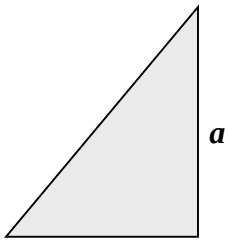
Birla Institute of Technology and Science, Pilani, Rajasthan
First Semester 2022-2023
Mid-Semester Test (Open Book)

Course Title: **Pattern Recognition** Course No. **BITS F446**

Time: 30 mins 02-11-2022 Total marks: 90 (30%)

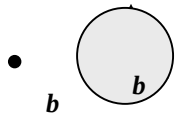
>>>>>>Read the questions carefully and answer to the point. Symbols are as defined in the class<<<<<<

Q1. Sketch the results of the morphological operations: (a) dilation and (b) erosion on the objects *1 & 2* using the structuring element *B* as shown in the figure. The dot in *B* is the representative point. The radius of the disc is ***b*** and the representative point is at a distance ***2b*** from the center as shown in the figure. Here the dimension a > b. For comparison, show the final result as solid line and original structure with the dashed line. Label the result with the dimensions *a & b.*



Object: 1

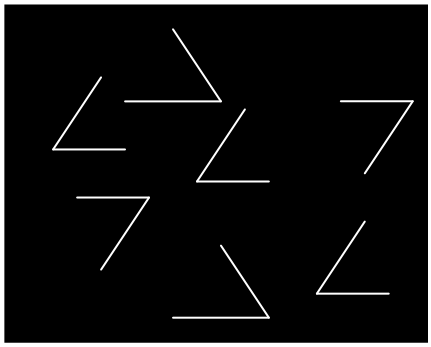
Object: 2



B

[10+10]

Q2. Propose an algorithm to identify the *location of the vertices* (meeting point of two lines) of the white angles (45^o) in the black background. The lines of angles are 1 pixel wide and the bases of the angles are horizontal. It is a binary image with 255 and 0 pixel values. (Justify the choice of the masks in the problem). **[10]**



----------All the best----------

Birla Institute of Technology and Science, Pilani, Rajasthan
First Semester 2022-2023
Mid-Semester Test (Closed Book)

Course Title: **Pattern Recognition** Course No. **BITS F446**

Time: 60 mins 02-11-2022 Total marks: 90 (30%)

>>>>>>Read the questions carefully and answer to the point. Symbols are as defined in the class<<<<<<

Q1. A 2x2, 8-bit input image (A) is

210	**114**
120	**35**

(a) Obtain the transformation function for histogram equalization to the image A. Plot the transformation function with appropriate labeling of the axes (show the values). Show the output image after the histogram equalization as 2x2 matrix. **[20]**

(b) Perform the gamma transformation (c=1, γ=1.1) on the above 2x2 input image (A) and write the matrix of the output image (as uint8). **[6]**

Q2. Short objective type questions:

a) An image of size 256x256 has linear gradient along y-direction only. The grayscale value varies as *f(x,y)=y-1*.

i) Plot the histogram of the image. *(Show proper labeling of the axes)* **[4]**

ii) What are the values of $\partial f/\partial x$ and $\partial f/\partial y$ at a location (75,25)? **[2]**

iii) What are the values of $\nabla^2 f$ at a location of (117,125)? **[2]**

iv) Sketch the images of most significant bit (MSB) plane and (MSB-1)th plane. **[3+3]**

Q3. In the optimal global thresholding technique, if the object pixel is four times more probable than that of background pixel, *find the optimal global thresholding grayscale value*. Assume the continuous variable and the grayscale value (*r*) lies in the range of 0-1. The probability density functions of object and background pixels are $Exp[-20(r-0.3)^2]$ and $Exp[-50(r-0.65)^2]$, respectively. **[20]**

_____All The Best_____