

I. Exercises

1. Solution:

Duality :

$$(A \bullet B)^c = (A^c \circ \hat{B})$$

$$\text{So, } (A \bullet B)^c = ((A \oplus B) \ominus B)^c$$

$$= ((A \oplus B)^c \oplus \hat{B})$$

$$= ((A^c \ominus \hat{B}) \oplus \hat{B}) \rightarrow \text{opening}$$

$$= (A^c \circ \hat{B})$$

∴ Duality is proven

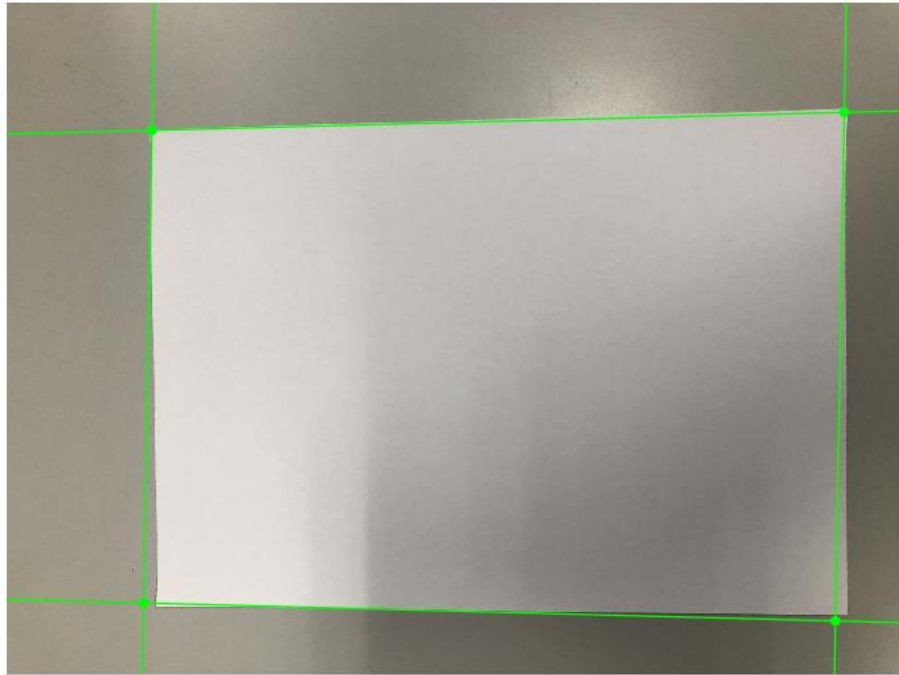
2. Solution:

Elem 1:										Elem 2:										No.
Date										Date										
Dilation										Dilation :										
0	0	0	0	1	1	1	1			0	0	0	0	0	1	1	0			
0	0	0	1	1	1	1	1			0	0	0	0	1	1	1	1			
0	0	0	1	1	1	1	1			0	0	0	1	1	1	1	1			
0	1	1	1	1	1	1	1			0	0	1	1	1	1	1	1	0		
1	1	1	1	1	1	1	1	0		0	1	1	1	1	1	0	0			
1	1	1	1	1	1	0	0	0		1	1	1	1	1	0	0	0			
1	1	1	1	1	0	0	0			1	1	1	1	0	0	0	0			
1	1	1	1	0	0	0	0			0	1	1	0	0	0	0	0			
Erosion										Erosion :										
0	0	0	0	0	0	0	0			0	0	0	0	0	0	0	0			
0	0	0	0	0	0	0	0			0	0	0	0	0	0	0	0			
0	0	0	0	0	0	0	0			0	0	0	0	0	1	0	0			
0	0	0	0	0	0	0	0			0	0	0	0	0	0	0	0			
0	0	0	0	0	0	0	0			0	0	0	0	0	0	0	0			
0	0	0	0	0	0	0	0			0	0	1	0	0	0	0	0			
0	0	0	0	0	0	0	0			0	0	0	0	0	0	0	0			
0	0	0	0	0	0	0	0			0	0	0	0	0	0	0	0			

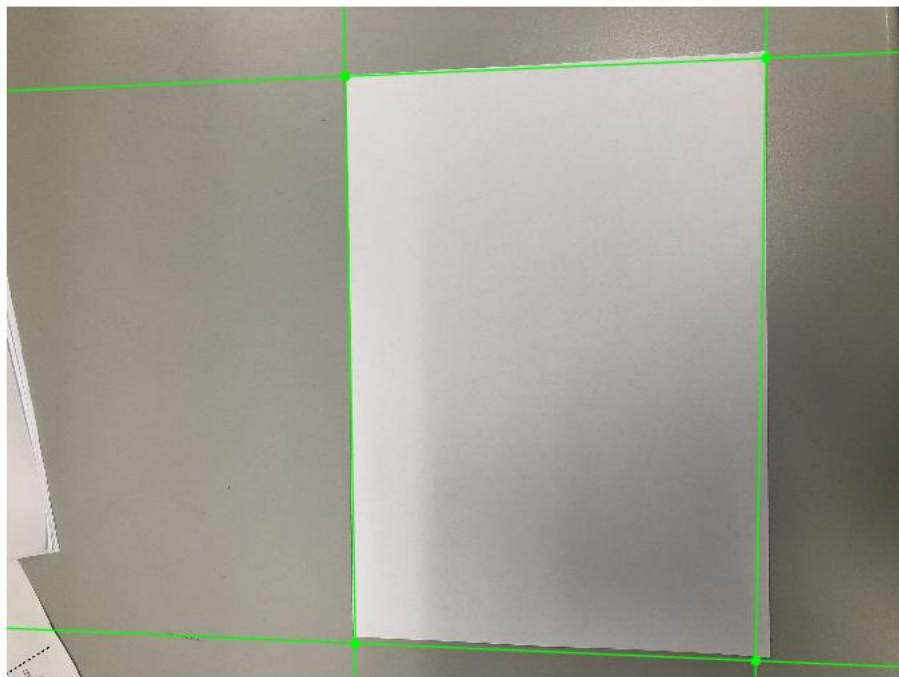
II. Programming Tasks

1. Hough Transform:

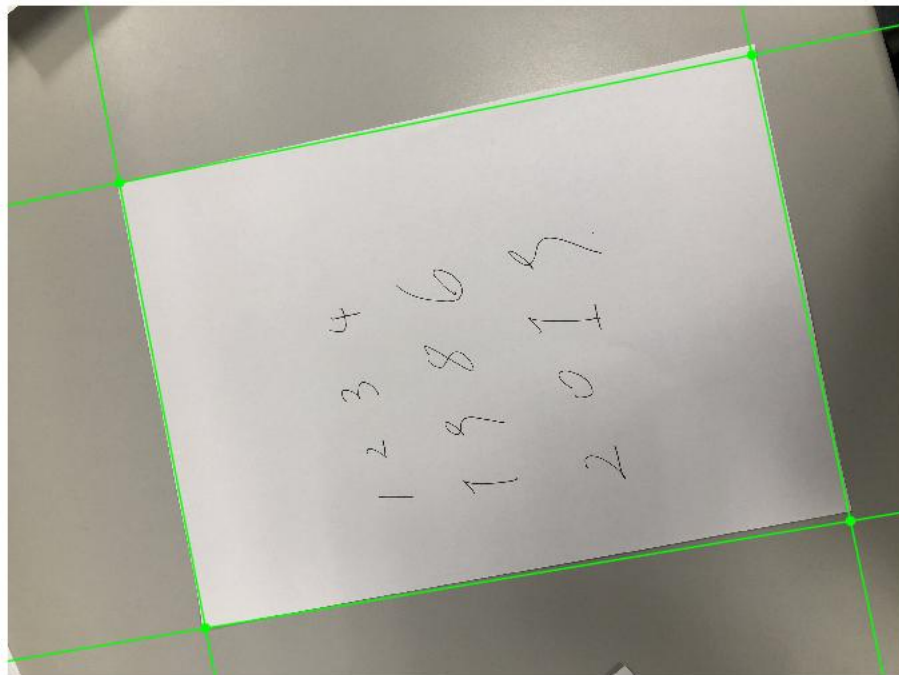
a.



b.



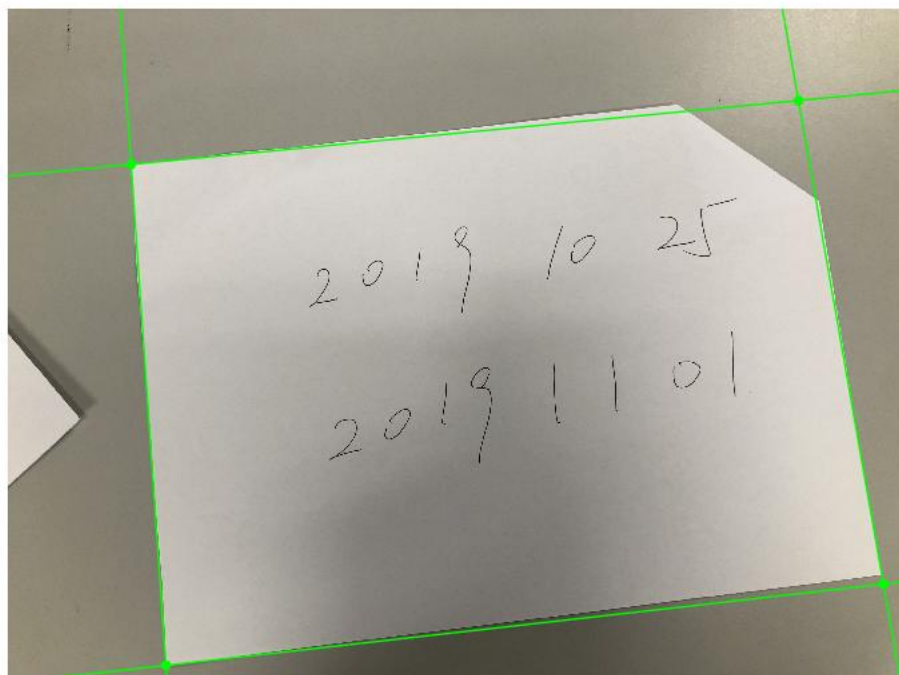
c.



A piece of white paper with handwritten numbers in black ink. The numbers are arranged in three columns. The first column contains the numbers 1, 2, 3, and 4 from bottom to top. The second column contains the numbers 7, 9, 8, and 6 from bottom to top. The third column contains the numbers 2, 0, 1, and 7 from bottom to top. The paper is placed on a dark surface with a green grid overlay.

4	6	7
3	8	1
2	9	0
1	7	2

d.

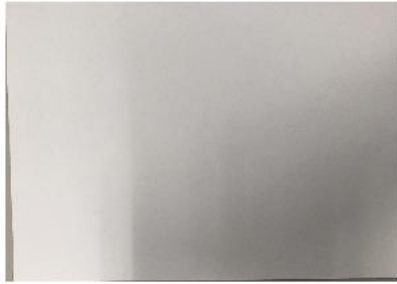


A piece of white paper with handwritten dates in black ink. The first line reads "2019 10 25" and the second line reads "2019 11 01". The paper is placed on a dark surface with a green grid overlay.

2019 10 25
2019 11 01

2. Image Warping:

a.



b.



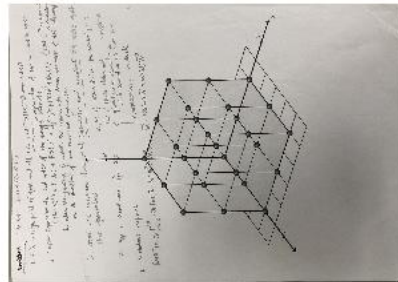
c.



d.

2019 10 25
2019 11 01

e.



f.

