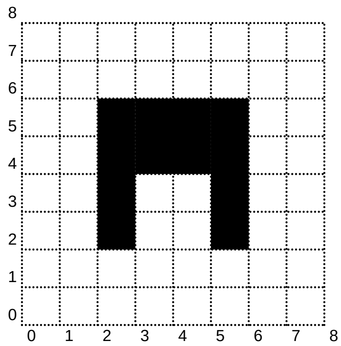
582412 Image Processing, Spring 2003
Exercise 5

1. Segment the image given below by using the split and merge procedure. Let $P(R_1) = TRUE$ if all pixels in R_1 have the same intensity. Show the quadtree corresponding to your segmentation.



2. Show that $(0°, 45°, 90°, 135°)$-limited polygon segmentation produces blocks that consist of at most 8 line segments.

3. Let the threshold ε equal 4. Segment the image below by using region growing technique. As the growing rule, use:

   i) the intensity difference between the pixel and the average of the segment;

   ii) the intensity difference between the pixel and the nearest pixel inside the region.

   Has the choice of the seed point any influence on the result of the algorithm?

10	11	12	13	14	15	16	17
11	12	13	14	15	16	17	18
12	13	**24**	**25**	**26**	**27**	18	19
13	14	**25**	**26**	**27**	**28**	19	20
14	15	**26**	**27**	**28**	19	20	21
15	16	**27**	**28**	19	20	21	22
16	17	18	19	20	21	22	23
17	18	19	20	21	22	23	24

4. By using iterative thresholding, calculate a global threshold value for the image given below, to the left. Would the segmentation result differ if the threshold value were calculated using only pixels whose Sobel response is at least 40 (the image to the right)?

10	11	12	13	14	15	16	17
11	12	13	14	15	16	17	18
12	13	**24**	**25**	**26**	**27**	18	19
13	14	**25**	**26**	**27**	**28**	19	20
14	15	**26**	**27**	**28**	19	20	21
15	16	**27**	**28**	19	20	21	22
16	17	18	19	20	21	22	23
17	18	19	20	21	22	23	24

16	16	16	16	16	16	16	16
16	36	56	56	56	40	20	16
16	56	76	56	56	60	40	16
16	56	56	16	4	44	24	16
16	56	56	4	44	44	4	16
16	40	60	44	44	4	16	16
16	20	40	24	4	16	16	16
16	16	16	16	16	16	16	16

5. The iterative thresholding algorithm was defined for the case of one threshold only. Generalize the algorithm for the case where two thresholds T_1 and T_2 should be used.

6. Does the claim $D_4 \geq D_e \geq D_8$ hold? Apply d_4 transform to the image shown below.