CW1: Coursework for Lecture 4: Binary Processing

Instructions:

Please include pictures of all relevant MATLAB *figures in your answer. Figures can be saved as pictures by choosing* `File->Save As` *in the Figure menubar. You can also add annotation to your figures using* `Insert->Title` *or* `Insert->TextBox`.
The images `ChromoBW_detail.bmp`*, and* `eggs.tif` *can be downloaded from Blackboard.*

1. Write a short (about 15 lines or less) MATLAB function to perform erosion on an image, using a fixed 3×3 structuring element, and by explicitly looping over all pixels in the input image. Don't forget about the pixels on the edges of the image.

   You should include a listing of your code in your answer, with comments.

2. Load the black-and-white image `ChromoBW_detail.bmp` into MATLAB , and convert it to a `double` variable, rather than `logical`. Then erode it twice using your function.

   Now perform two dilations on the result. You will need to suitably invert the image in order to use the same code. Can you see why this works?

   Compare the initial image with the result after the erosion and dilation sequence. Has this had the desired result on the image?

   Displaying Images
   When an image variable has been converted to double, `imshow` will not always work as you require, depending on the range of the image values. You can then use `imagesc( ); axis image; colormap(gray(256));` to obtain the desired result.

3. Load the image `eggs.tif` into MATLAB , and convert it to a `double` variable, rather than `uint8`. If your code has been written correctly, then your function should work just as well on this greyscale image, as on the black-and-white image.

4. Perform several erosions on the image, and then (by using suitable image inversions as before), the corresponding number of dilations. Now compare it (i.e. take the absolute difference) with the original image in order to compute the top-hat transformation. Has it performed as

claimed? What happens if you vary the number of erosion/dilation stages?

5. You should also try performing the other top-hat transformation, which switches the order of the erosion and dilation steps, although you should not see much effect on this particular image.

MATLAB Hints:
You may find the MATLAB functions `max`, `min`, and `size`, and `abs` useful.
When trying to find the maximum value in an array `max(array_name)` will give you the maximum value of each column. To find the maximum across the whole array, you'll need to use instead `max(array_name(:))`.