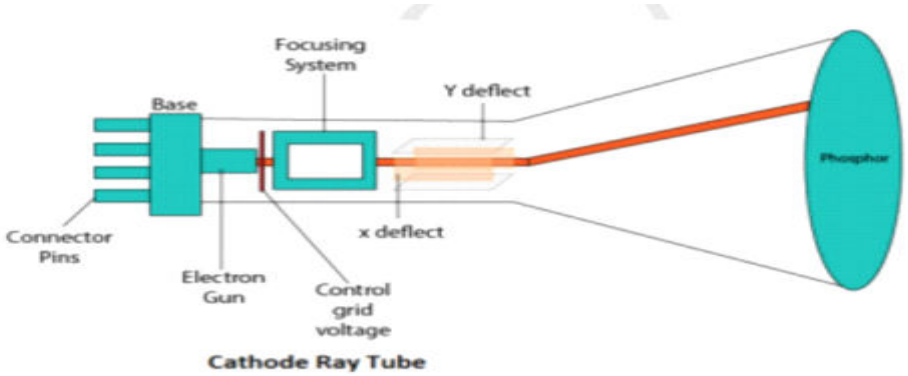
CGA Sem4 Q&A

*1. Explain CRT with a diagram?

Cathode Ray Tube (CRT):

- CRT stands for Cathode Ray Tube.
- CRT is a technology used in traditional computer monitors and televisions.
- The image on CRT display is created by firing electrons from the back of the tube of phosphorus located towards the front of the screen.
- Once the electron heats the phosphorus, they light up, and they are projected on a screen.
- The color you view on the screen is produced by a blend of red, blue and green light.



Cathode Ray Tube

Components of CRT:

1. Electron Gun:

- Electron gun consisting of a series of elements, primarily a heating filament (heater) and a cathode.
- The electron gun creates a source of electrons which are focused into a narrow beam directed at the face of the CRT.

2. Control Electrode:

- It is used to turn the electron beam on and off.

3. Focusing system:

- It is used to create a clear picture by focusing the electrons into a narrow beam.

4. Deflection Yoke:

- It is used to control the direction of the electron beam.
- It creates an electric or magnetic field which will bend the electron beam as it passes through the area.
- In a conventional CRT, the yoke is linked to a sweep or scan generator.
- The deflection yoke which is connected to the sweep generator creates a fluctuating electric or magnetic potential.

5. Phosphorus-coated screen:

- The inside front surface of every CRT is coated with phosphors.
- Phosphors glow when a high-energy electron beam hits them.
- Phosphorescence is the term used to characterize the light given off by a phosphor after it has been exposed to an electron beam.

***2. Explain Sutherland Hodgeman Algorithm for polygon clipping with example.**

- A polygon can be clipped by processing its boundary as a whole against each window edge.
- This is achieved by processing all polygon vertices against each clip rectangle boundary in turn.
- beginning with the original set of polygon vertices, we could first clip the polygon against the left rectangle boundary to produce a new sequence of vertices.
- The new set of vertices could then be successively passed to a right boundary clipper, a top boundary clipper and a

bottom boundary clipper, as shown in figure (l).

- At each step a new set of polygon vertices is generated and passed to the next window boundary clipper.
- This is the fundamental idea used in the Sutherland - Hodgeman algorithm.

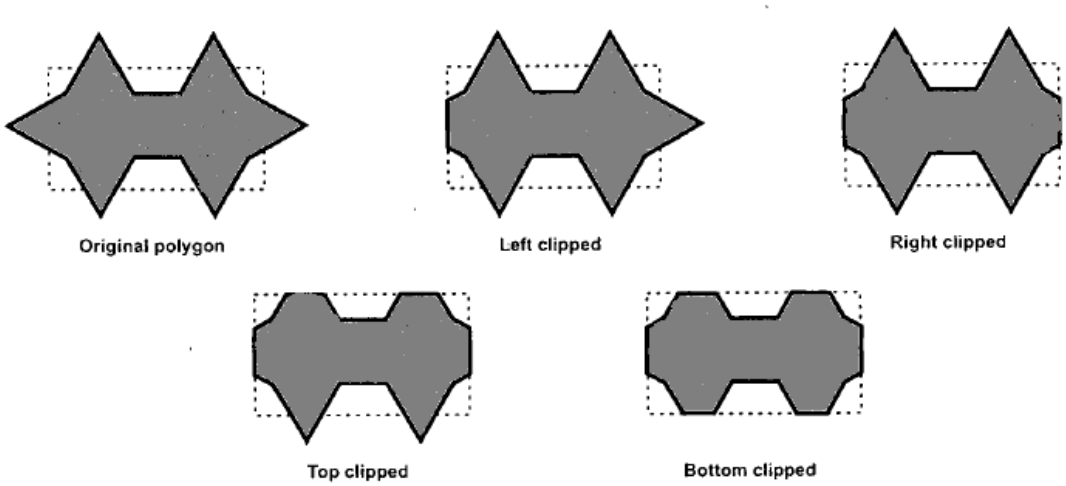


Fig. (l) Clipping a polygon against successive window boundaries

- The output of the algorithm is a list of polygon vertices all of which are on the visible side of a clipping plane.
- Such each edge of the polygon is individually compared with the clipping plane.
- This is achieved by processing two vertices of each edge of the polygon around the clipping boundary or plane.
- This results in four possible relationships between the edge and the clipping boundary or Plane.

***3. What is 2D transformation? Explain different transformations in 2D.**

- 2D Transformation in computer graphics is a process of modifying and re-positioning the existing graphics in 2 dimensions.
- Transformations help change the object's position, size, orientation, shape, etc.
- Following are the basic 2-D Transformation:-

Translation

- The translation transformation shifts a node from one place to another along one of the axes relative to its initial position.
- The initial position of the xylophone bar is defined by x, y, and z coordinates.

Rotation

- The rotation transformation moves the object around in a clockwise or anti-clockwise direction.
- You can use the rotate method of the Transform class to perform the rotation.

Scaling

- The scaling transformation causes an object to either appear larger or smaller, depending on the scaling factor.
- Scaling changes the node so that the dimensions along its axis are multiplied by the scale factor.
- The scale transformation is used to see the scaling.

Shearing

- A shearing transformation means change in the shape of an Object.
- The coordinates of the node are shifted by the specified multipliers.

Reflection

- In reflection transformation, we get reflection of an object like mirror image.

Multiple Transformations

- You can construct multiple transformations by specifying an ordered chain of transformations.
- For example, you can scale an object and then apply a shearing transformation to it, or you can translate an

object and then scale it.

***4. Explain Window to viewport transformation.**

World Cordinate System:

This is the object space or the space in which the application model is defined.

World Window:

This is the rectangle in the world defining the region that is to be displayed.

Viewport:

The rectangular portion of the interface window that define where the image will actually appear.

Viewing Transformation:

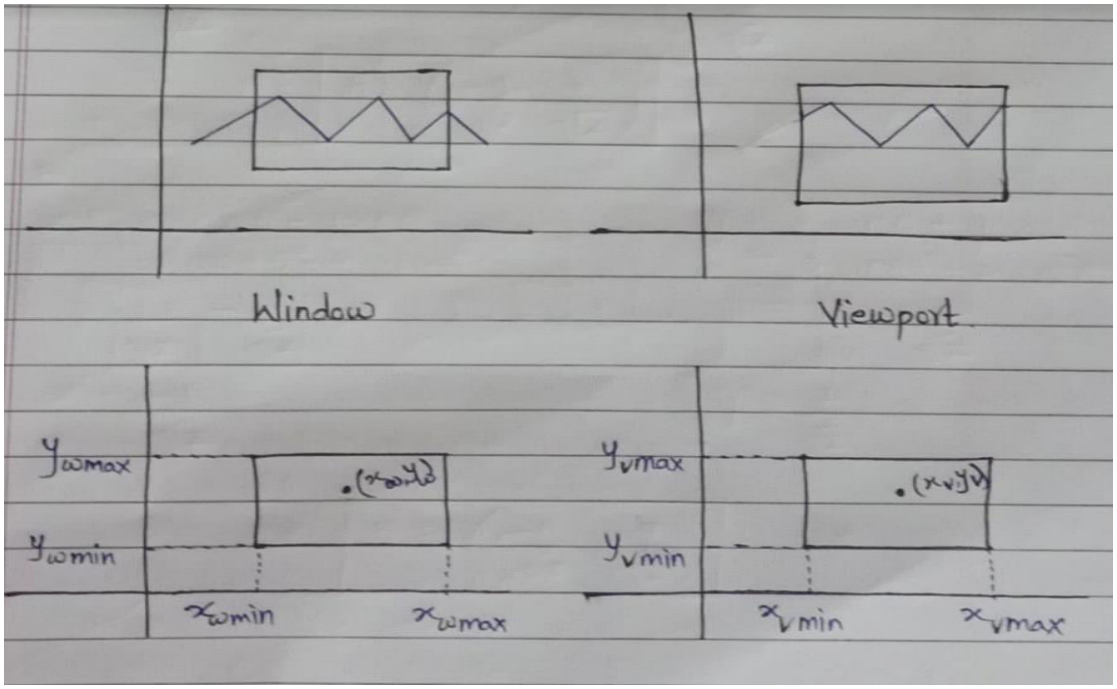
The process of mapping a world window in world cordinate to the viewport.

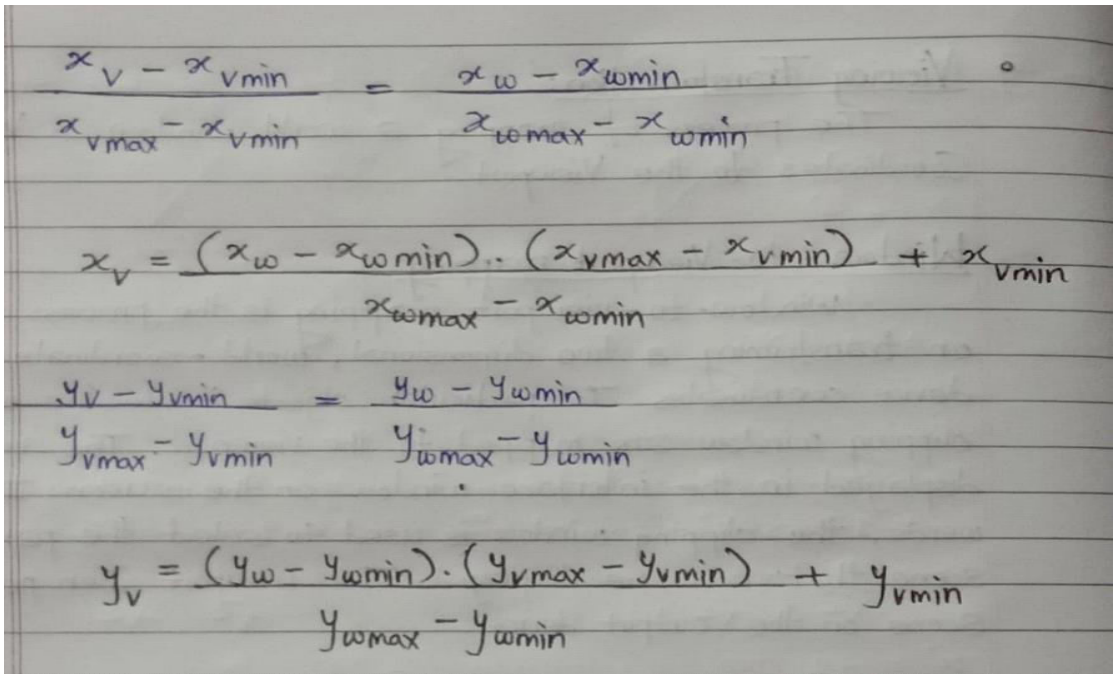
Window-to-Viewport mapping:

This mapping is the process of mapping or transforming a 2-Dimentional, world cordinate scene to device cordinate.

In particular, objects inside the world or clipping window are mapped to a viewport.

The viewport is displayed in the interface window on the screen.





***5. Describe RGB color space?**

Color:

- Color perception is naturally independent.
- Various standard human observers are defined in the disciple of Colorimetry.

Color Spaces:

- A range of colors that can be created by the primary colors of pigment and theses colors then define a specific color space.
- It is a way to represent colors, usually used in relation to computers or graphics boards.
- Color includes levels of grey.

RGB Color model:

- The RGB color model is an additive color model in which red, green, and blue light are added together in various ways to reproduce a broad array of colors.
- The name of the model comes from the initials of the three additive primary colors, red, green, and blue.
- The main purpose of the RGB color model is for the sensing, representation, and display of images in electronic systems, such as televisions and computers, though it has also been used in a conventional photography.

- Before the electronic age, the RGB color model already had a solid theory behind it, based on the human perception of colors.
- In the RGB color model, we use red, green, and blue as the three primary colors.
- We do not actually specify what wavelengths these primary colors correspond to, so this will be different for the different types of output media, for example, different monitors, films, videotapes, and slides.

***6. Explain Color appearance.**

- The goal of color appearance models is to provide an analytic relation between a specification of a stimulus and the context in which it is viewed and its color appearance.
- A Color appearance Model provides mathematical formulae to transform Physical measurements of the stimulus and viewing environment into Correlates of perceptual attributes of color
- There are different parameters used for color appearance which are given as follows:- HUE - Brightness - Lightness - Colorfulness -Chroma - Saturation

HUE:

- It is an Attribute of a visual sensation according to which an area appears to be similar to one of the perceived colors i.e. pure color: red, yellow, green, and blue, or to a combination of two of them.
- Hue is a more technical definition of our color perception which can be used to communicate color ideas.

Brightness:

- It is an Attribute of a visual sensation according to which an area appears to emit more or less light.
- It is referred to as the absolute level of the perception.

Lightness:

- It is a representation of variation in the perception of a color or color space's brightness.
- It is referred to as relative brightness normalized for changes in the illumination and viewing conditions.
- Lightness defines a range from dark (0%) to fully illuminate (100%).

Colorfulness:

- It is an attribute of a visual sensation according to which the perceived color of an area seems to be more or less

chromatic (e. multiple color variations).

Chroma:

- Chroma is a component of a color model. There's a blue yellow and a red-green chroma component.

Saturation:

- Saturation is used to determine certain color and measured as percentage value.
- Saturation defines a range from pure color (100%) to gray (%) at a constant lightness level.

***7. Define animation. Explain any 5 principles of animation**

Animation:-

- It is defined as the act of making something alive, it is an art o creating, viewing & moving images with the use of computer.
- An animation is nothing but the movement of serial of still images created on timely manner and displayed in rapid succession with certain speed.
- This creates an illusion of movement because of

persistance of vision.

Principles:-

1)Squash & Stretch

- This principle is often demonstrated with a bouncing ball, the ball appears stretch when it is falling and squash when it hits the ground.
- By squashing and stretching the ball, an animator gives more realistic feel.

2)Anticipation

- It is the preparation for the main action.
- For example, before you throw the ball you must first swing your arm backwards.
- The backward motion is the anticipation.

3)Staging

- Influence by theatrical principle, staging helps establish mood, create focus and clearify what is happening in the scene.

4)slow-in and Slow-out

- In a physical world, object and human need to pickup

momentum before they can reach full speed.

- Similarly it take time to decrease speed before something can coome to a complete stop.

5)Appeal

- A character with appeal isn't always attractive.
- He or She can be an ugly or evil character with a certain level of charisma that it makes sense within the story.

6)Secondary Action

- Secondary action creates interest and realism in animation.
- It should not be staged such that it can be noticed but still not overpower the main action.

*__8. What is an image? Explain any 5 image formats.__

Image:-

- An image is a virtual represetation of something.
- Image is a picture that has been created or copied and stored in an electronic form.

Different format of Images:-

1)JPEG:-

- It stands for Joint Photographic experts group. JPEG format is designed only to store still images.
- JPEG files are image that have been compressed to store a lot of informationin a small size file.

2)GIF:-

- GIF stands for Graphic Interchange Format. GIF format supports storage of both still images and simple animation.
- These format compresses images but as different from JPEG, the compression is lossless but the file cannot be made as small as JPEG.

3)SVG:-

- SVG is Scalable Vector Graphic.
- Scalibility means the file can beviewed on a computer display of any size and resolution, whether the small screen of a smartphone or a large while screen display in PC.

4) TIFF:-

- TIFF stands for Tagged Image File Format.

- TIFF image are uncompressed and thus contain a lot of detail image data.

5)PNG:-

- It stands for Portable Network Graphic
- It allows for a full range of colors and better compression.
- As compared to JPEG it creates larger file.

***9. Explain different types of coherence.**

Coherence

- A fixed relationship between the phase of waves in a beam of radiation of a single frequency.
- Two beams of light are coherent when the phase difference between their waves is constant; they are noncoherent if there is a random or changing phase relationship.

Types of coherence:

- **Object Coherence**

Visibility of an object can often be decided by examining a circumscribing solid.

- **Face Coherence**

Surface properties computed for one part of a face can be applied to adjacent part after small incremnental modification.

- **Edge Coherence**

The visibility of an edge changes only when it crosses another edge, so if one segment of an non-segment intersecting edge is visible, the entire edge is also visible.

- **Scan Line Coherence**

Lines or Surface segments visible in one scan line are also likely to be visible in adjacent scan lines. Consecutively, the image of a scan line is similar to the image of adjacent scan line.

- **Area Coherence**

A group of adjacent pixel in an image is often covered by the same visible object. This coherence is based on the assumption that a small enough region of pixel will most likely to lie within a single polygon.

- **Depth Coherence**

The depth of adjacent parts of the same surface are similar.

- **Frame Coherence**

Pictures of the same scene at successive point in time are likely

to be similar, despite small changes in object and viewpoint, except near the edge of moving object.

***10.Write a short note on Curve representation.**

Three types of representations for curves and surfaces are common in computer graphics and geometric design: explicit,implicit and parametric.

Implicit Curves:

- An implicit curve or surface is the set of zeros of a function of 2 or 3 variables.
- We use implicit curve functions to define lines and planes.
- Provides no control over tangents at connection points when joining several implicit functions.
- Implicit functions are hard to find for many shapes.
- Use a function that states which points are on and off the curves.

Explicit curves:

- Do not allow for multiple values for a given argument

- Cannot describe vertical tangents, as infinite slopes are hard to represent.
- Cannot represent all curves (vertical lines, circles)
- Gives the value of one variable, the dependent variable in other terms of the other the independent variable.

Parametric curves:

- Curves have a parametric form called parametric curves.
- A curve in the plane is said to be parametrized if the set of coordinates on the curves (x,y,z) is represented as a function of a variable t.
- The variable t is called a parameter and the relations between x,y,z, and t are called a parametric equation
- The parametric form of a curve is a function that assigns a position to values of the free parameters.
- That the parametric function is a vector-valued function.
- This example is a 2D curve, so the output of the function is a 2-D vector, in 3D it would be a 3 vector.
- It is simple and flexible

11. Differentiate between Random and Raster Scan display.

Differentiate between Random and Raster Scan Display:

Random scan/Vector scan	Raster scan
1. It has high Resolution	1. Its resolution is low.
2. It is more expensive	2. It is less expensive
3. Any modification if needed is easy	3.Modification is tough
4. Only screen with view on an area is displayed.	4. Whole screen is scanned.
5. Beam Penetration technology come under it.	5. Shadow mark technology came under this.
6. It is restricted to line drawing applications	6. It is suitable for realistic display.
7. Eg: Pen plotter	7. Eg: TV

12.Explain 3D transformation in detail.

3-D Transformation:

- In very general terms a 3D model is a mathematical representation of a physical entity that occupies space.
- In more practical terms, a 3D model is made of a description of its shape and a description of its color

appearance.

- 3-D Transformation is the process of manipulating the view of a three-D object with respect to its original position by modifying its physical attributes through various methods of transformation like Translation, Scaling, Rotation, Shear, etc.

Properties of 3-D Transformation:

- Lines are preserved,
- Parallelism is preserved,
- Proportional distances are preserved.

One main categorization of a 3D object's representation can be done by considering whether the surface or the volume of the object is represented:

Boundary-based:

- The surface of the 3D object is represented.
- This representation is also called b-rep.
- Polygon meshes, implicit surfaces, and parametric surfaces, which we will describe in the following, are common representations of this type.

Volume-based:

- The volume of the 3D object is represented. Voxels and Constructive Solid Geometry (CSG) Are commonly used to represent volumetric data.

Types of Transformations:

- Translation
- Scaling
- Rotation
- Shear
- Reflection

13.Write a short note on Chromatic adaptation?

- The surroundings in which viewer objects and images has a larger effect on how we perceive those objects/ the range of viewing environment (i.e., by mean of light) is very large, from sunlight too moonlight or from candle light to luminous light.
- A human visual system accommodates these change in the environment through a process called as adaptation.

There are three types of adaptation: -

- Light adaptation
- Dark adaptation
- Chromatic adaptation

Light Adaptation:

- 1) It refers to the change occurs when we move from very dark to very light environment i.e., dark -> light
- 2) When this happens we are dazzled at first by the light but soon we adapt to the new situation and then we begin to distinguish objects in our environment.

Dark Adaptation:

- 1) It refers to the change occurs when we move from very light to very dark environment i.e., light -> dark
- 2) When this happens we see very little at first but after some time the details of an objects starts appearing in front of us.
- 3) Time needed to adapt objects in dark adaptation is much longer than that of light adaptation.

Chromatic Adaptation:

- 1) It refers to the human's ability to adjust and largely ignore differences in the color of the illumination.

For example, color appears much more colorful in a sunny day as compare to a cloudy day.

- 2) Chromatic adaptation is the ability of the human visual system to discount the color of a light source and to approximately preserve the appearance of an object.

For example, a white piece of paper appears to be white when viewed under sky light and tungsten light (light under a light bulb).

- 3) Chromatic adaptation is the biological equivalent of a white balancing operation that is available on most of the modern cameras.

It allows white objects to appear white for a large number of lightning conditions.

14.Compare all visible surface detection methods.

Comparison of VSD (HSR) techniques

Algorithms/ Methods	Memory	Speed	Issues in Implementation	Remarks
Z-Buffer	Two arrays	Depth complexity	Scan conversion, Hardware	Commonly used
Painter's	One array	Apriori sorting helps speed-up	Scan conversion	Splitting and sorting the major bottleneck
Ray casting	Object database	O(#pixels, #surfaces or objects)	Spatial data structures help speedup	Excellent for CSG, shadows, transparency
Scanline, Area sub-division			Hard	Cannot be generalized for non-polygonal models

15.Explain different types of Image compression.

Image:-

- An image is a virtual representation of something. It is a picture that has been created or Copied and stored in an electonic form.

There are two types of Image Compression:-

a) Lossy image compression

- It reduces a file by permanently eliminating certain information, which is no longer in use.
- When uncompressed, the compressed part is no longer

available only remaining part of an image is present.

- Decompression cannot retrieve the orignal data back.
- It is generally used for video & audio where loss in certain amount of information will not be detected by most users.
- JPEG:- Joint Photographic Expert Group file is a type of lossy compression, which is commonly used for photograph, and to display images on web.
- Using JPEG compression, the creator can decide how much loss to introduce and make a trade off between filesize and image quality.

b) Lossless Compression

- It reduces the file size without eliminating any information from the orignal image.
- When uncompressed all orignal data can be recovered as it is.
- Decompression retrieves the orignal image back, All of the information is restored completely.
- It is generally used for text or spreadsheet files, where lossing words or financial data cou;d cause a problem.

16.Difference between active & passive graphics device?

Difference Between Active and Passive computer graphics devices:

Active Devices	Passive Devices
It is dynamic in nature.	It is static in nature.
It provides two way communication between user and computer.	It provides one way communication only through computer.
Control is provided to user to manipulate the graphics.	Control is not provided to user to manipulate the graphics. It works on already written instructions.
Modern application.	Older application.
Higher bandwidth user interaction with hardware devices.	No interaction between user and hardware devices.

Facility available which supports 2D and 3D transformation.	No facility available which supports 2D and 3D transformation.
Eg: Resistors	Eg: CRT, LED

17.Write a short note on Photometry.

- The measurement of the intensity of brightness of light that can be perceived by the human eye is called photometry.
- Meaning of photometry is different from radiometry.
- Radiometry measures the levels of optical radiations.

- In 1924, the Commission Internationale de l'Eclairage (CIE) decided to make photometry a part of modern science.
- They also defined the response of the average human eye.
- The commission experimented and measured light-adapted eyes for several people and put down the data.
- The curve of the data revealed that people strongly responded to green color and were less sensitive to extreme ends like red and violet.
- The modern photometer meaning 'is the radiant power of every wavelength', measured by a luminosity function as per the human's sensitivity to brightness.
- Photometry is the science behind the measurement of light, which is perceived in terms of brightness to the human eye.
- It should not be confused with radiometry which refers to the measurement of radiant energy in terms of absolute power.
- Photometry is a branch of science which concerns light in terms of colour which is experienced by the eye from physical stimulation that exerts influence on photons

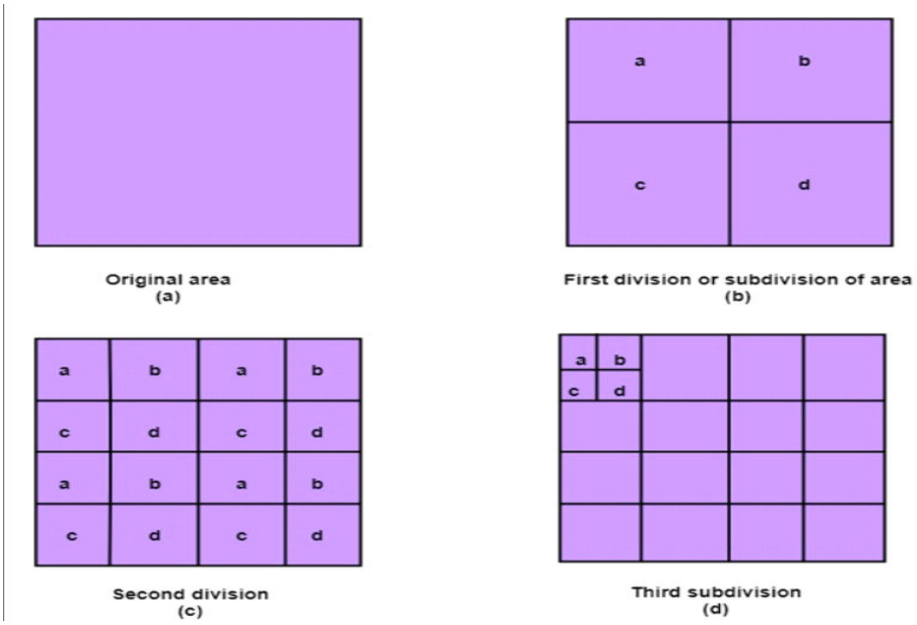
inside the eye and also the response with the brain.

- It is used to describe and measure the propagation of light through materials and space.

18.Explain Warnock's Algorithm (Area sub division mehod) in detail.

Area Subdivision Algorithm

- It was invented by John Warnock and also called a Warnock Algorithm.
- It is based on a divide & conquer method.
- It uses fundamental of area coherence.
- It is used to resolve the visibility of algorithms.
- It classifies polygons in two cases i.e. trivial and non-trivial.
- Trivial cases are easily handled.
- Non trivial cases are divided into four equal subwindows.
- The windows are again further subdivided using recursion until all polygons classified trivial and non trivial.



Classification of Scheme

It divides or classifies polygons in four categories:

- Inside surface
- Outside surface
- Overlapping surface
- Surrounding surface

19.Write a short note on Image Processing

Image:-

- An image is a virtual representation of something.
- It is a picture that has been created or copied and stored

in an electronic form.

Image Processing:-

- Image processing is a technique to improve quality of an image by performing mathematical operations on an image.
- To improve the quality of an image, image enhancement technique are used.
- Image processing is a method of conveting an image into digital form and perform some operation on it in order to get enhanced image or to extract some useful information from it.

Image processing basically includes the following three steps:-

i. Input:

- Importing the image by optical scanner or by digital photography.

ii. Processing:-

- Analysing and manipulating the image which includes data compression, image enhancement and spotting patterns that are not properly visible to human eyes like satellite

photographs.

iii. Output:-

- Output is the last stage in which result can be altered image or report that is based on image analysis.

There are two types of Image Processing

1. Analog:

- This technique of Image processing can be used for hardcopies and printout.

2. digital:

- This technique of Image processing can help in manipulation of the digital image.

20.For triangle ABC, A(1,2) B(3,4) C(2,5) perform the following 2D transformations:

i) Translation by factor (2,3)

ii) Scaling towards y-axis Sy = 6

iii) Rotation by angle = 45 degree anticlockwise

Given, A(1,2); B(3,4); C(2,5)

i. **Translation by factor (2,3)**

ii. **Scaling towards y-axis Sy = 6**

iii. **Rotation by angle = 45 degree anticlockwise**

21.Perform reflection on point (4,5) through x-axis and y-axis.

Solution:-

i. Given, point P (4, 5)

ii. And, P' is the image of point P in y-axis

iii. Thus, the co-ordinates of P' will be (-4, 5) Again,

iv. P" is the image of P' under reflection in origin.

v. Thus, the co-ordinates of P" will be (4, -5).

vi. The single transformation that maps P onto P" is the x-axis.