Assignment 1

1. On a sunny day, it takes a noticeable amount of time before you can see clearly enough to find an open seat when you enter a dark theater. **Brightness adaptation,** a visual process, is to blame for this.

The process by which the eye adapts to progressively darker conditions is known as dark adaptation. Changes in the retina's rod and cone cells' sensitivity are involved in the slow process, which lasts for several minutes. Cone cells oversee photopic vision, but rod cells oversee scotopic vision, or night vision, because they are more sensitive to low light levels (daylight vision).

The rod cells temporarily lose their sensitivity when the eyes are exposed to strong light, and it takes some time for them to regain it. Because of this, it takes the eyes a noticeable amount of time to get used to the theater's gloom.

In order to manage the amount of light entering the eye, the iris and pupil must also be adjusted. The neuronal processing in the retina and the brain must also be adjusted as part of the brightness adaptation process.

2.a) We must determine the resolution in line pairs per millimeter (lp/mm) needed to fit a 2048 × 2048-pixel image into a 5 x 5 cm space.

We need to fit 2048 pixels in 5cm width .

Resolution = (2048/2){in pairs} / 50 (lp/mm)

Resolution = 20.48 lp/mm

b) DPI vertical = 2048/2 = 1024

As both are symmetric, DPI horizontal = 1024

DPI = horizonatal + vertical / 2

DPI = 1-24

4. Using similar triangle, we can,

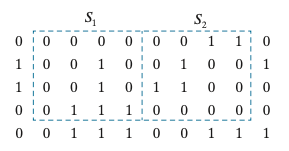
Image size / image distance from focus = object size / object distance from focus

Object size = 100mm

No. of pixels per mm to represent the image is,

1024 / 100 = which is approx. 10

As pixels need to represented in pairs hence, 10/2=5 lp/mm

5. 



1. S1 and S2 are not 4-connected because q is not in the set N4(p). as we check all directions right, left, up and down next to p (as V=1).
2. S1 and S2 are 8-connected as q is in the set of N8(p) across the diagonal.
3. S1 and S2 are m-connected because q is ND(p) and the intersection of N4(p) and N4(q) has no matches and is empty.

6. In image processing, a composite transformation is a sequence of multiple transformations applied to an image in a specific order. The order of the transformations is important as it determines the result.

When an image is reflected along the x-axis, the transformation matrix is: [1 0; 0 -1]

When the image is translated to point (10,5), the transformation matrix is: [1 0 10; 0 1 5]

When the image is rotated 60 degrees clockwise, the transformation matrix is: [cos(60) -sin(60) 0; sin(60) cos(60) 0]

When the image is sheared vertically by 10 units, the transformation matrix is: [1 tan (10) 0; 0 1 0]

To obtain the composite transformation matrix, the individual transformation matrices are multiplied together in the order they are applied, starting with the last transformation matrix and ending with the first transformation matrix.

7. The composite transformation matrix for an image that is reflected along x, translated to point (10,5), rotated 60 degrees clockwise, and sheared vertically by 10 units is:

[cos(60) -sin(60) 0; sin(60) cos(60) 0] \* [1 tan(10) 0; 0 1 0] \* [1 0 10; 0 1 5] \* [1 0; 0 -1]

This composite transformation matrix can then be used to transform the image using matrix multiplication.

Yes, the order of the above transformations makes a difference in the final transformed output. The order in which the transformations are applied determines the final result.

In the order provided, the image is first reflected along the x-axis, then translated to point (10,5), then rotated 60 degrees clockwise, and lastly sheared vertically by 10 units.

The final transformation matrix obtained in reverse order is:

[1 tan(10) 0; 0 1 0] \* [cos(60) -sin(60) 0; sin(60) cos(60) 0] \* [1 0 10; 0 1 5] \* [1 0; 0 -1]

This composite transformation matrix will apply the transformations in the reverse order, i.e the image will first be sheared vertically by 10 units, then rotated 60 degrees clockwise, then translated to point (10,5), and lastly reflected along the x-axis. As a result, the final transformed output will be different from the previous order of transformations.

It's worth noting that, the order of the transformation is important, as it determines the result of the transformed image.