582412 Image Processing, Spring 2003
Exercise 2

1. Perform bilinear interpolation $2 \times 2 \rightarrow 5 \times 5$ to the image block below.

$$\begin{vmatrix} 0 & 16 \\ 16 & 0 \end{vmatrix}$$

2. The task is to perform uniform quantization for an image with a gradual slide in grey levels from black to white when moving from one border of the image to the other. Let us assume that the eye is capable of observing a sudden change in grey levels, if the change is more than 7 steps in the scale. How many bits per pixel should the resulting image have so that there would not exist any observable false contouring effects?

3. a) Develop a procedure for computing the median of an $n \times n$ neighbourhood.
   b) Propose a technique for updating the median as the center of the neighbourhood is moved from pixel to pixel.

4. Equalize the histogram of the 8×8 image below. The image has grey levels $0, 1, \ldots, 7$. In the lecture notes, does the illustration (HE II) describe the working of the HE I algorithm.

$$\begin{vmatrix} 4 & 4 & 4 & 4 & 4 & 4 & 4 & 0 \\ 4 & 5 & 5 & 5 & 5 & 5 & 4 & 0 \\ 4 & 5 & 6 & 6 & 6 & 5 & 4 & 0 \\ 4 & 5 & 6 & 7 & 6 & 5 & 4 & 0 \\ 4 & 5 & 6 & 6 & 6 & 5 & 4 & 0 \\ 4 & 5 & 5 & 5 & 5 & 5 & 4 & 0 \\ 4 & 4 & 4 & 4 & 4 & 4 & 4 & 0 \\ 4 & 4 & 4 & 4 & 4 & 4 & 4 & 0 \end{vmatrix}$$

5. Consider and explain the details of histogram specification. A copy of that particular section of the course book is provided in the course folder

6. Explore the two image processing tools, *gimp* and *xv*, available under the *Linux* operating systems on the computers at CS department. Do they provide tools for the following operations:

   - DC-shift;
   - image negation;
   - contrast stretching; and
   - histogram equalization?