

HW Assignment # 1

Total points: 100

Deadline: 2.13.2024 (11:59 PM)

Assumptions:

- If I is an image, then a pixel intensity can be represented by $I(x,y)$ where x denotes column and y denotes row.
- The index starts from 0 for both the column and row.

Part I: Answer the following: (25 points * 2 = 50 points)

(a) Consider image I which has 640 columns and 480 rows. It is stored as a 1D vector in memory following a row-major order. There is only a single white pixel in I which is located at $[38,52]$ position. Thus, at which index in the 1D vector a pixel with “255” intensity will be found?

(b) Consider the following image:

$I =$

1	2	3	4	5
6	7	8	9	10
11	12	13	14	15
16	17	18	19	20

Using the conventions considered in class (also mentioned in the “Assumptions” section of this document at the top), what are the pixel intensity values at $I(0,1)$, $I(1,1)$, and $I(2,1)$ positions?

Part II: Programming Assignment (50 points)

Write a python function *flipflopim* that accepts an image of size $m \times n$ (where m, n even) stored as a matrix, displays the image to the screen, rearranges the quadrants of the images as depicted below, displays the rearranged image to the screen, and returns the rearranged image which is the same size as the original image as a matrix. You are not allowed to use any built-in functions from Python’s image processing toolbox to perform the image flip-flop. You are only allowed to use the built-in functions for reading and displaying the images.



Image



Flip-flop

Stan Birchfield

(see next page)

Deliverables for HW1:

In order to receive full credit for this assignment you must submit two files.

1) A PDF document containing two sections. Section I will have the answers to the questions for Part I. Section II will have your python script copied and pasted into the same Word file. Finally, convert the doc file into a PDF.

2) A .py-file containing the Python code (with comments for each line) for the function *flipflopim* (.py file). It is the responsibility of the students to ensure that their .py-files execute without errors to avoid point deductions.

Additional Instructions:

- This assignment should be completed individually by the student and no form of collaboration and/or re-use of others' answers will be accepted.
- Proper citation should be provided for any references used.
- It is advised to show your detailed work (e.g., show step-by-step calculations for math problems, add comments for every line in your code/pseudo-code, etc.). It helps to get you partial credit even if the answer is wrong.