

# Homework 3 of CSE 473/573

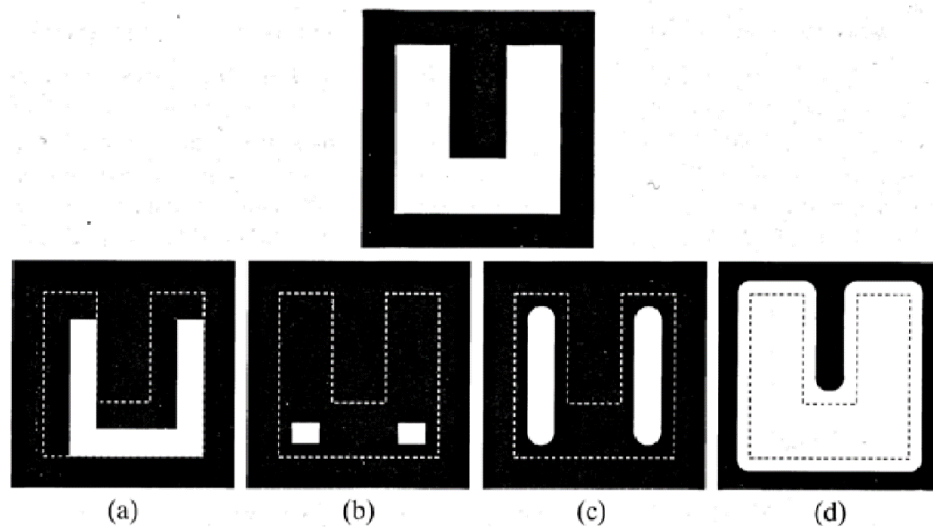
Due Time: 3:00pm. Nov. 30 2018 at Norton 112

## Submission requirement:

- A hard copy of your homework need to be submitted at class.
- You are also asked to submit a '.pdf ' file of your homework on UBlearns, the file name should be in 'UBIT-person number.pdf' format. The due time is same with the hard copy, i.e. 3:00 pm Nov. 30.

## Prob. 1 Mathematical Morphology [2']

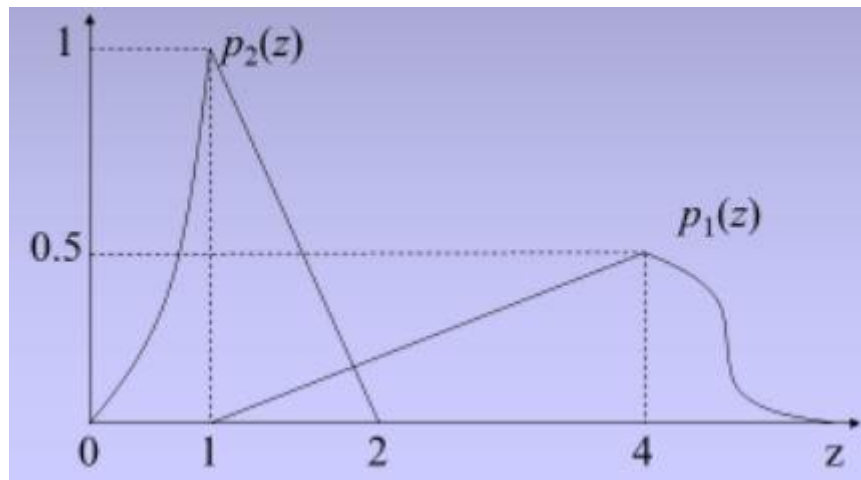
The image shown in the first row is a reference image. Image (a-d) are four images that are obtained by using different structuring element and different morphological operations on the reference image. The dashed lines show the boundary of the original image for your reference.



For each of the image on the second row, show the operation and structuring element you used. You are asked to show your answer for (a), (b), (c) and (d). If anyone needs more than one step of operations, please list your operation and structuring element step by step. Label your origin position for each one.

### Prob. 2 Image Segmentation [1']

Suppose that an image has the gray-level probability density function shown in figure. Here  $p_1(z)$  corresponds to objects with the probability of occurrence  $P_1$  and  $p_2(z)$  corresponds to the background with the probability of occurrence  $P_2$ . Find the optimal threshold between object and background pixels. Please show your computing process and show your final answer.



### Prob. 3 Hough transform [2']

- Write the lines  $y = x - 2$ ,  $y = 1 - x/2$  in  $(r, \theta)$  form. (10%)
- Show that if you use the line equation  $x \cos \theta + y \sin \theta = \rho$ , each image point  $(x,y)$  results in a sinusoid in  $(\rho, \theta)$  Hough space. Relate the amplitude and phase of the sinusoid to the point  $(x,y)$ . Does the period (or frequency) of the sinusoid vary with the image point  $(x,y)$ ? (10%)

### Late Submission Policy

Homework should be submitted by the deadline. • Late submissions are allowed for one day and will result in a 20% penalty (20% of the maximum possible score will be deducted from your score.). A day is defined as 24 hours after the day/time the assignment is due (excluding weekends or school holidays). No help will be available from the TAs or from the instructor for an assignment after its scheduled due date. • After one day, submissions will not be accepted.