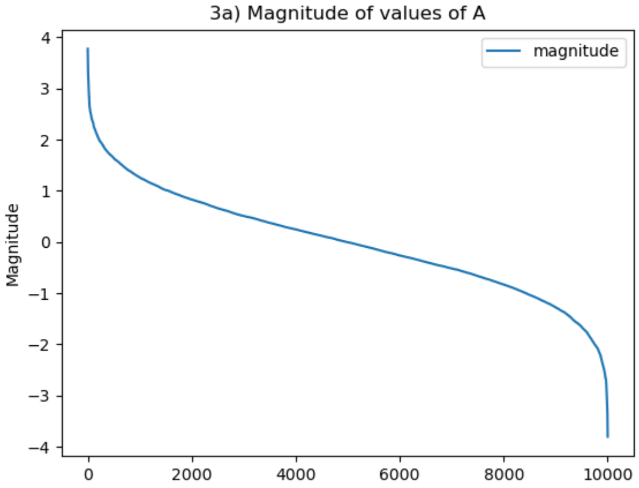
(f) The first line produces a numpy array of shape $(99,)$ of the integer values $[1, 99]$ (inclusive, and in increasing order) and stores this resulting array in the variable `a`.
The second line takes the array `a` and reverses its order and stores the resulting array at `b`. Note: `b` does not copy the result as a new numpy array, rather it still holds a pointer to `a`. The numpy array stored at `a` is essentially unaffected.

2.

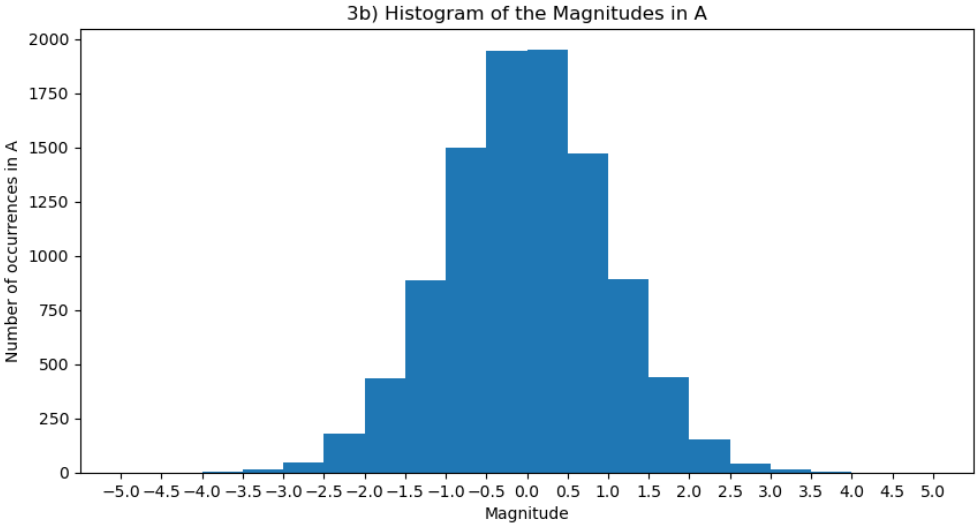
```
import numpy as np


def random_dice(N):
    return (6 * np.random.rand(N) + 1).astype(int) # results stores the faces (i.e. 1, 2, 3,
                                                    4, 5, 6) rolled from N different trials

def reshape_vector(y=np.array([1, 2, 3, 4, 5, 6])):
    return y.reshape((-1, 2))

def max_value(z=np.array([[1,2],[3,4],[5,6]])):
    return np.where(z == np.max(z))

def count_ones(v=np.array([1, 8, 8, 2, 1, 3, 9, 8])):
    return np.sum(v == 1)
```

1 Short programming problem

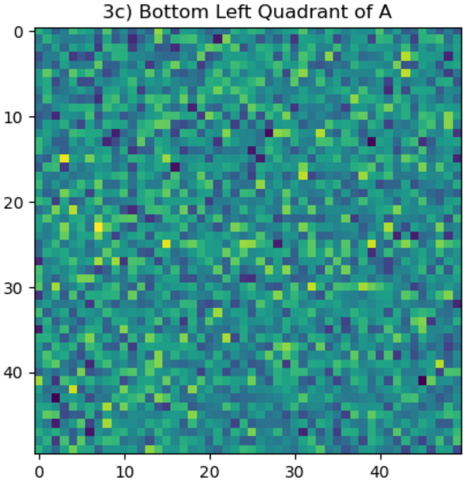
(a) 3a.png



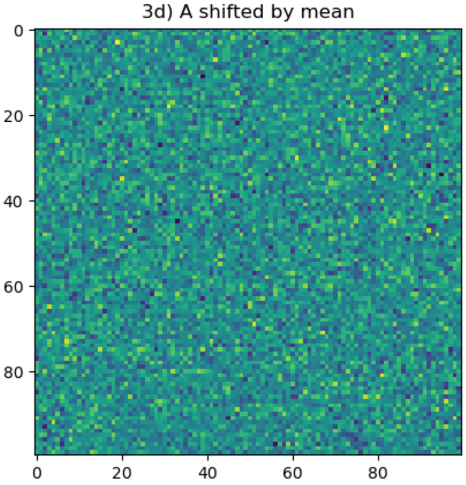
(b) 3b.png



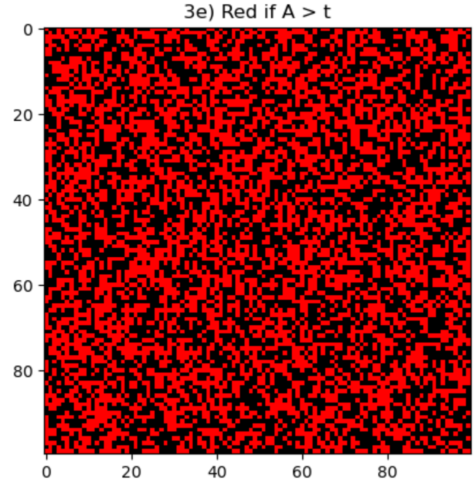
(c) 3c.png



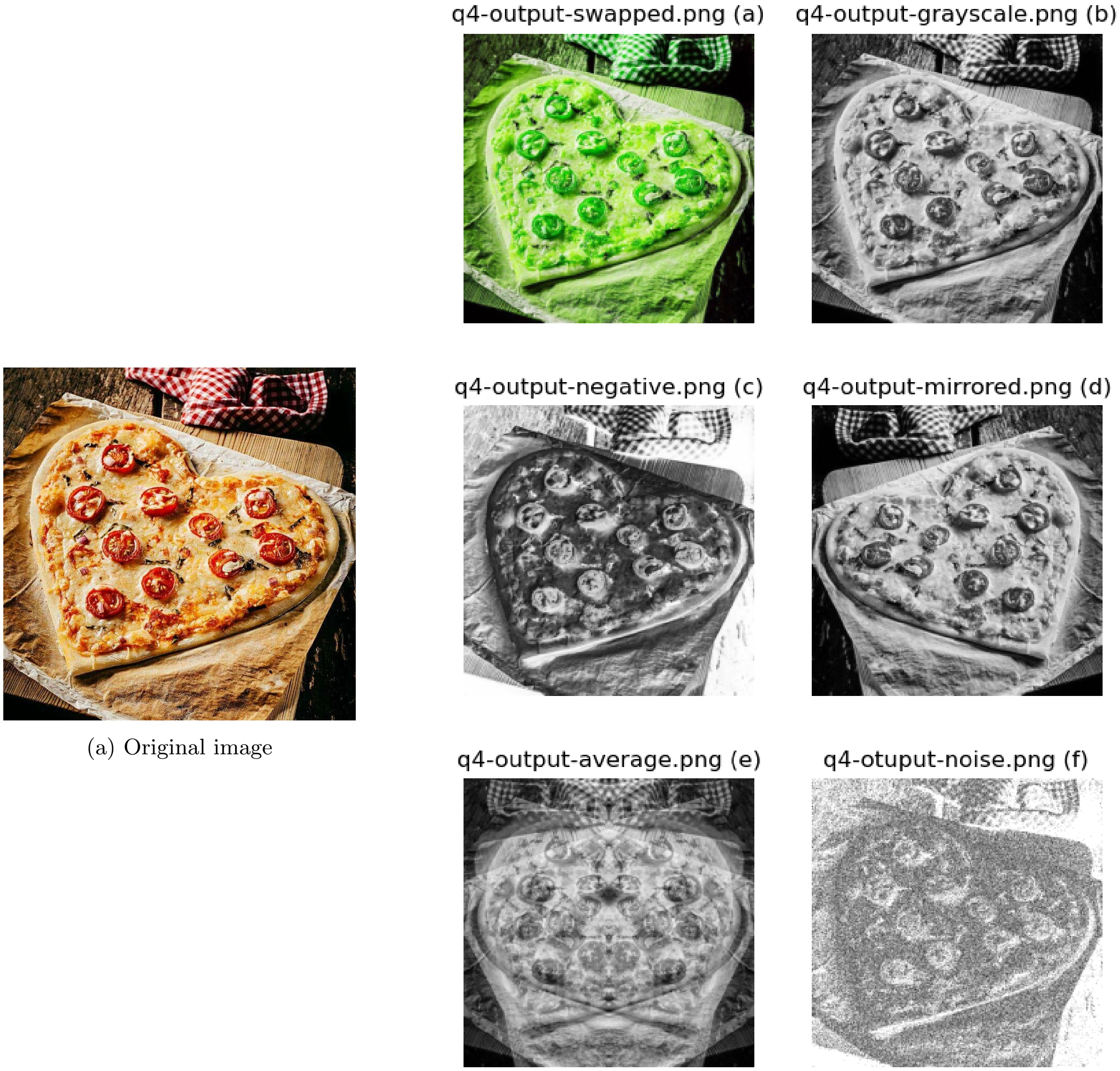
(d) 3d.png



(e) q3-output-z.png



Short programming problem



q4-output-swapped.png (a)

q4-output-grayscale.png (b)

q4-output-negative.png (c)

q4-output-mirrored.png (d)

q4-output-average.png (e)

q4-otuput-noise.png (f)

(a) Original image

(b) Results

Figure 1: Results for the short programming assignment