T-61.5100 Digital image processing, Exercise 6/07

Morphological image processing

1. (a) Give a morphological algorithm for converting an 8-connected binary boundary to an m-connected boundary (see Section 2.5.2). You may assume that the boundary is fully connected and that it is one pixel thick.

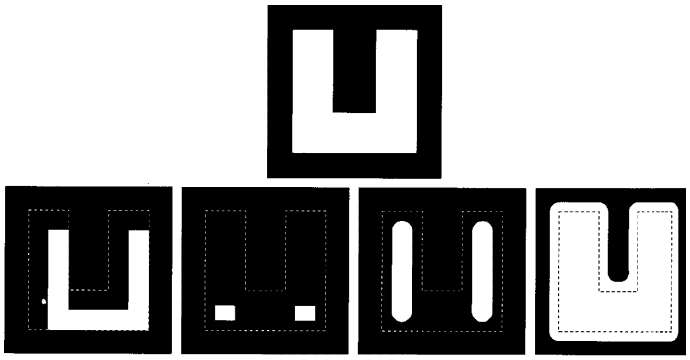
   (b) Does the operation of your algorithm require more than one iteration with each structuring element? Explain your reasoning.

   (c) Is the performance of your algorithm independent of the order in which the structuring elements are applied? If your answer is yes, prove it; otherwise give an example that illustrates the dependence of your procedure on the order of application of the structuring elements.

2. How can the given object be cleaned up by using morphological operations? (The outline of the zero in the image should be closed.)

0	0	0	0	0	0	0	0	0
0	0	1	1	0	1	1	0	0
0	0	1	0	1	0	0	1	0
0	0	0	0	0	0	1	0	0
0	0	1	0	0	0	1	0	0
0	1	1	1	1	1	1	0	0
0	0	0	0	0	0	0	0	0

3. Give the structuring element and morphological operation(s) that produced each of the results shown in images (a) through (d). Show the origin of each structuring element clearly. The dashed lines show the boundary of the original set and are included only for reference. Note that in (d) all corners are rounded.



4. Sketch what the sets C, D, E, F would look like when the following sequence of operations is applied to a given image: $C = A \ominus B$; $D = C \oplus B$; $E = D \oplus B$; $F = E \ominus B$, where B is the structuring element. The initial set A consists of all the image components shown in white. Note that this sequence of operations is simply the opening of A by B, followed by the closing of that opening by B. You may assume that B is round and just large enough to enclose each of the noise components.