



VIT

SCHOOL OF ELECTRONICS ENGINEERING
CAT - 2 QUESTION PAPER, FALL SEMESTER (2023-24)
BECE312L: ROBOTICS AND AUTOMATION

Course: B.Tech. (ECE) Slots: D1+D2 Class Nbrs: VL2023240100304/305 Faculty: Sanjay Kumar Singh

Answer all questions

- Q.1 Apply split and merge technique to segment the 8×8 image as illustrated in Figure 1. The logical predicate $P(R) = \text{TRUE}$, when all the pixels in the region R , have the same intensity. Give the result after each split and merge step. Also, give the quad tree. [10]

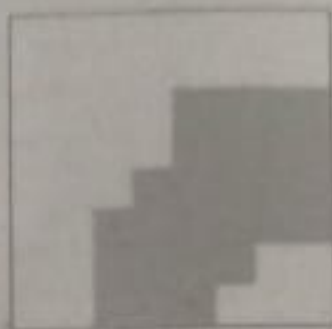


Figure 1

- Q.2 For the schematic of the image shown in Figure 2, determine the following parameters:

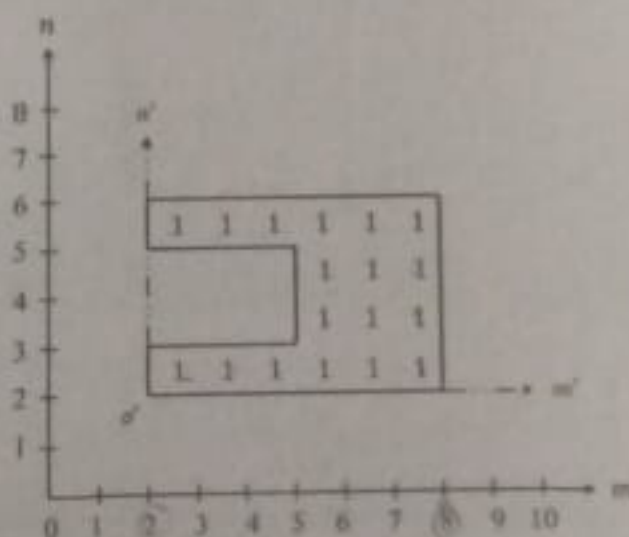


Figure 2

- (a). Centroid
(b). Minimum aspect ratio
(c). Thinness and
(d). Compactness

[4]
[2]
[2]
[2]

- Q.3 Consider the following rotation matrix R :

$$R = \begin{bmatrix} 0 & A & B \\ C & D & -0.354 \\ E & 0.612 & F \end{bmatrix}$$

The ratio between B and D is 2, and $B > 0$.

- (a). Find the values of A, B, C, D, E, F .
(b). Verify that the obtained R is a rotation matrix within some rounding errors.

[5]
[5]



Q.4 Figure 3 shows an object and a frame attached to it. Perform two successive rotations of the object with respect to the current frame as follows: [10]

- First, apply an anticlockwise rotation of 90° about x -axis. Then, apply a clockwise rotation of 90° about the y -axis.

Now, repeat the same by changing the order of rotation as follows:

- Apply a clockwise rotation of 90° about the y -axis. Then, apply an anticlockwise rotation of 90° about x -axis.

Hence, graphically show that rotations do not commute.

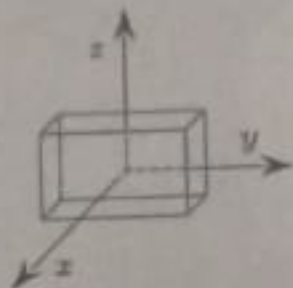


Figure 3

Q.5 Are Euler angles the same as that of roll, pitch and yaw? Find the rotation matrix equivalent to the ZYX Euler angles $(45^\circ, 45^\circ, 45^\circ)$ and prove whether ZYX Euler angles are identical to XYZ Roll-Pitch-Yaw angles. [10]

