582412 Image Processing, Spring 2003

Exercise 1

1. A common measure of transmission for digital data is the number of bits transmitted per second (*bit /s*). Generally, transmission is accomplished in packets consisting of a stat bit, a byte (8 bits) of information, and a stop bit. Using this approximation, answer the following:

   (a) How many minutes would it take to transmit a 512×512 image with 256 gray levels at 9600 bit/s?

   (b) What should be the capacity (bit/s) of a digital transfer channel, if images described in item (a) (25 images/second) are to be transferred in real time?

2. Consider the two image subsets, S_1 and S_2, shown in the figure below. For $V = \{1\}$, determine whether these two subsets are (a) 4-adjacent, (b) 8-adjacent, or (c) m-adjacent.

	S_1				S_2				
0	0	0	0	0	0	0	1	1	0
1	0	0	1	0	0	1	0	0	1
1	0	0	1	0	1	1	0	0	0
0	0	1	1	1	0	0	0	0	0
0	0	1	1	1	0	0	1	1	1

3. Develop an algorithm for converting a one-pixel-thick 8-path to a 4-path.

4. (a) Give the condition(s) under which the D_4 distance between two points p and q is equal to the shortest 4-path between these points.

   (b) Is this path unique?

5. Try out the two image processing tools, *gimp* and *xv*, available under the *Linux* operating systems on the computers at CS department. Load the 3D-image available at http://www.cs.helsinki.fi/u/klemstro/kk-k03/3D.jpg. Accomplish the following operations, and see whether the 3D-illusion still works after each of the steps.

   - Transform the image to gray scale;
   - reduce its size to half of the original;
   - flip the image by 90°.

6. Look at the picture, given on the back of this paper, and follow the directions attached to it. Think through why the visual system generates this visual illusion.

Concentrate on the 4 dots in the middle
of the picture for about 30 secs.

Then, take a look at the wall and
start blinking your eye.
You will see a circle of light....
continue looking at that circle.....

what do you see?