H

S. No. 3623

CODE: ....

The LNM Institute of Information Technology, Jaipur

(Deemed to be University)

Instruction to Candidate (for examination)

1. Immediately on receipt of the Test Booklet the candidate will fill in the required particulars on the cover page with Ball Point Pen only.
2. Candidates shall maintain perfect silence and attend to their Question Paper only. Any conversation or gesticulation or disturbance in the Examination Room / Hall shall be deemed as misbehaviour. If a candidate is found using unfair means or impersonating, it shall be treated as breach of code of conduct and the matter dealt with accordingly.
3. No candidate, without the special permission of the Invigilator concerned, will leave his/her seat or Examination Room until the full duration of the paper is over. Candidate should not leave the room / hall without handing over their Answer Sheets to the Invigilator on duty.
4. During the examination time, the invigilator will check ID Card of the candidate to satisfy himself / herself about the identity of each candidate. The invigilator will also put his/her signature in the place provided in the Answer Sheet.
5. The Candidate shall fill the number of supplementary sheets attached, on the front page of the main answer sheet.
6. **Bringing cell phones /communication devices in the examination hall is strictly prohibited. Exam conducting authority will not be responsible for the custody of such articles. However, use of scientific calculator is permitted.**

Name of the student: Parul Shandilya

Roll No. : 16UCS126

Name of Examination : Mid Sem

Subject : MPA

Day & Date : Friday 28/Sep/2018

No. of Supplementary Sheets Attached: ....

Parul
Student's Signature

Invigilator's Signature

Question No.	Marks Obtained
1	2
2	2
3	1
4	3
5	~~2~~ 4
6	5
7	
8	
9	
10	
Total Marks	17

Good

111

101

1+0+4

111

Q1

101	111	011
000	101	000
001	000	010

Bit 1 plane

0	1	1
0	0	0
0	0	1

Bit 2 plane

1	1	0
0	1	0
0	0	0

2

After Bit plane Slicing

LSB → 0.

100	110	010
000	100	000
000	000	010

Q2.

Geometric Mean filter

$$= \left(\prod_{x,y \in m,n} g(x,y) \right)^{\frac{1}{mn}}$$

$$= (3 \times 4 \times 5 \times 4 \times 2 \times 4 \times 4 \times 5 \times 4)^{\frac{1}{9}}$$

$$= 3.76$$

$f(x,y) = 3.76$

2

Q3

a) $h(x,y) = g(x,y) + \frac{\sigma_N^2}{\sigma_L^2}\left(\sum g(x,y) - m_L\right)$ Local mean.

(Local variance high means it has some edge.)
It can detect salt noise.

?

b) ~~Filter acts as a smoothing filter. Removes both salt and pepper noise.~~
Filter act as a sharpening filter, it enhances the values of the intensity.

Q4.

$$\begin{bmatrix} 0 & 0 \\ 1 & 0 \\ 1 & 1 \\ 0 & 1 \end{bmatrix} \quad \begin{bmatrix} a & c \\ b & d \end{bmatrix}$$

$$\cancel{\underset{2\times 2}{\begin{bmatrix} a & c \\ b & d \end{bmatrix}}} \underset{4\times 2}{\begin{bmatrix} 0 & 0 \\ 1 & 0 \\ 1 & 1 \\ 0 & 1 \end{bmatrix}} \underset{2\times 2}{\begin{bmatrix} a & c \\ b & d \end{bmatrix}}$$

3

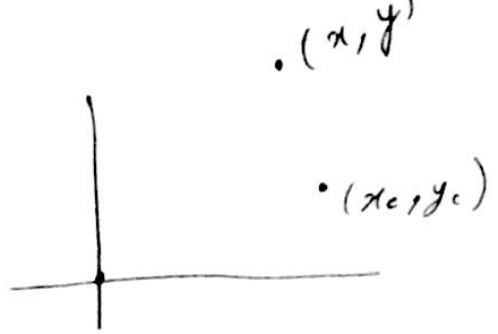
$$= \begin{bmatrix} 0 & 0 \\ a & c \\ a+b & c+d \\ b & d \end{bmatrix} = \begin{bmatrix} 0 & 0 \\ 2 & 3 \\ 8 & 4 \\ 6 & 1 \end{bmatrix}$$

$b = 6 \quad d = 1 \quad a = 2 \quad c = 3$

$$\begin{bmatrix} 2 & 3 \\ 6 & 1 \end{bmatrix}$$

Os.

$$\begin{bmatrix} x' \\ y' \end{bmatrix} = \begin{bmatrix} \cos\theta & -\sin\theta \\ \sin\theta & \cos\theta \end{bmatrix} \begin{bmatrix} x \\ y \end{bmatrix}$$



We will solve this by considering ~~...~~ (x_c, y_c) as origin.

New coordinate of (x, y) when origin is
(x_c, y_c) is $(x - x_c, y - y_c)$
$(0, 0)$ is $(-x_c, -y_c)$
and (x_c, y_c) will be $(0, 0)$

So

$$\begin{bmatrix} x_0' \\ y_0' \end{bmatrix} = \begin{bmatrix} \cos\theta & -\sin\theta \\ \sin\theta & \cos\theta \end{bmatrix} \begin{bmatrix} x - x_c \\ y - y_c \end{bmatrix}$$

coordinate considering the fact that origin is (x_c, y_c)

~~coordinate of origin~~.

Now we will shift back to the original origin.

that is shifting to

$(-x_c, -y_c)$

thus

$x_{required} = x_0' + x_c$

$y_{required} = y_0' + y_c$

$$\begin{bmatrix} x_0' \\ y_0' \end{bmatrix} + \begin{bmatrix} x_c \\ y_c \end{bmatrix} = \begin{bmatrix} \cos\theta & -\sin\theta \\ \sin\theta & \cos\theta \end{bmatrix} \begin{bmatrix} x - x_c \\ y - y_c \end{bmatrix} + \begin{bmatrix} x_c \\ y_c \end{bmatrix}$$

$$= \begin{bmatrix} x_{required} \\ y_{required} \end{bmatrix} = \begin{bmatrix} \cos\theta & -\sin\theta \\ \sin\theta & \cos\theta \end{bmatrix} \begin{bmatrix} x - x_c \\ y - y_c \end{bmatrix} + \begin{bmatrix} x_c \\ y_c \end{bmatrix}$$

(4)

$x_{required} = (x - x_c)\cos\theta - \sin\theta(y - y_c) + x_c$

$y_{required} = (x - x_c)\sin\theta + \cos\theta(y - y_c) + y_c$

$x_{required} = \overbrace{x\cos\theta - y\sin\theta}^{x'} - x_c\cos\theta + y_c\sin\theta + x_c$

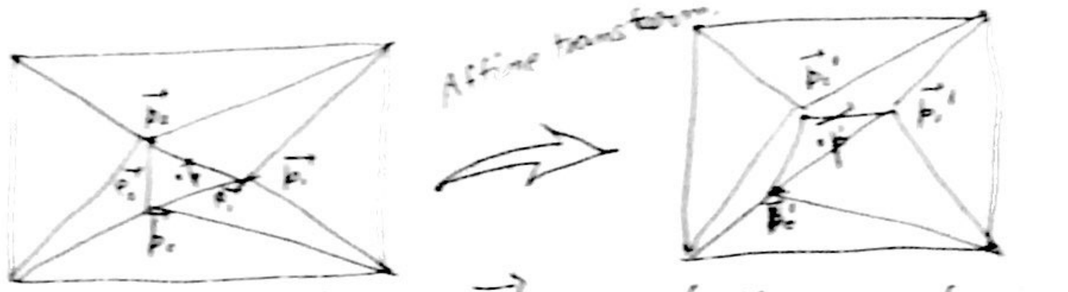
$y_{required} = \underbrace{x\sin\theta + y\cos\theta}_{y'} - x_c\sin\theta - y_c\cos\theta + y_c$

$x_{required} = x' - (x_c\cos\theta - y_c\sin\theta) + x_c$

$y_{required} = y' - (x_c\sin\theta + y_c\cos\theta) + y_c$

$$\begin{bmatrix} x_{required} \\ y_{required} \end{bmatrix} = \begin{bmatrix} x' \\ y' \end{bmatrix} - \begin{bmatrix} \cos\theta & -\sin\theta \\ \sin\theta & \cos\theta \end{bmatrix} \begin{bmatrix} x_c \\ y_c \end{bmatrix} + \begin{bmatrix} x_c \\ y_c \end{bmatrix}$$

Q6.



~~Basic~~

① — $\vec{p_2'} = A\vec{p_2} + t$ (Affine transforming

② — $\vec{p_1'} = A\vec{p_1} + t$

③ — $\vec{p_0'} = A\vec{p_0} + t$

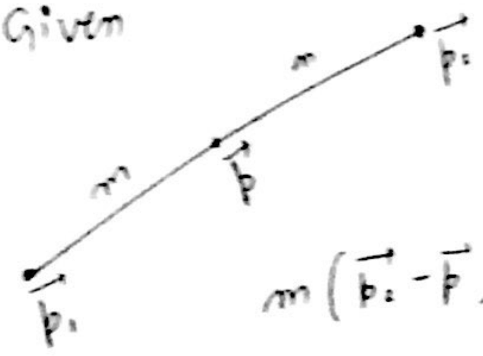
$\vec{p} = \alpha\vec{e_1} + \beta\vec{e_2}$

Property of Affine

~~To prove~~ ~~α and β~~

Now

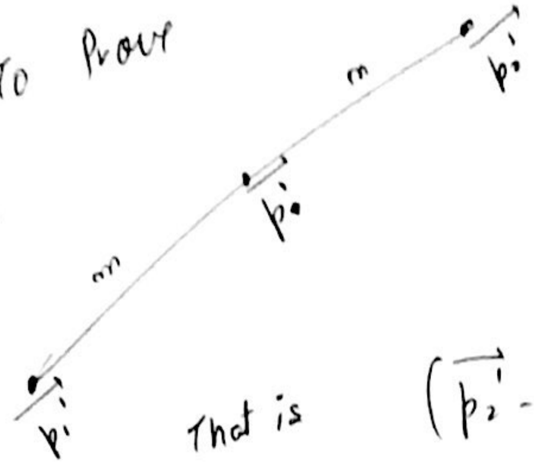
~~To prove~~ Given



$$\frac{\vec{p_2} - \vec{p}}{\vec{p} - \vec{p_1}} = \frac{n}{m}$$

$$m(\vec{p_2} - \vec{p}) - n(\vec{p} - \vec{p_1}) = 0 \quad — ④$$

To Prove



$$\frac{\vec{p_2'} - \vec{p'}}{\vec{p'} - \vec{p_1'}} = \frac{n}{m}$$

That is $(\vec{p_2'} - \vec{p'})\, m - (\vec{p'} - \vec{p_1'})\, n = 0$

Proof considering LHS.

$$(\vec{p_2'} - \vec{p'})\, m - (\vec{p'} - \vec{p_1'})\, n$$

By ① ② & ③

$$((A\vec{p_2} + t) - (A\vec{p} + t))\, m - ((A\vec{p} + t) - (A\vec{p_1} + t))\, n$$

$$(A\vec{p_2} - A\vec{p})\, m - (A\vec{p} - A\vec{p_1})\, n$$

$$m(\vec{p_2} - \vec{p}) - n(\vec{p} - \vec{p_1})$$

by equation ④

$$m(\vec{p_2} - \vec{p}) - n(\vec{p} - \vec{p_1}) = 0 \quad ⑤$$

Hence LHS = RHS

Proved

~~Here $\vec{p_0}$ $\vec{p_1}$ $\vec{p_2}$ (Affine vectors)~~

The LNM Institute of Information Technology
Multimedia Processing and Applications
Mid Term Exam 2018-19

Duration: 90 minutes **Maximum Marks: 20**

Q1 Given the following 3x3 image with eight intensity levels. It is required to do a bit-plane slicing of the given image. Show the Bit 2 plane. [2 Marks]

5	7	3
0	5	0
1	0	2

Q2 Given the following 3x3 image. Apply geometric mean filter and show pixel value at coordinate shown as f(x, y). [2 Marks]

3	4	5
4	2	4
4	5	4

	f(x,y)	

Q3 With reference to an adaptive filter applied to any point (x, y) of a noisy image g(x, y), answer the following in one sentence:

(a) If the local variance is high compared to the variance of the noise corrupting the original image, what should be the response of the filter and why?

(b) If the two variances are equal, what is the response of the filter and why? [2+2=4 Marks]

Q4 A unit square represented by $\begin{bmatrix} 0 & 0 \\ 1 & 0 \\ 1 & 1 \\ 0 & 1 \end{bmatrix}$ is transformed by a 2x2 transformation matrix. The resulting position vectors are $\begin{bmatrix} 0 & 0 \\ 2 & 3 \\ 8 & 4 \\ 6 & 1 \end{bmatrix}$. Determine the transformation matrix used. [3 Marks]

Q5 The transformation matrix obtained after rotating an image by an angle θ around its origin is given by:

$$\begin{bmatrix} x' \\ y' \end{bmatrix} = \begin{bmatrix} cos\theta & -sin\theta \\ sin\theta & cos\theta \end{bmatrix} \begin{bmatrix} x \\ y \end{bmatrix}$$

Obtain the transformation matrix after rotating the image around a point (x_c, y_c), other than the origin. [4 Marks]

Q6 Show (for 2-D case) that division of a line in the ratio m:n is invariant to affine transformation. [5 Marks]