Computer Vision-IT813

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Image Segmentation

- Region-based segmentation is a technique for determining the region directly.

- Region growing is a simple region-based image segmentation method. It is also classified as a pixel-based image segmentation method since it involves the selection of initial seed points.

- Applications-Finding tumors ,veins etc in medical images , finding targets in satellite/aerial images , finding people in surveillance images , summarizing video etc
- Methods- Thresholding , k-means clustering etc

- Region growing is a procedure that groups pixels or sub regions into larger regions.
- The simplest of these approaches is pixel aggregation, which starts with a set of seed points and from these grows regions by appending to each seed points those neighboring pixels that have similar properties (such as gray level, texture, color, shape).
- Region growing based techniques are better than the edge-based techniques in noisy images where edges are difficult to detect

- Region growing methods can correctly separate the regions that the same properties we define.

- Region growing methods can provide the original images which have clear edges with good segmentation results.

- The concept is simple. We only need a small number of seed points to represent the property we want, then grow the region.

- Computationally expensive
- It is a local method with no global view of the problem.
- Sensitive to noise.
- Unless the image has had a threshold function applied to it, a continuous path of points related to color may exist which connects any two points in the image.

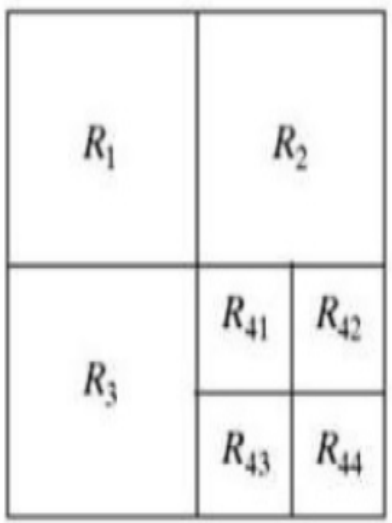
REGION SPLITTING

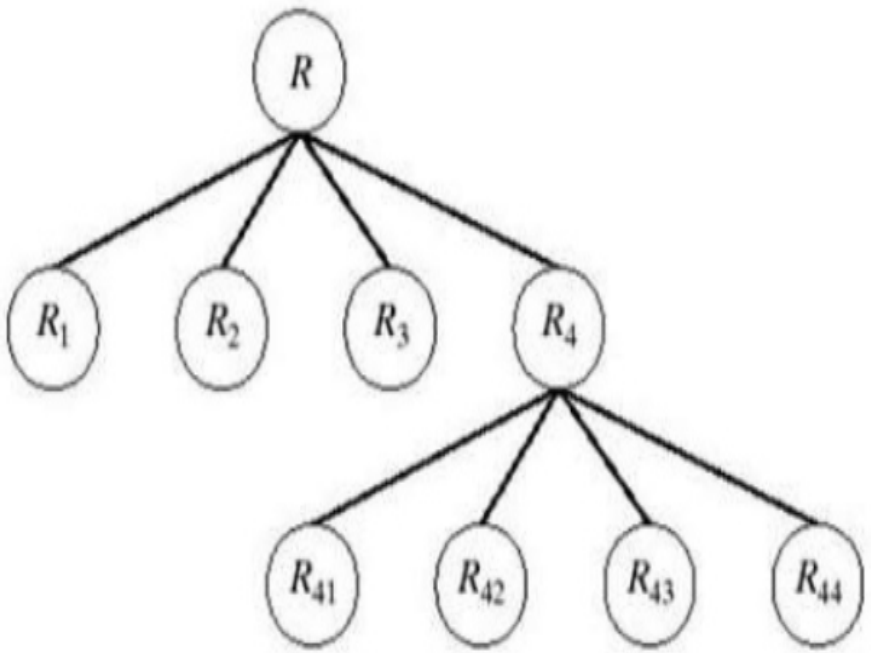
- Region growing starts from a set of seed points.
- An alternative is to start with the whole image as a single region and subdivide the regions that do not satisfy a condition of homogeneity.

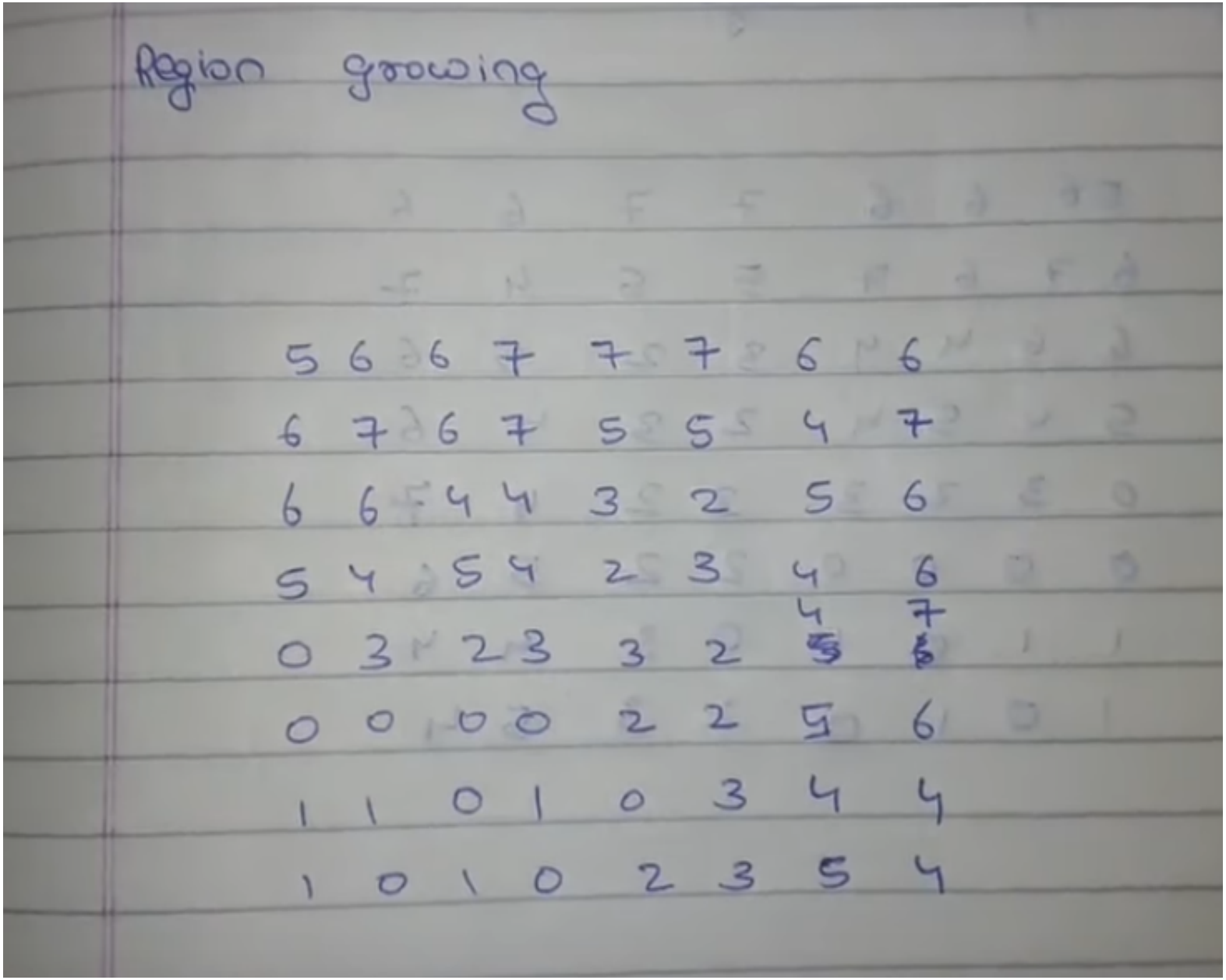
REGION MERGING

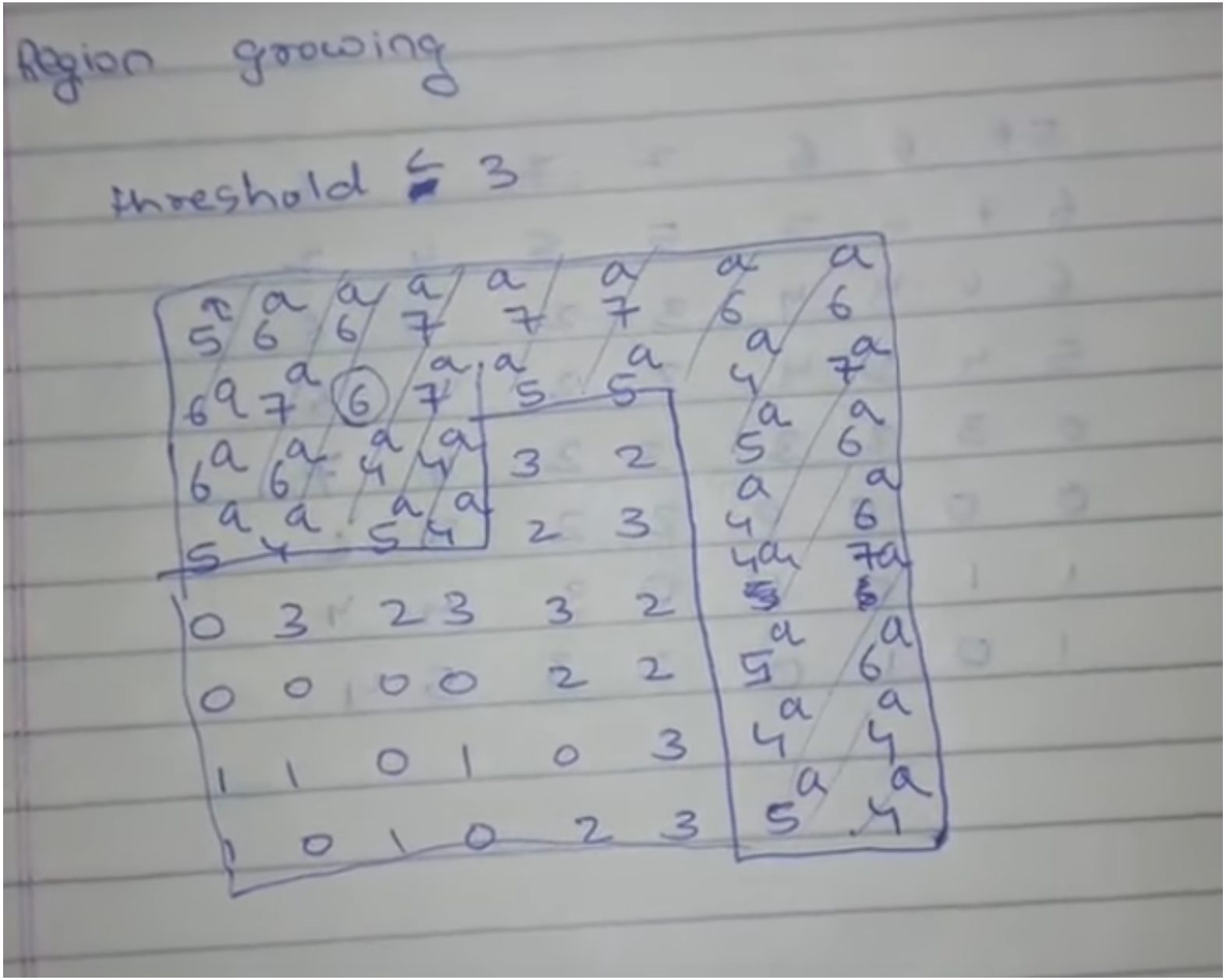
- Region merging is the opposite of region splitting.
- Start with small regions (e.g. 2x2 or 4x4 regions) and merge the regions that have similar characteristics (such as gray level, variance).
- Typically, splitting and merging approaches are used iteratively

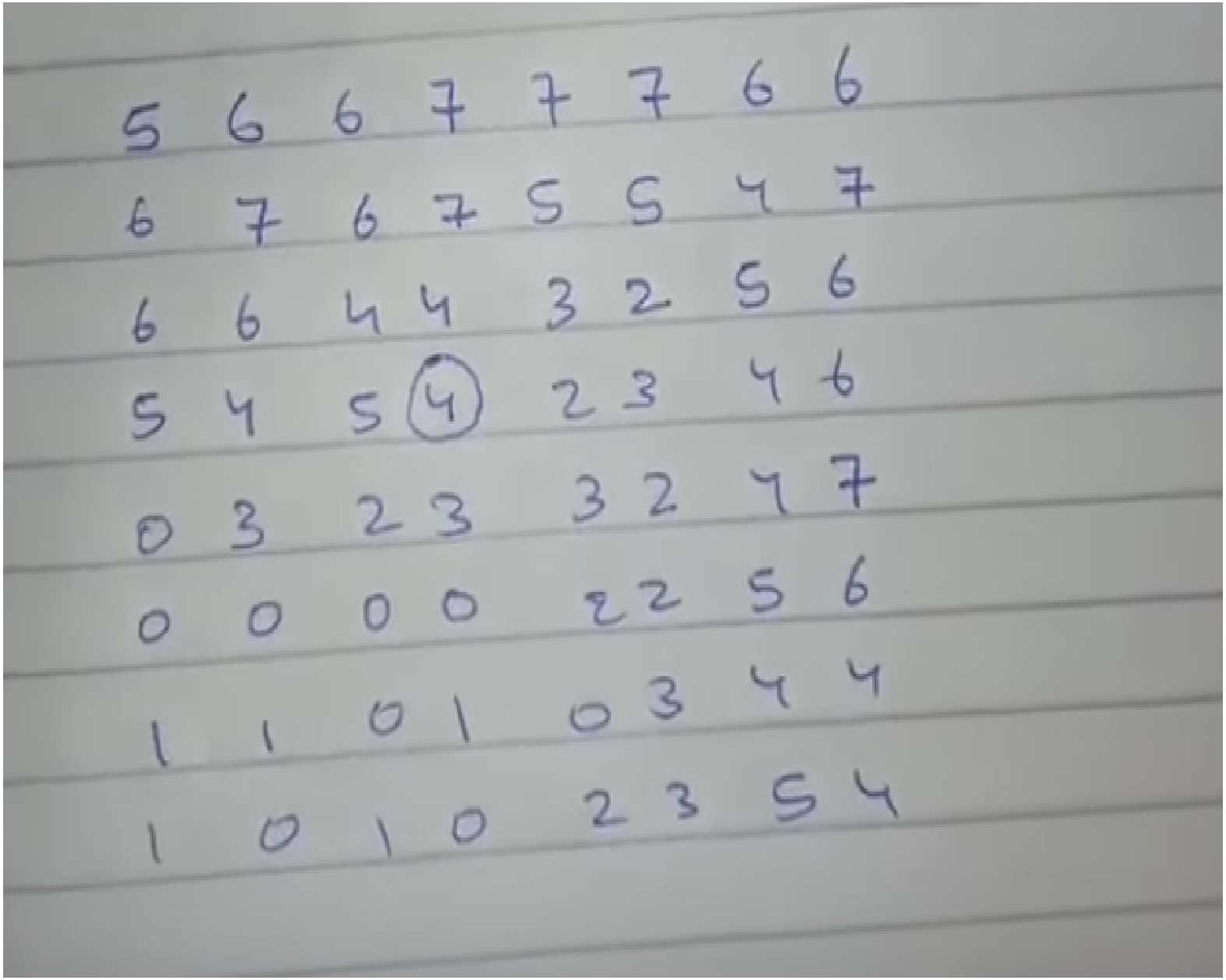
REGION SPLITTING AND MERGING

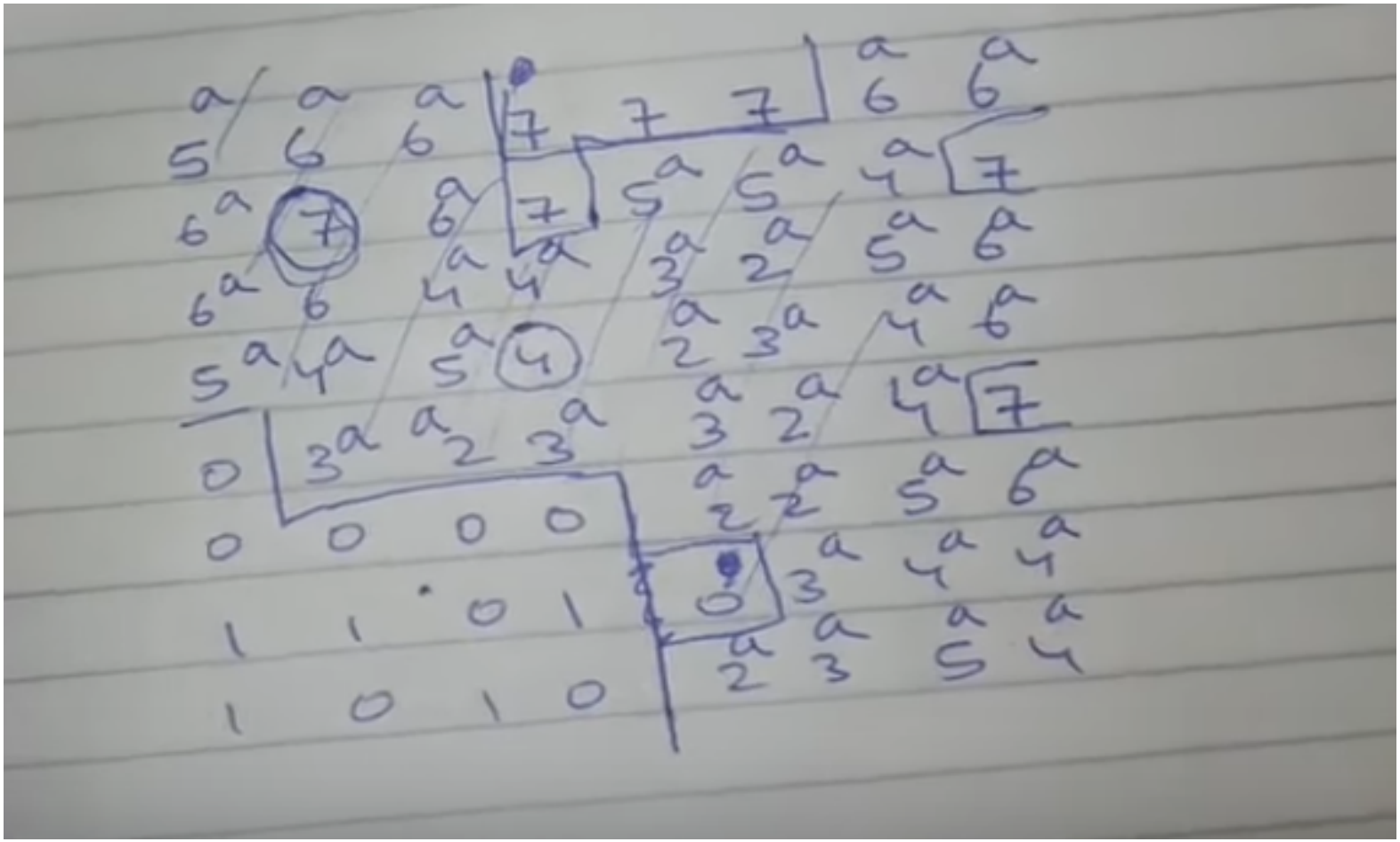


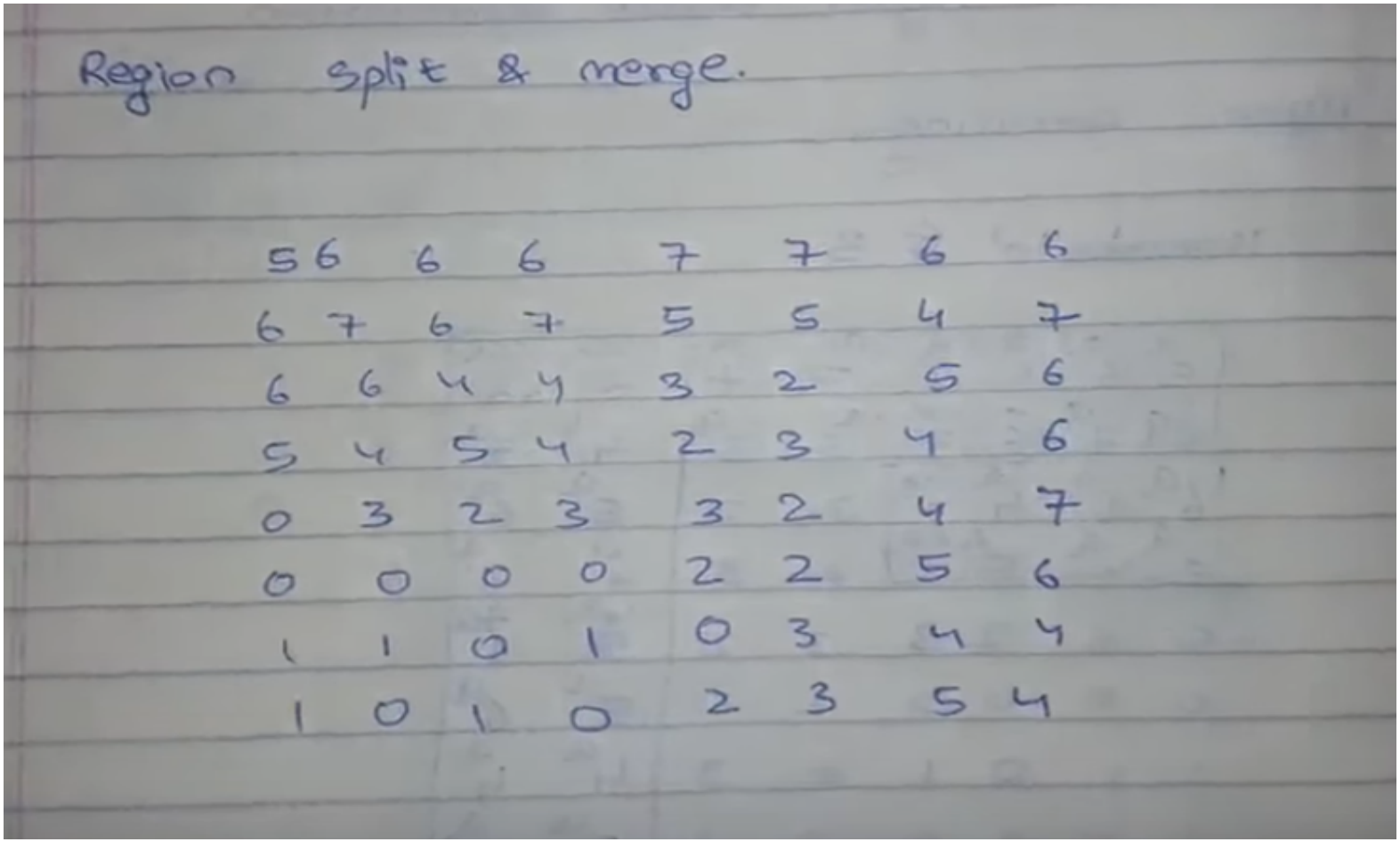


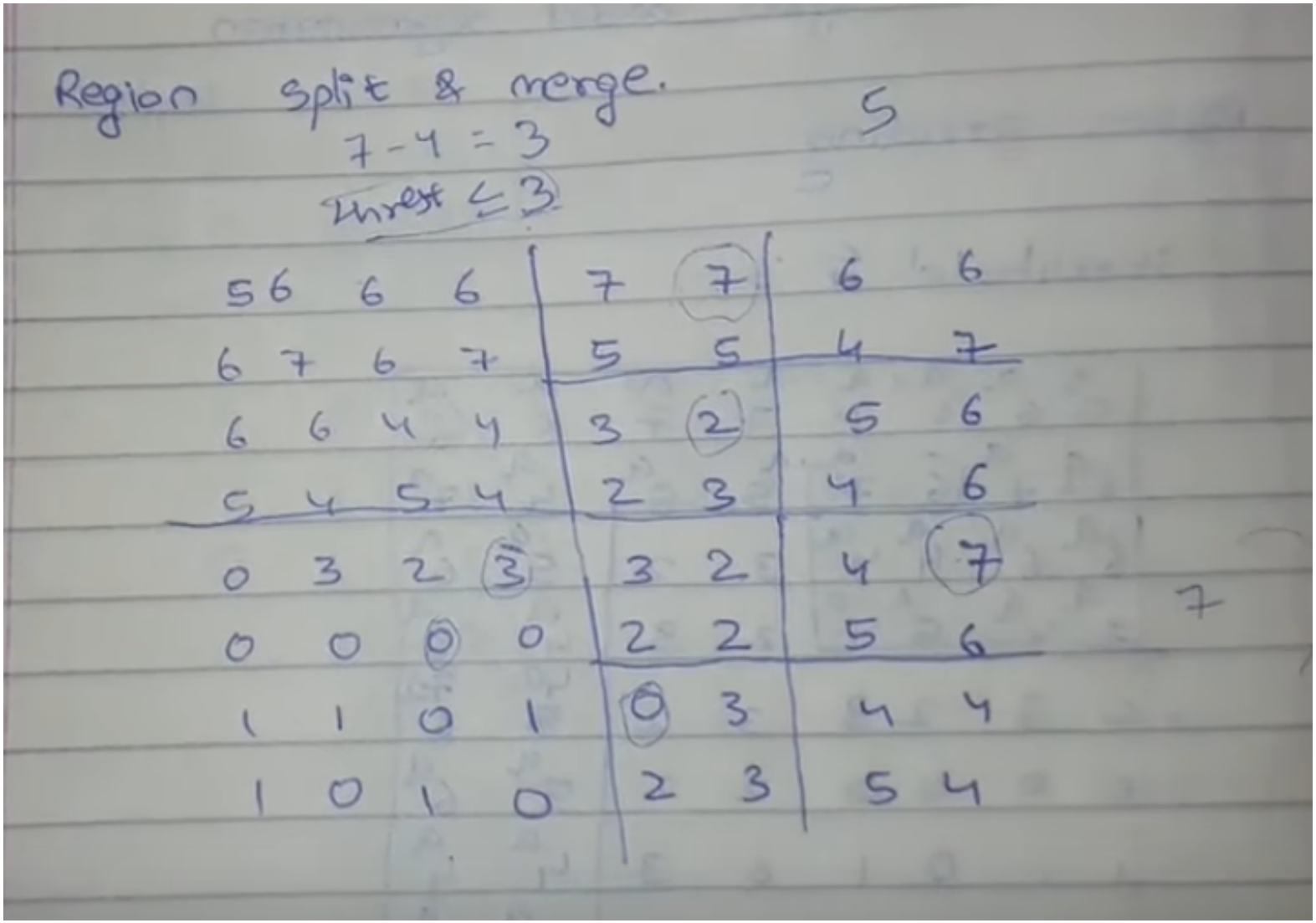

Region growing
5 6 6 7 7 7 6 6
6 7 6 7 5 5 4 7
6 6 4 4 3 2 5 6
5 4 5 4 2 3 4 6
0 3 2 3 3 2 4 7
0 0 0 0 2 2 5 6
1 1 0 1 0 3 4 4
1 0 1 0 2 3 5 4

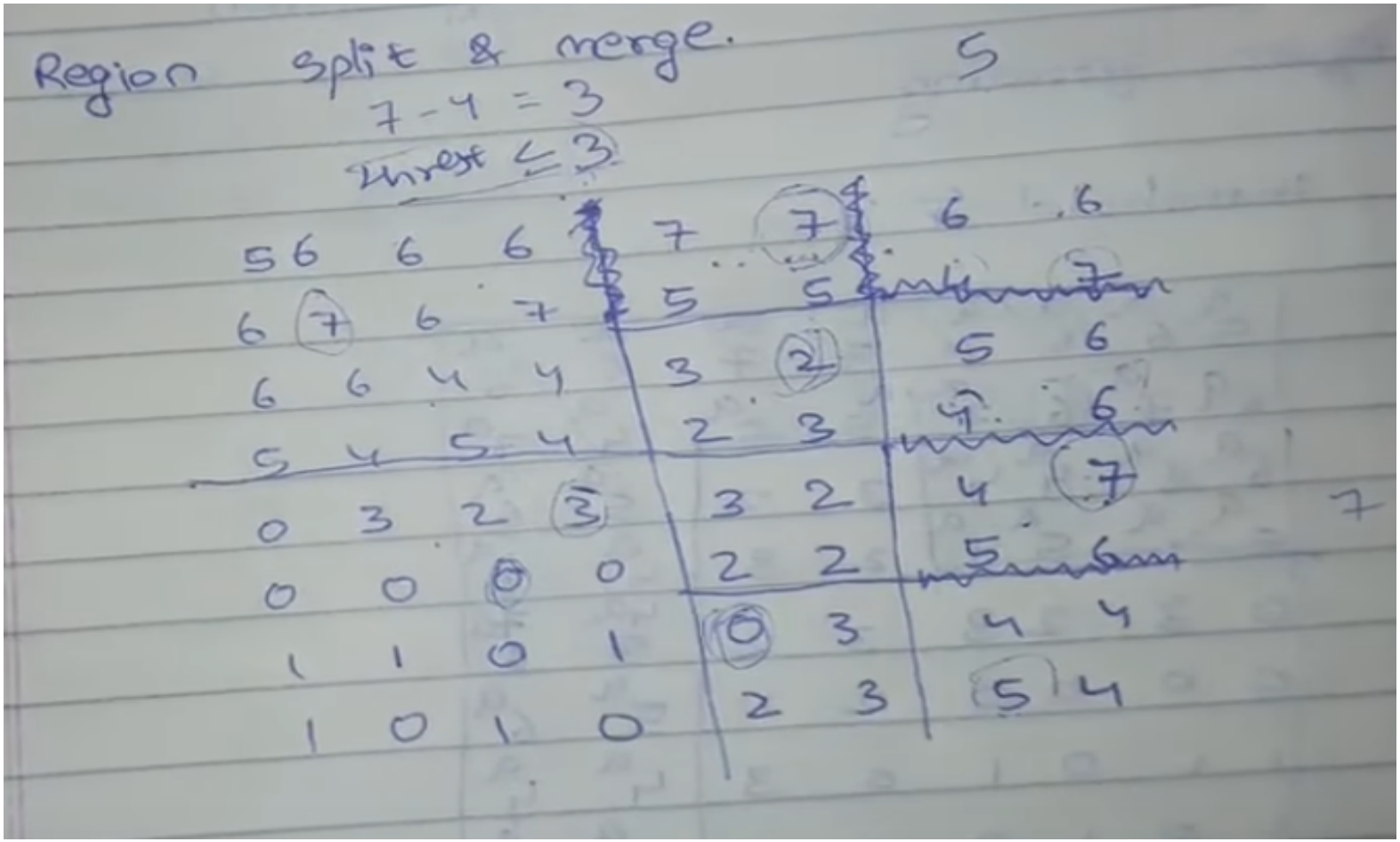

Region growing
threshold = 3

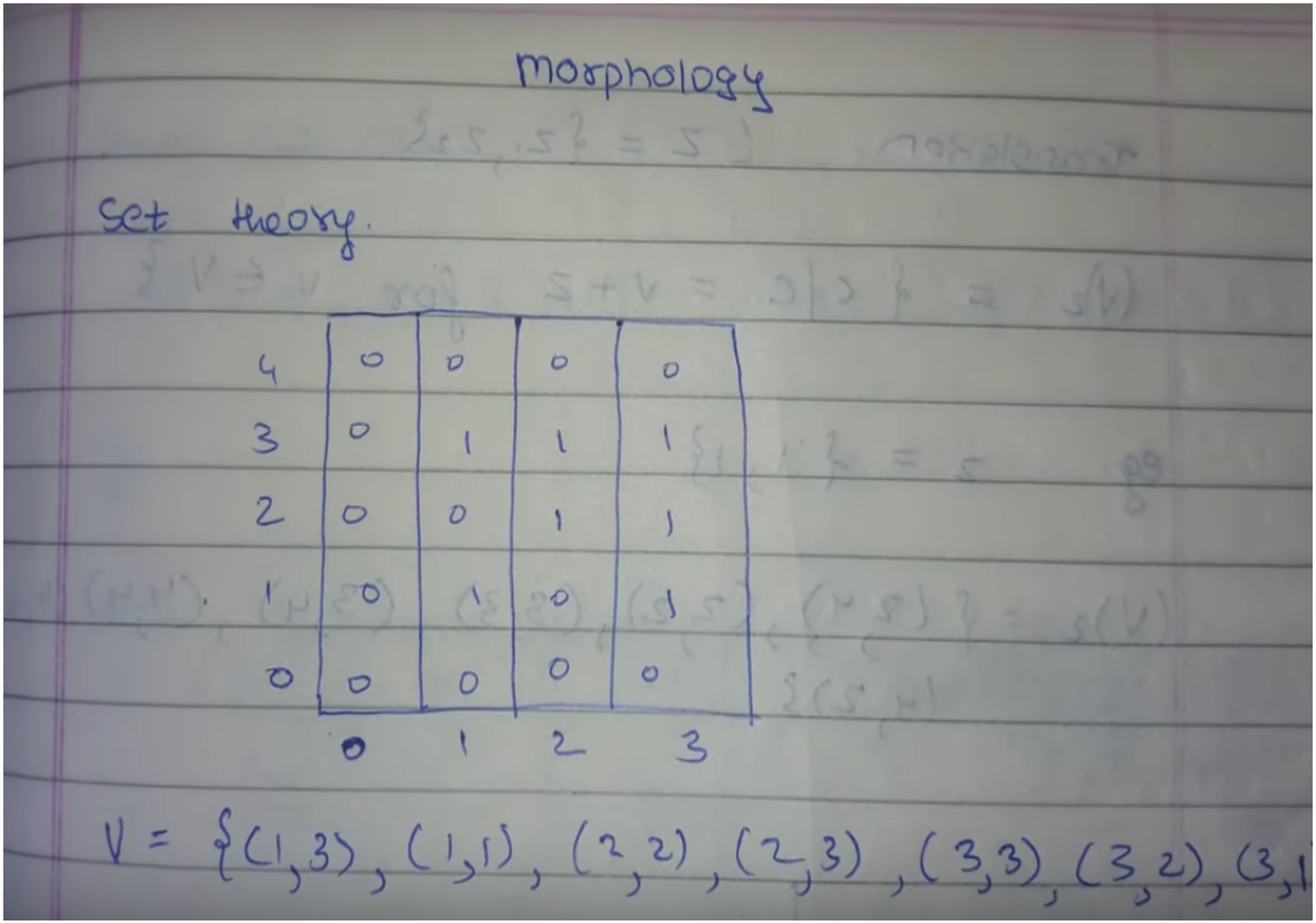

5 6 6 7 7 7 6 6
6 7 6 7 5 5 4 7
6 6 4 4 3 2 5 6
5 4 5 4 2 3 4 6
0 3 2 3 3 2 4 7
0 0 0 0 2 2 5 6
1 1 0 1 0 3 4 4
1 0 1 0 2 3 5 4

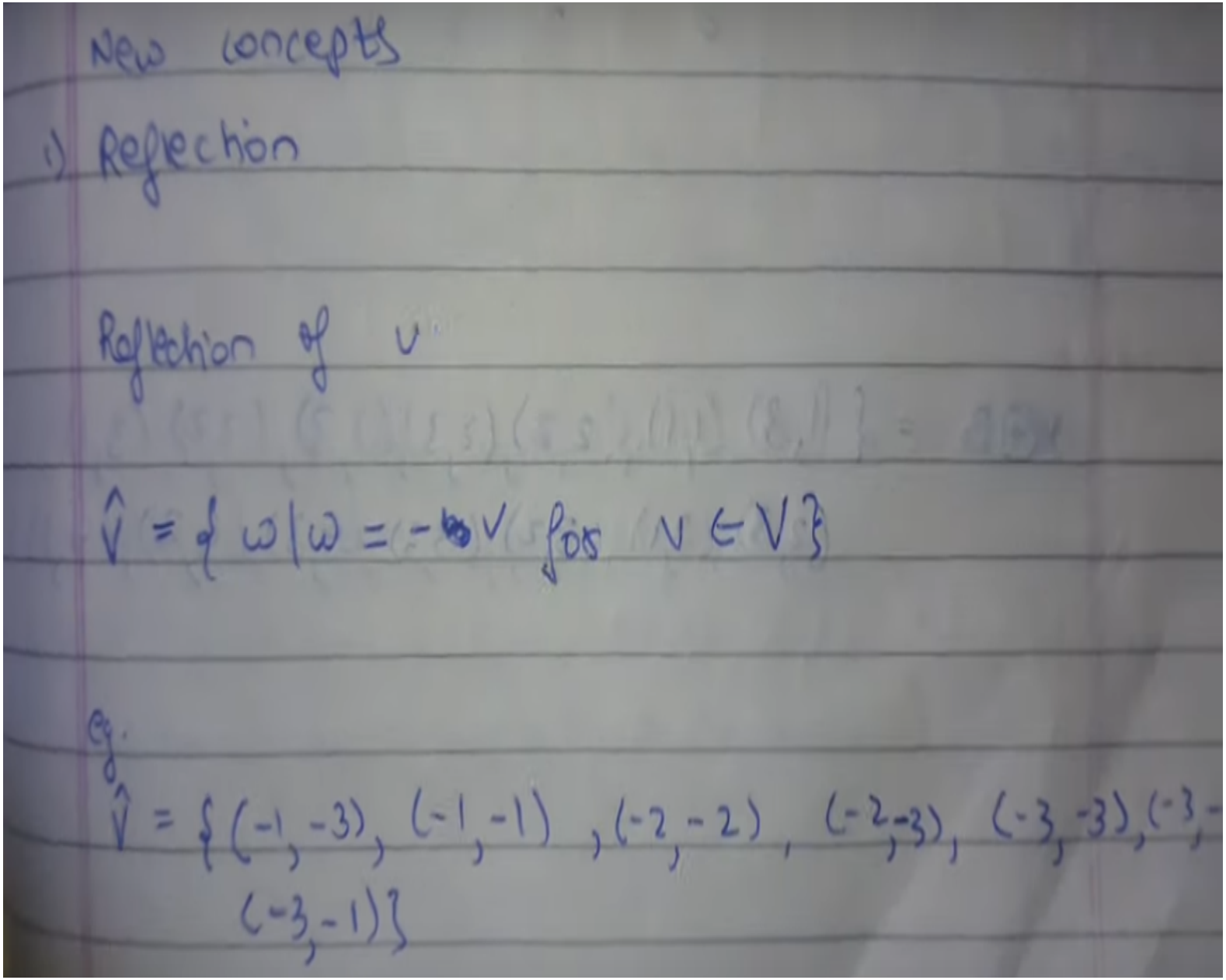


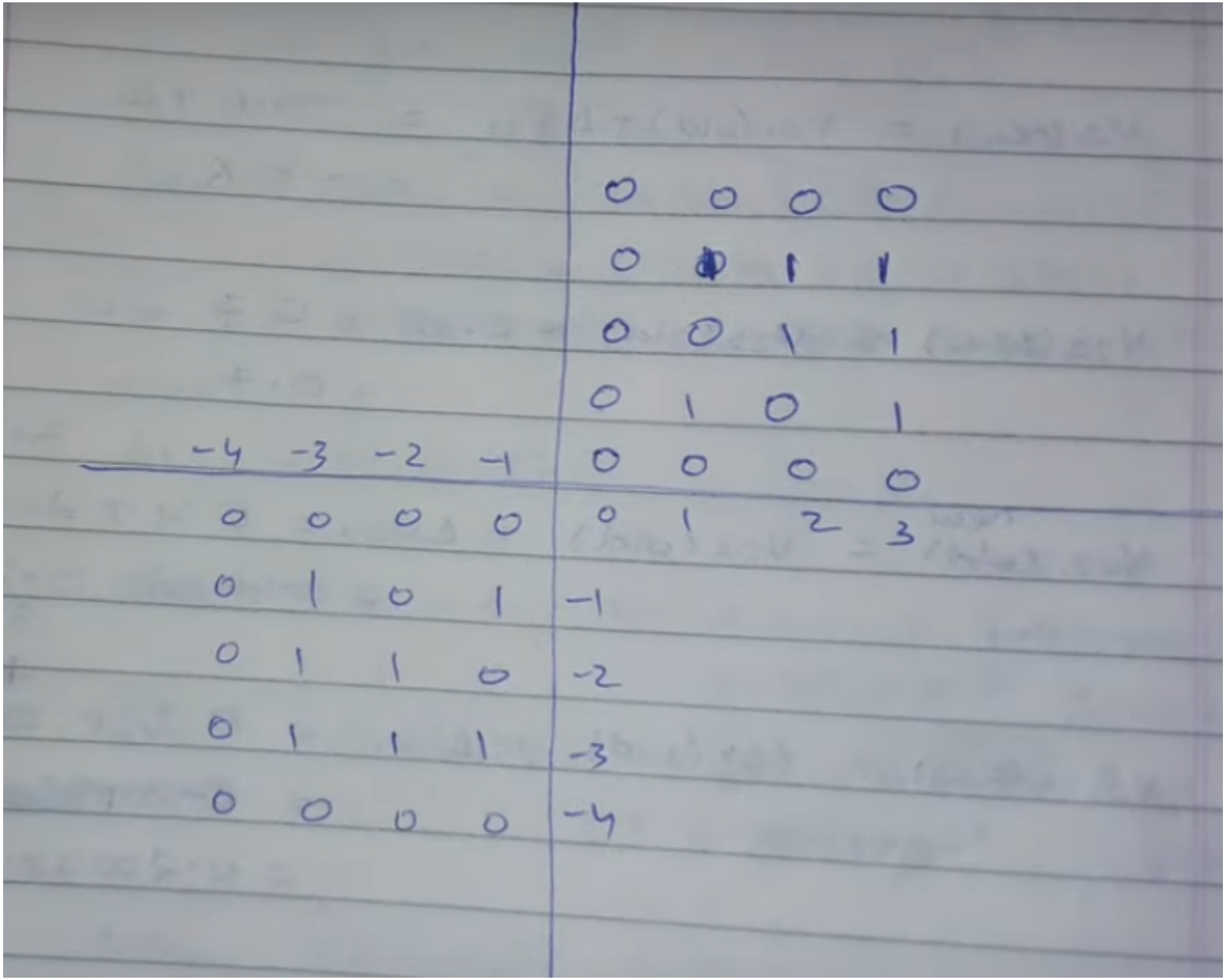

Region split & merge.
5 6 6 6 7 7 6 6
6 7 6 7 5 5 4 7
6 6 4 4 3 2 5 6
5 4 5 4 2 3 4 6
0 3 2 3 3 2 4 7
0 0 0 0 2 2 5 6
1 1 0 1 0 3 4 4
1 0 1 0 2 3 5 4


Region split & merge.
7 - 4 = 3
Thresh ≤ 3
5
7
5 6 6 6 7 7 6 6
6 7 6 7 5 5 4 7
6 6 4 4 3 2 5 6
5 4 5 4 2 3 4 6
0 3 2 3 3 2 4 7
0 0 0 0 2 2 5 6
1 1 0 1 0 3 4 4
1 0 1 0 2 3 5 4


Region split & merge.
7 - 4 = 3
threst ≤ 3


Morphology
Set theory.
4 0 0 0 0
3 0 1 1 1
2 0 0 1 1
1 0 1 0 1
0 0 0 0 0
0 1 2 3
V = {(1,3), (1,1), (2,2), (2,3), (3,3), (3,2), (3,1


New concepts
1) Reflection
Reflection of V
$\hat{V} = \{ \omega \mid \omega = -v \text{ for } v \in V \}$
eg.
$\hat{V} = \{(-1,-3), (-1,-1), (-2,-2), (-2,-3), (-3,-3), (-3,-$
$(-3,-1)\}$


0 0 0 0
0 0 1 1
0 0 1 1
0 1 0 1
0 0 0 0
0 1 2 3
-4 -3 -2 -1
0 0 0 0
0 1 0 1
0 1 1 0
0 1 1 1
0 0 0 0
-1
-2
-3
-4

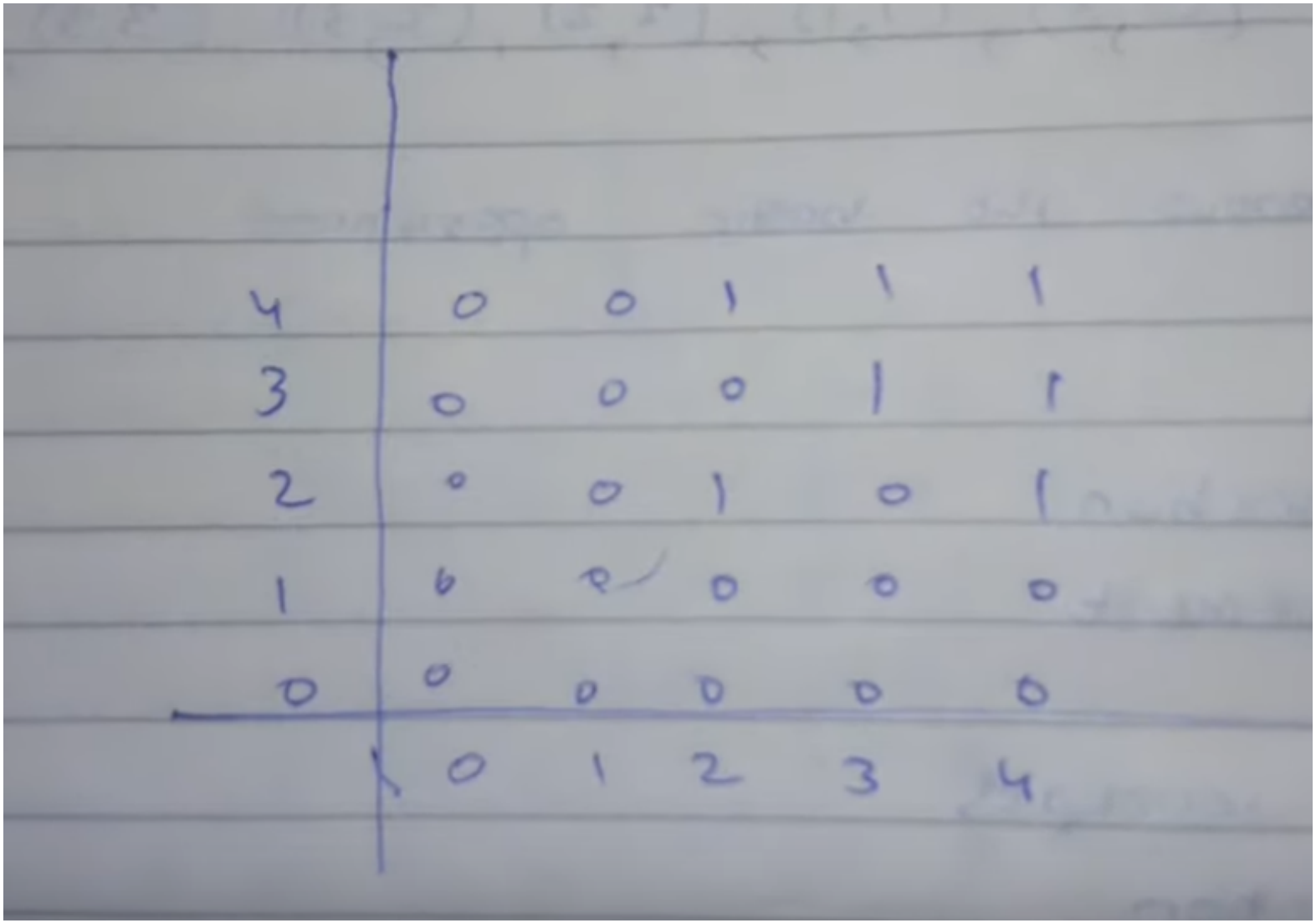
$V = \{(1,3),(1,1)(2,2),(2,3)(3,3)(3,2)(3,1)\}$

Translation. $Z = \{z_1, z_2\}$

$(V)_Z = \{ c \mid c = v + z, \text{ for } v \in V \}$

eg. $z = \{1, 1\}$

$(V)_Z = \{(2,4),(2,2),(3,3),(3,4),(4,4)(4,3)$
$(4,2)\}$


4 0 0 1 1 1
3 0 0 0 1 1
2 0 0 1 0 1
1 0 0 0 0 0
0 0 0 0 0 0
0 1 2 3 4

Dialet Dilation

① $X \oplus B = \{ p \in Z^2 \mid p = x + b,\ x \in X,\ b \in B \}$

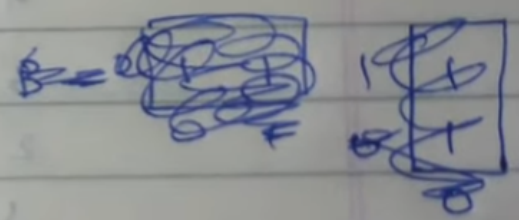
② $X \oplus B = \{ p \mid (\hat{B})_p \cap X \neq \phi \}$

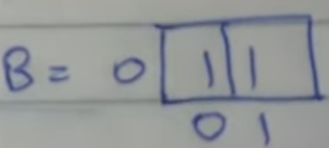
eg.

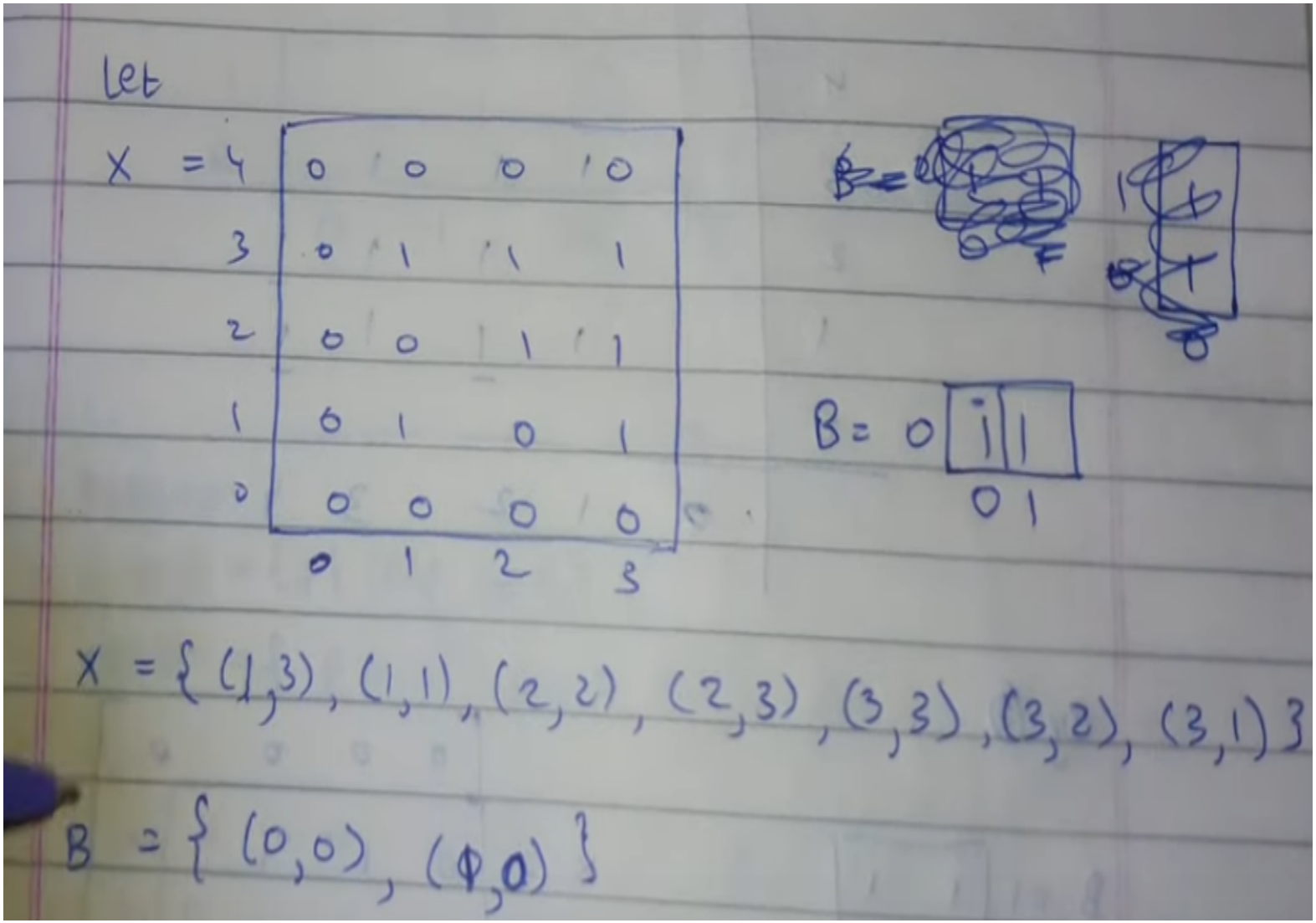
Let

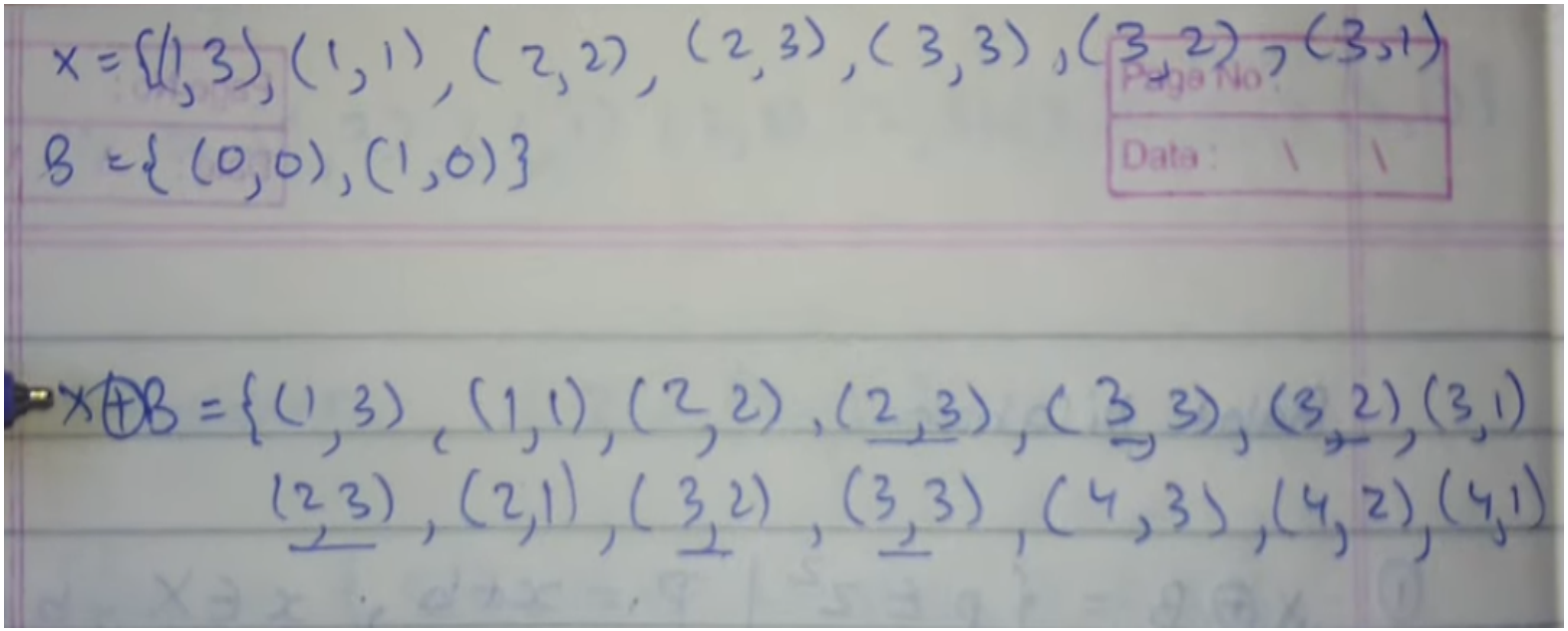
$X =$

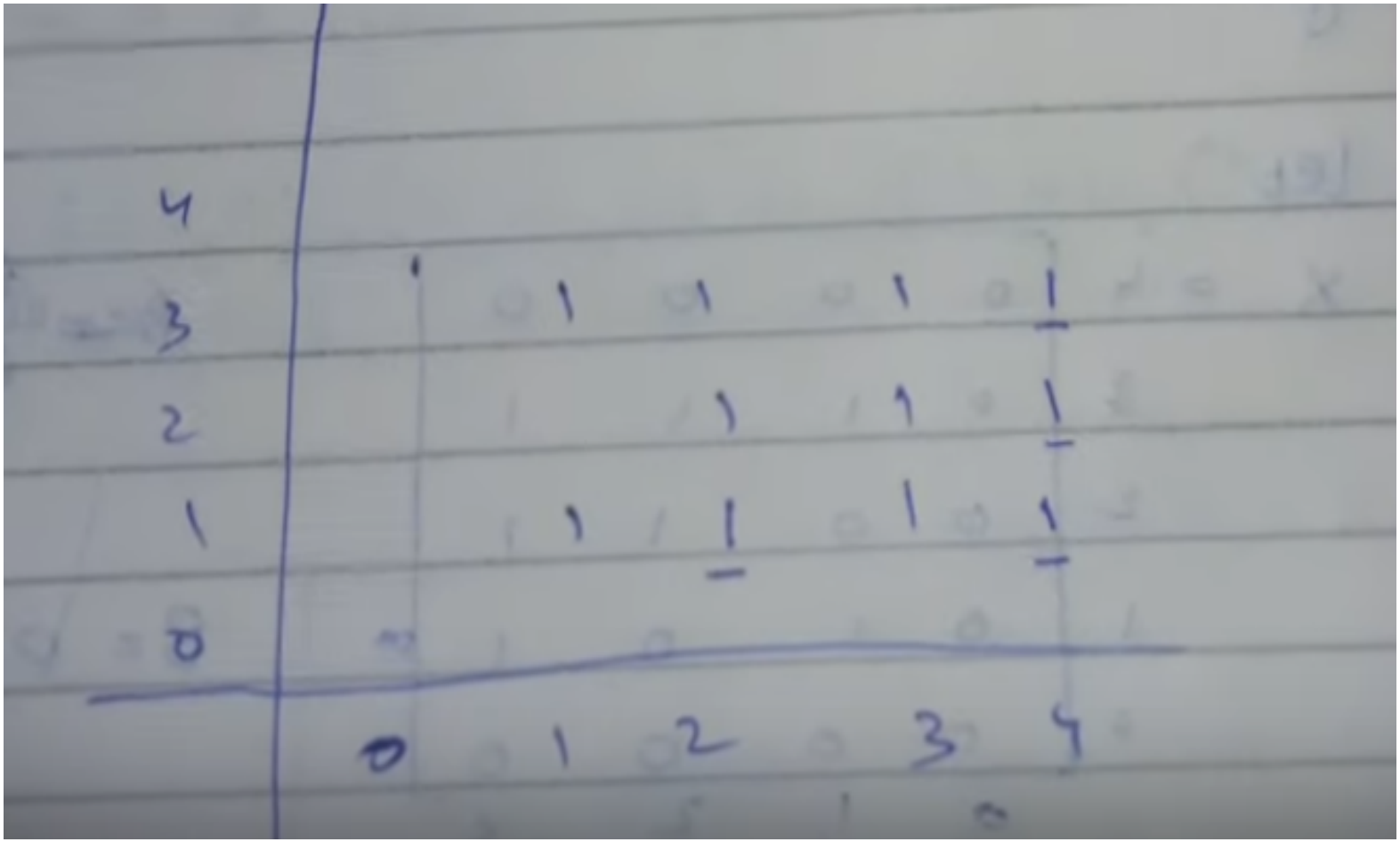
4	0	0	0	0
3	0	1	1	1
2	0	0	1	1
1	0	1	0	1
0	0	0	0	0
	0	1	2	3

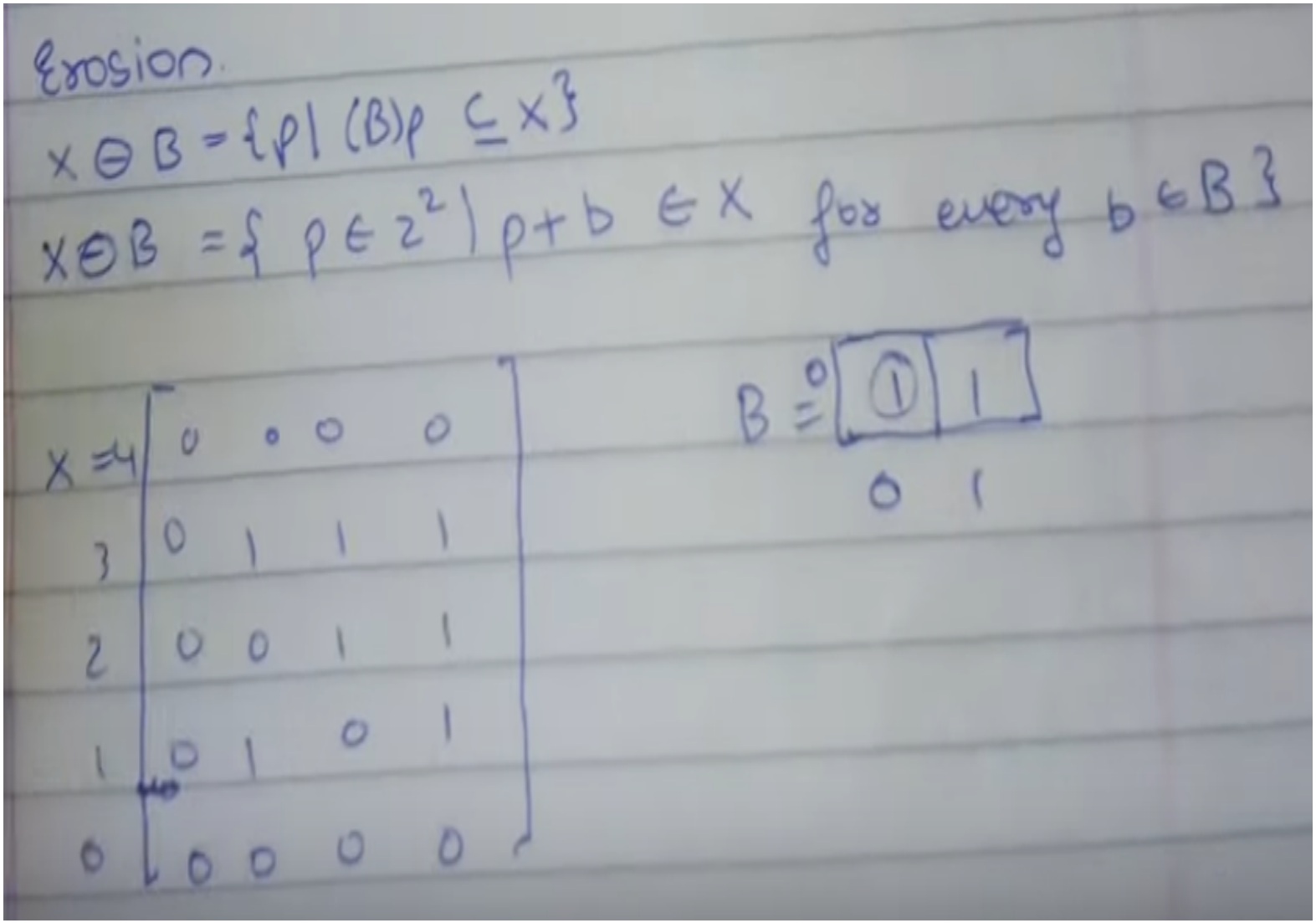


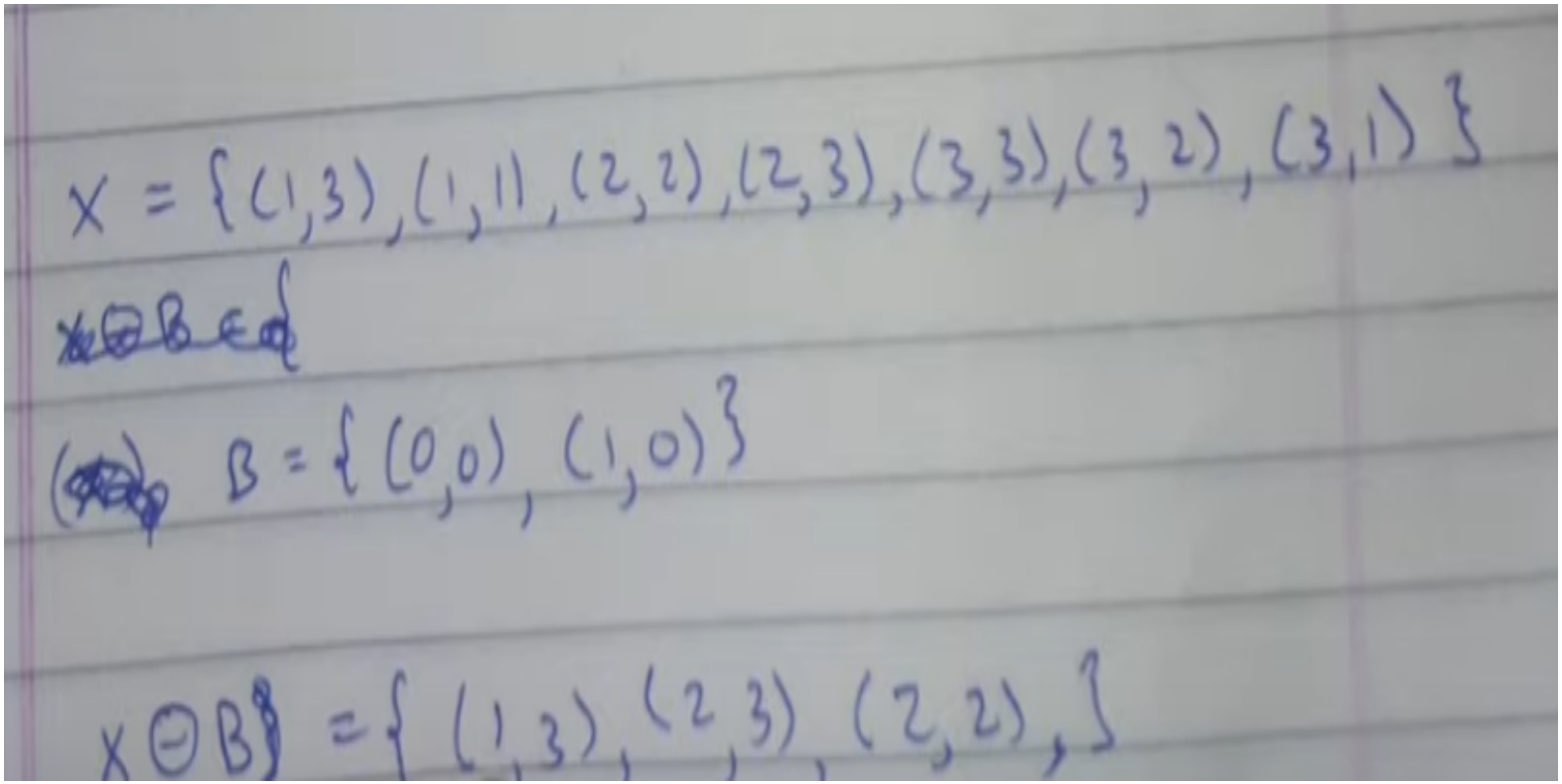


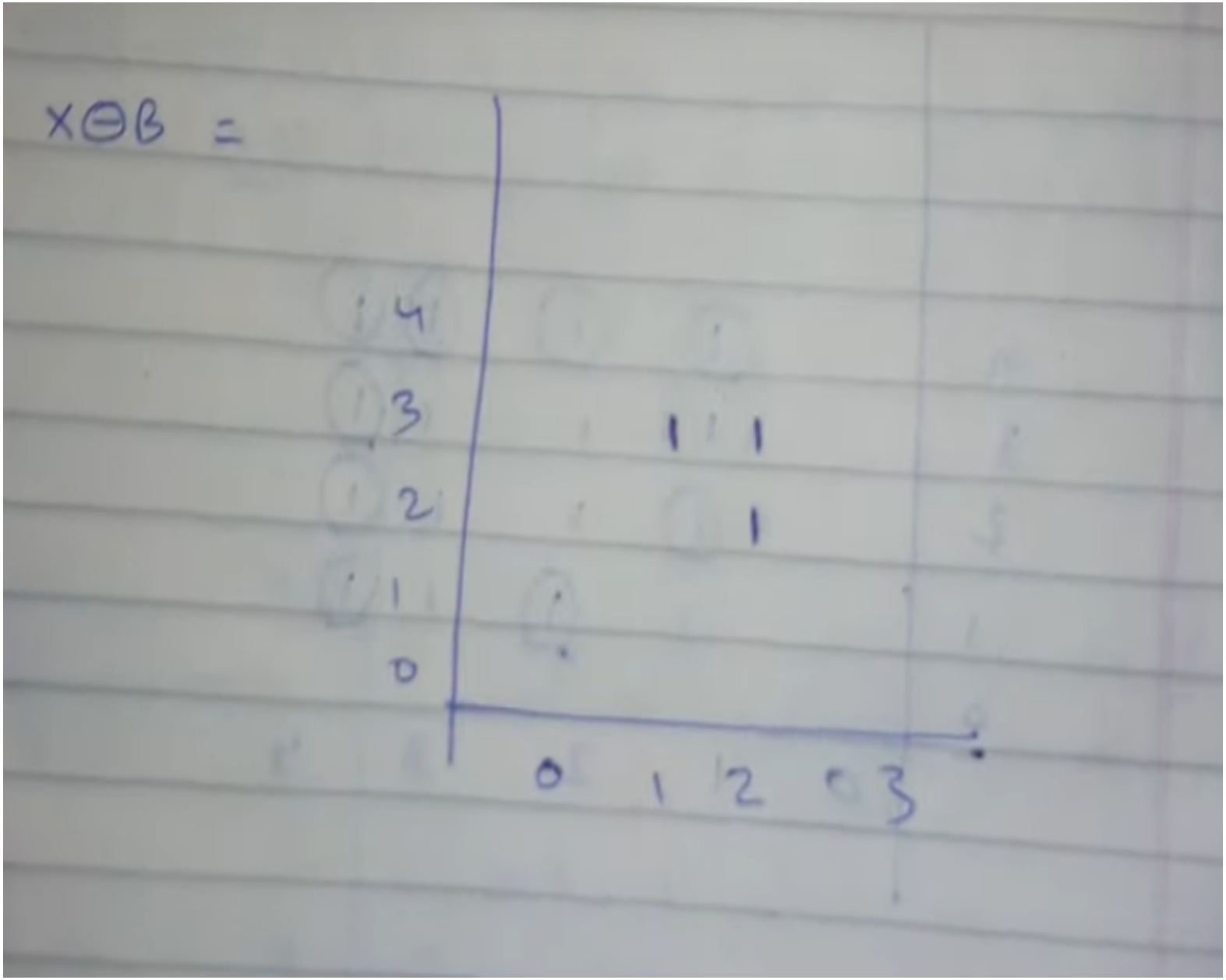

let
X = 4 0 0 0 0
3 0 1 1 1
2 0 0 1 1
1 0 1 0 1
0 0 0 0 0
0 1 2 3
B = 0 1
0 1
X = {(1,3), (1,1), (2,2), (2,3), (3,3), (3,2), (3,1)}
B = {(0,0), (Φ,0)}


X = {(1,3), (1,1), (2,2), (2,3), (3,3), (3,2), (3,1)}
B = {(0,0), (1,0)}
X ⊕ B = {(1,3), (1,1), (2,2), (2,3), (3,3), (3,2), (3,1)
(2,3), (2,1), (3,2), (3,3), (4,3), (4,2), (4,1)}


4
3
2
1
0
0 1 2 3 4


Erosion.
$X \ominus B = \{p \mid (B)p \subseteq X\}$
$X \ominus B = \{ p \in Z^2 \mid p+b \in X \text{ for every } b \in B \}$
X = 4 3 2 1 0
0 0 0 0
0 1 1 1
0 0 1 1
0 1 0 1
0 0 0 0
B =
0 1
1


X = {(1,3), (1,1), (2,2), (2,3), (3,3), (3,2), (3,1)}
B = {(0,0), (1,0)}
X ⊖ B = {(1,3), (2,3), (2,2),}


X⊖B =
4
3
2
1
0
1 1
1
0 1 2 3