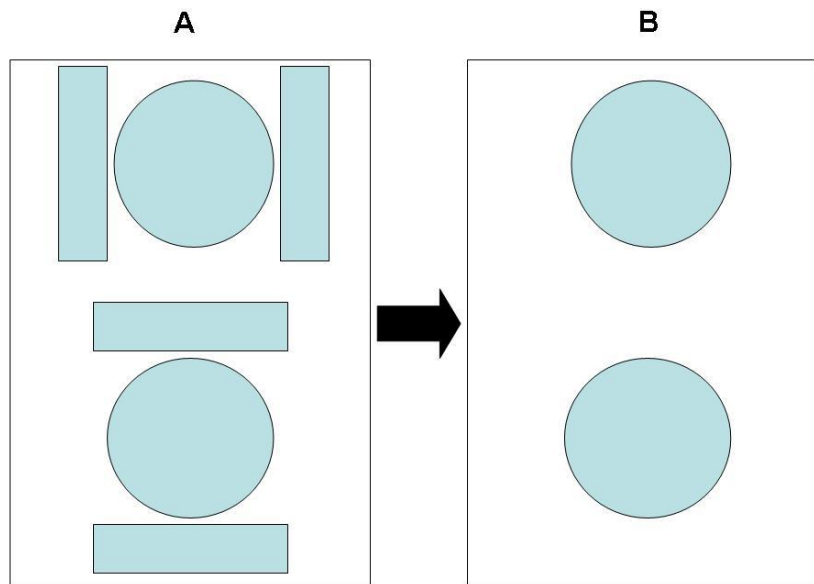
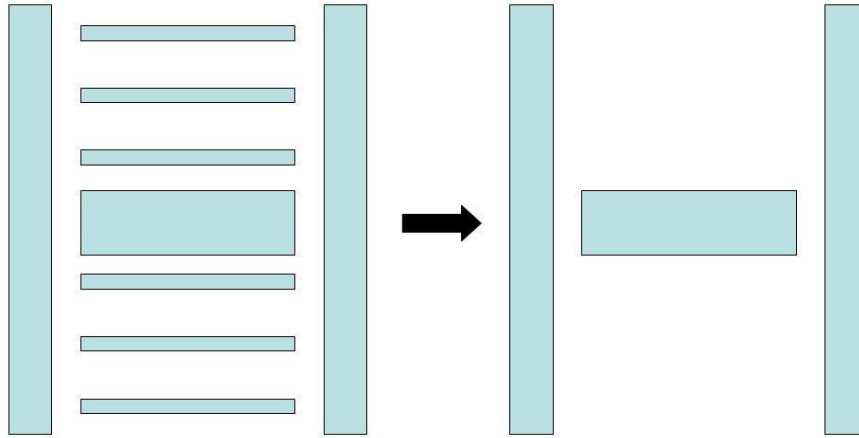


1. Explain what you understand by the morphological operations of *erosion* and *dilation* ?
2. Under what special circumstances can you expect erosion followed by dilation using the same structuring element to leave the image *unchanged*. Give a simple example to clarify your answer.
3. Two different types of cell are randomly mixed together. They are all of the same average area but one type of cell is approximately circular whereas the other exhibits a significant degree of ellipticity. A high contrast, digital image of a large but sparsely distributed sample of cells is formed using a microscope. Suggest a structuring element and a morphological operation which, if repeated, will enable you to automatically estimate the relative fractions of each type of cell in the sample.
4. Describe a basic methodology for achieving each of the following image processing tasks –
 - i) Identification of all occurrences of the word “*thou*” in a typeset version of Shakespeare’s play “A Midsummer Night’s Dream”.
 - ii) Estimation of the size distribution of a large number of approximately circular pebbles passing by on a conveyor belt. (You may assume that the pebbles are all considerably darker than the conveyor belt background and are non-overlapping)
5. Give a succinct description of the key steps in morphological edge detection.
6. Briefly explain why this method is sensitive to edges and state its main advantage over methods which rely on convolution with a derivative filter kernel.
7. Outline a morphological method which may be used to compensate an image which has been subject to non-uniform illumination. State clearly the limitations of the method you describe.

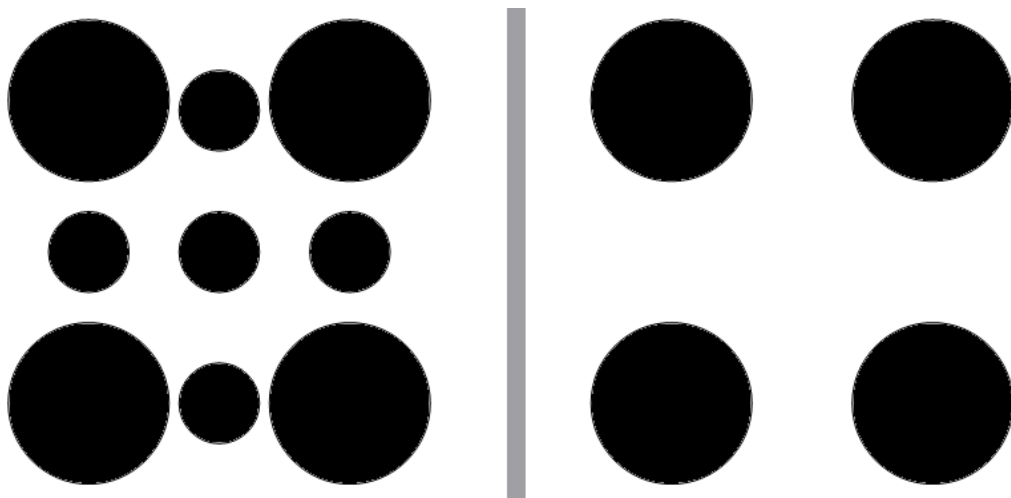
8. Define the morphological operations of erosion and dilation. How could you use these operations to (approximately) produce binary image B from binary image A below ? State clearly what structuring elements you choose.
9. Load the greyscale image shapes.png into Matlab and write a code fragment that will achieve this task. (**imerode**, **imdilate**, **im2bw**, **imshow** will be useful)



10. How would you combine erosion and dilation to produce *exactly* the image below *on the right* from the image below *on the left*. State clearly what structuring element you would select to achieve this task. Load the image shapes2.png and implement this in Matlab.



11. Repeat this exercise in Matlab using the image below to produce the image *on the right* of the grey line (cjs_circles.png) starting from the image below *on the left* of the grey line. Do you obtain an exact version using a circular structuring element? If not, why not?



12. What is a landmark and what basic types are defined in relation to geometric transformation of digital images?

13.

14. In the spatial transformation of one set of landmarks x_I, y_I to another reference set x_B, y_B a bilinear transformation of the following form is used –

