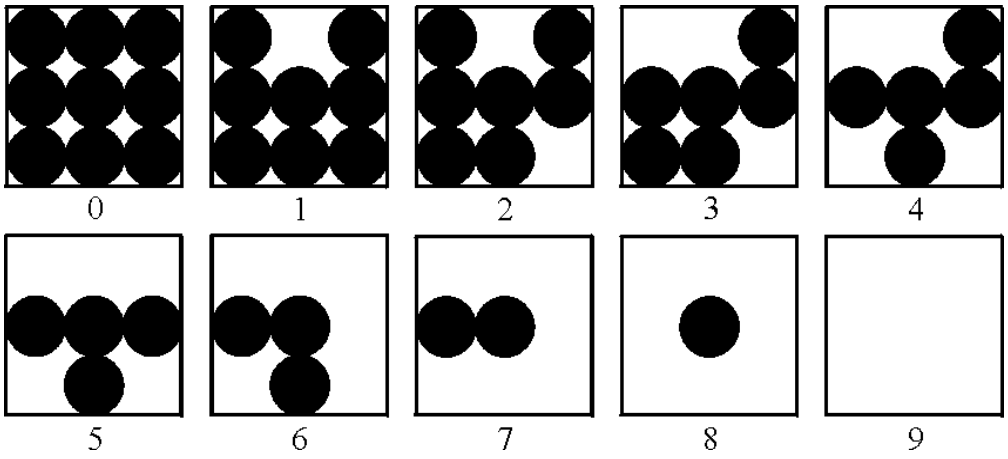
Lab Assignment #1

Due Mon. Sept. 17 by 11:59pm

(upload to CatCourses)

Title: Binary Image Rendering using Halftoning.

Halftoning is a technique that uses patterns of black and white dots to simulate a grayscale image. It is useful when an output device can only print or display black or white. The figure below shows 3x3 patterns of black and white dots that you will use to represent blocks of 3x3 pixels in grayscale images. That is, the input will be a grayscale image whose pixels have values from 0 to 255 and the output will be an image that only contains two values, one corresponding to black and the other to white.



(Ignore the fact that the dots above are circular. They should really be square.)

Your assignment:

a) In MATLAB, write the *function* `halftone` that takes a grayscale image with values 0-255 as its input (this input should be a matrix, not a filename) and returns a binary (two-valued) image (again a matrix) as its output. The input and output should be of type `uint8`. Your function should use the 10 dot patterns above to transform the grayscale image to the binary image. You will have to decide on this transformation. Importantly, **your input and output images should have the same size (number of pixels)**. Include the code for this function in your lab report.

b) Write a test script that generates a test pattern image consisting of a gray scale "wedge" of size 256x256, whose first row is all 0, the next row is all 1, and so on, with the last row being 255.

Convert this image using your halftoning function. Include the original and halftone images in your lab report. Include this test script in your report.

c) Write a test script that performs halftoning on the three images supplied with this lab:

- Fig0225(a)(face).tif
- Fig0225(b)(cameraman).tif
- Fig0225(c)(crowd).tif

(These images are from the text.)

Include the halftone versions of these images in your lab report.

d) In your lab report, discuss whether your results on the three images above agree with the conclusions arrived at in the textbook on 59-60 and in figure 2.26.

Notes:

- Your function should be able to process images of any size, not just multiples of 3. Come up with a scheme to handle the edges when a dimension is not a multiple of 3.
- For question (d), it might be better to evaluate the results using the monitor rather than printouts. The printer might perform halftoning or similar processing itself to render the images. Also, keep in mind that MATLAB resizes large images when they are displayed with the `imshow` function. This resizing can create artifacts. You will see a message in the command window when an image is resized for display. Keep this in mind for future labs.
- The directions above are deliberately not very detailed. Part of the exercise is interpreting what is meant by the directions. Please ask questions as needed.