APPLICATIONS OF BINARY MORPHOLOGICAL OPERATIONS

- **Thinning and Thickening**
- Skeleton Method

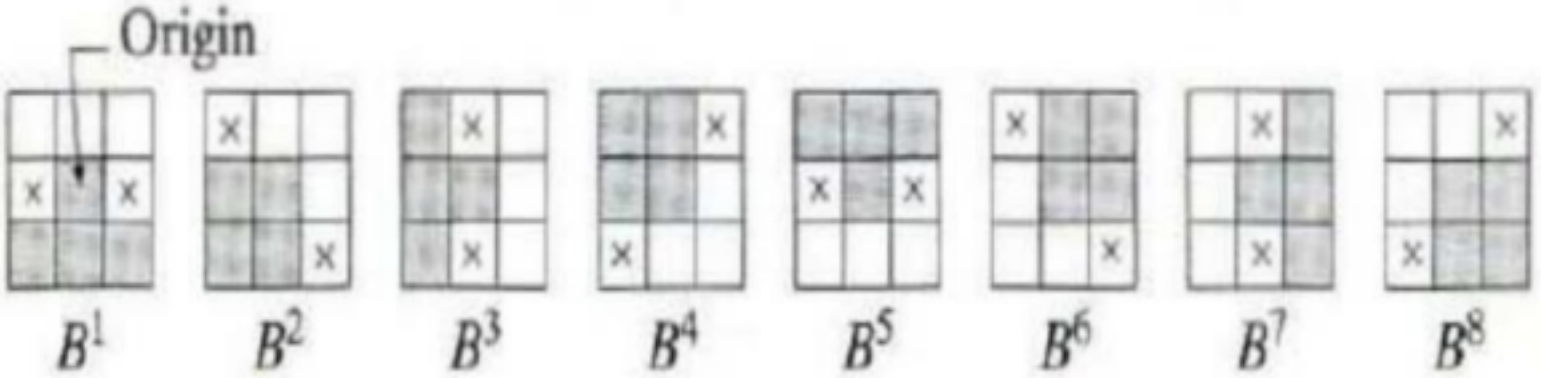
THINNING AND THICKENING

THINNING METHOD

• Thinning operation is often used to make lines in images having more than one-pixel width thinner. • The thinning operations of an image *A* by structuring element E is defined as:

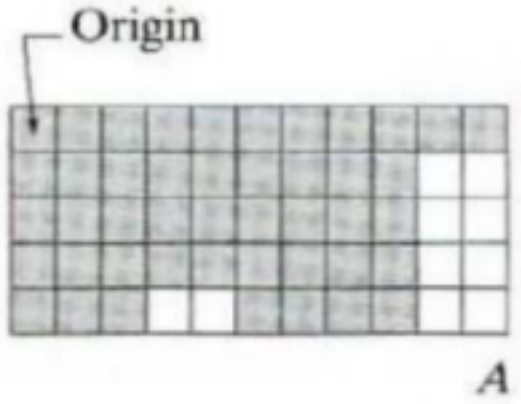
$$\text{Thinning: } \square = A - (A \otimes E)$$

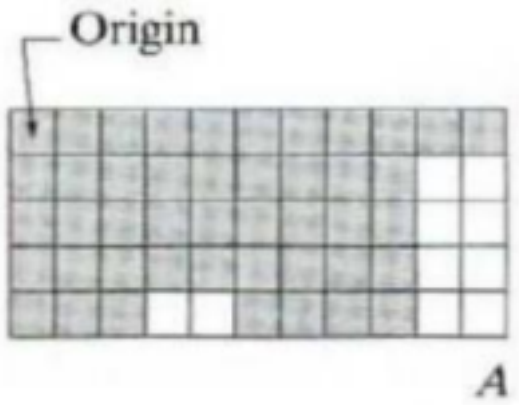
- Structuring elements are



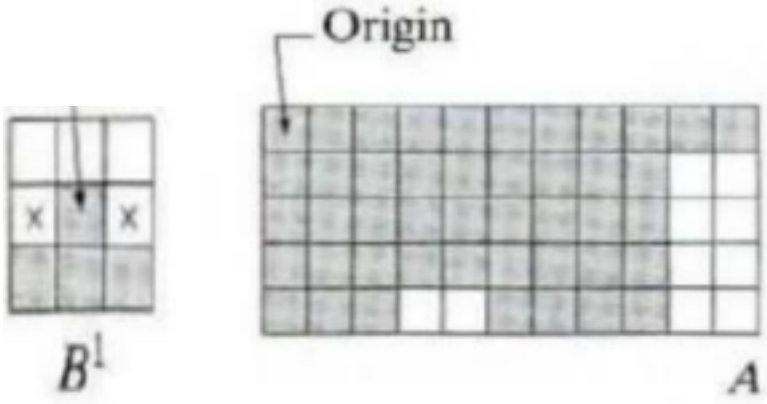
set of structuring elements commonly used for thinning

- Perform Thinning on the following Set A.


Origin
A

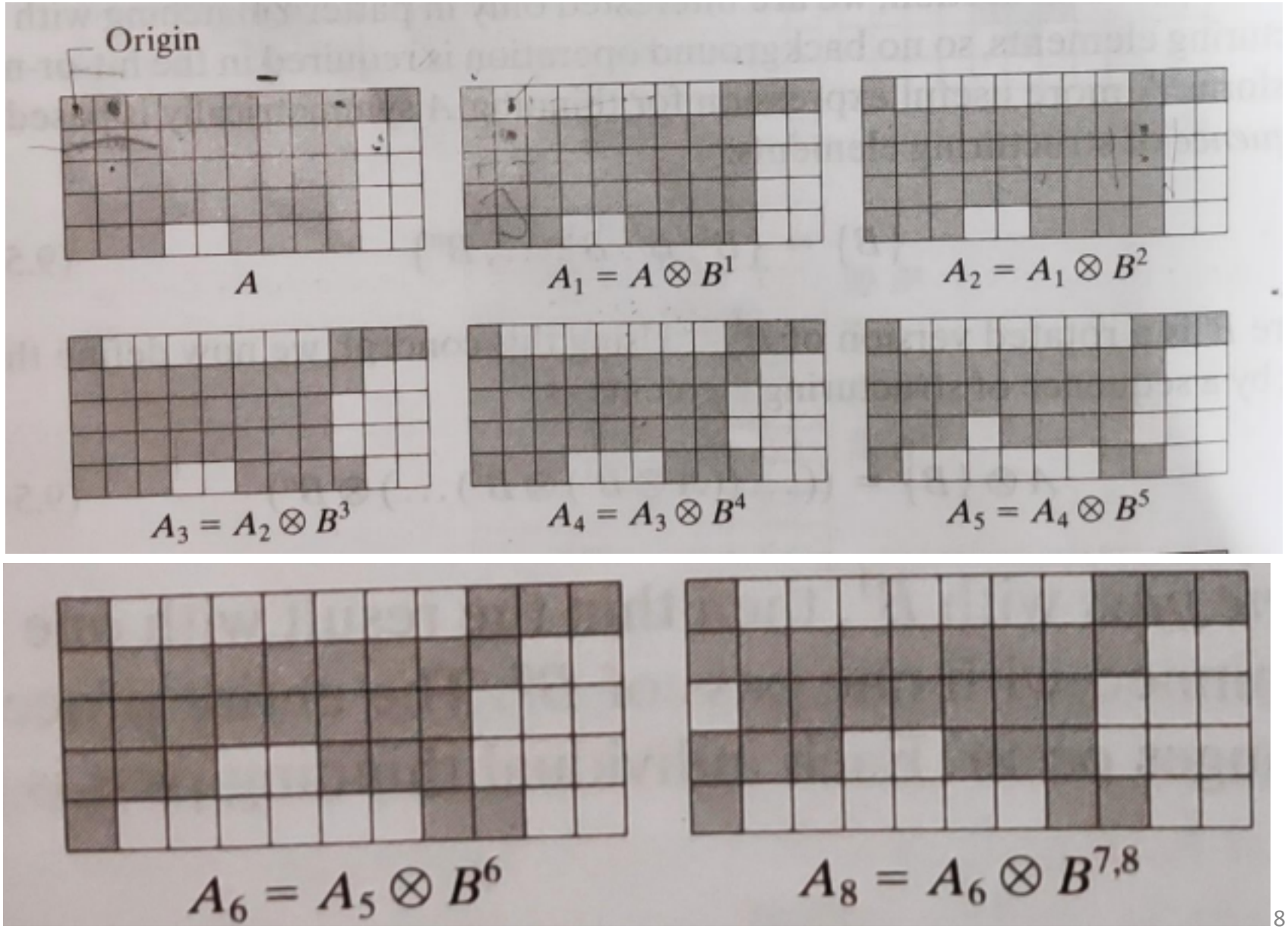


1	1	1	1	1	1	1	1	1	1	1
1	1	1	1	1	1	1	1	1		
1	1	1	1	1	1	1	1	1		
1	1	1	1	1	1	1	1	1		
1	1	1	1	1	1	1	1	1		
1	1	1			1	1	1	1		



0	0	0
*	1	*
1	1	1

1	1	1	1	1	1	1	1	1	1	1
1	1	1	1	1	1	1	1	1		
1	1	1	1	1	1	1	1	1		
1	1	1	1	1	1	1	1	1		
1	1	1	1	1	1	1	1	1		
1	1	1			1	1	1	1		

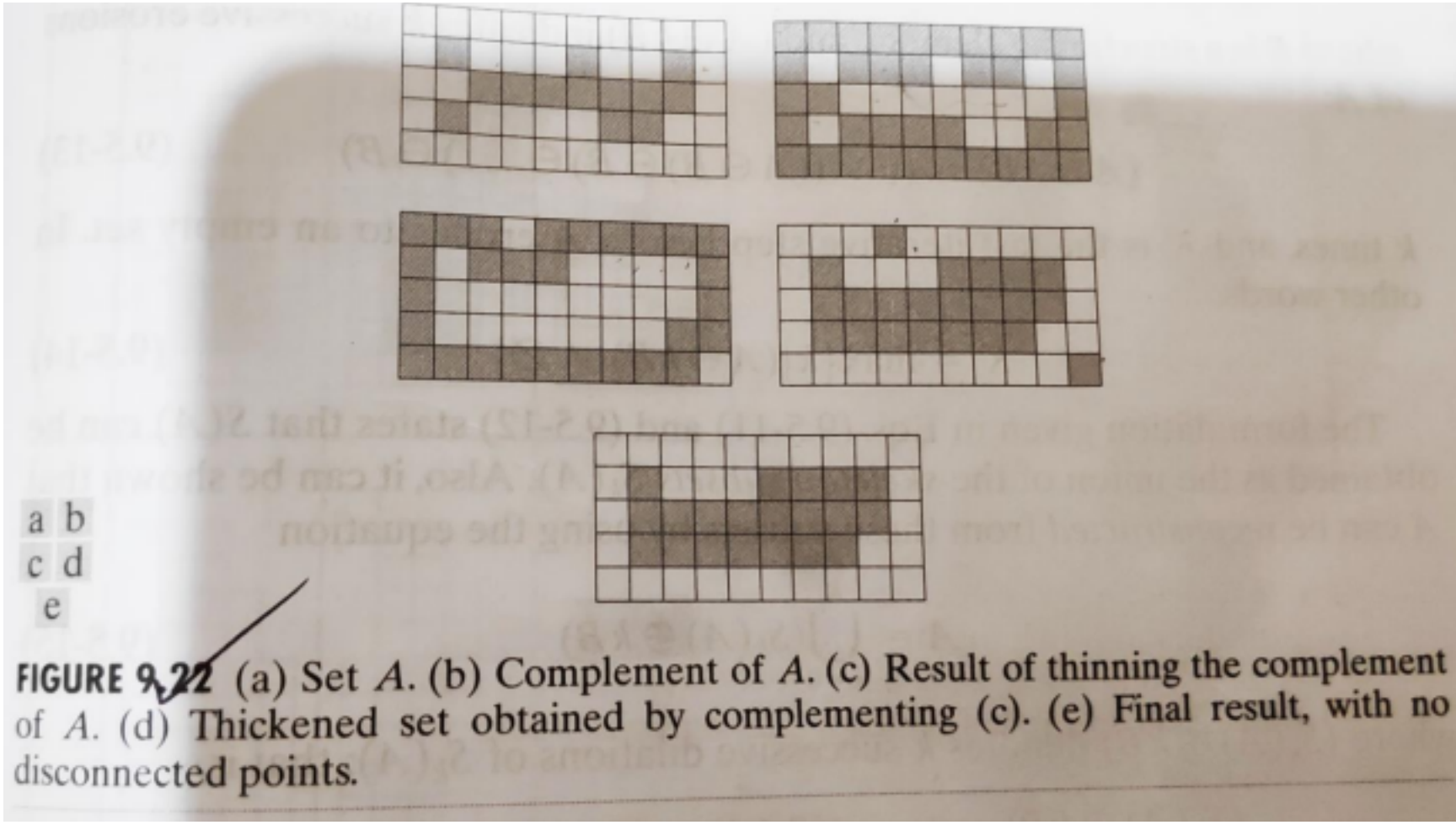


THICKENING METHOD

- Thickening operation is used to broaden the lines that may connect broken borders.
- The thickening operations of an image A with the structuring element E is defined as:

$$\text{Thickening: } \boxtimes = A \cup (A \otimes E)$$

- To thicken set A, we form $C=A^c$, thin C and than form C^C.



a b
c d
e

FIGURE 9.22 (a) Set A. (b) Complement of A. (c) Result of thinning the complement of A. (d) Thickened set obtained by complementing (c). (e) Final result, with no disconnected points.