1999 Paper 5 Question 4

Computer Graphics and Image Processing

A company wishes to produce a greyscale display with pixels so small that a human will be unable to see the individual pixels under normal viewing conditions.

What is the minimum number of pixels per inch required to achieve this? Please state all of the assumptions that you make in calculating your answer. It may be helpful to know that there are 150 000 cones per square millimetre in the human fovea, and that there are exactly 25.4 millimetres in an inch. [6 marks]

If the pixels could be only black or white, and greyscale was to be achieved by halftoning, then what would the minimum number of pixels per inch be in order that a human could not see the halftone dots? Again, state any assumptions that you make. [2 marks]

The company currently produces a display device with 2-bit greyscale (that is: four different shades of grey). Describe an error-diffusion algorithm which will convert an 8-bit greyscale image into a 2-bit image suitable for display on this device. [Note: the two images must have the same number of pixels.] [7 marks]

Illustrate that your algorithm works using the following test image.

200	40
250	220

[2 marks]

You are asked to design a 4×4 ordered dither matrix. What rules should you follow in the design? [3 marks]