CSO-351 (Computer Graphics).

Assignment-6.

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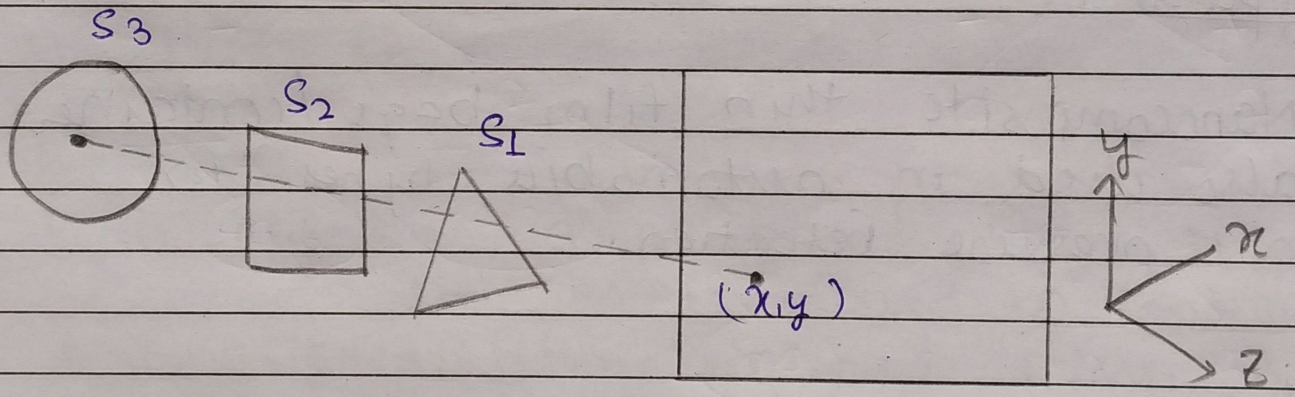
Answer-1

A)

Z-Buffer Algorithm:

This is most commonly used image-space approach to find visible surface.

* This is a depth buffer method which compares surface depth at each pixel position on the projection surface.



Algorithm:

*) Initialize
→ for each buffer position (x,y).
depth(x,y) = 0
refresh(x,y) = background colour

*) for each polygon

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→ compute depth z for each (x,y) position on the polygon

if z > depth (x,y) then
depth(x,y) ← z
refresh(x,y) ← color of polygon at (x,y)

** for depth calculation.
let eqn of plane = $ax+by+cz+d=0$
then.

$$z = \frac{-(ax+by+d)}{c}$$

B) BSP- Trees

This algorithm is useful in rapidly drawing 3-D scenes composed of polygons.

*) choose polygon arbitrarily (can start with any polygon).
*) split its cell using plane on which polygon lies.
*) continue until each cell contains only one polygon fragment.
*)

example

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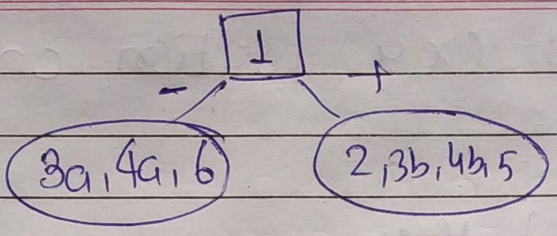
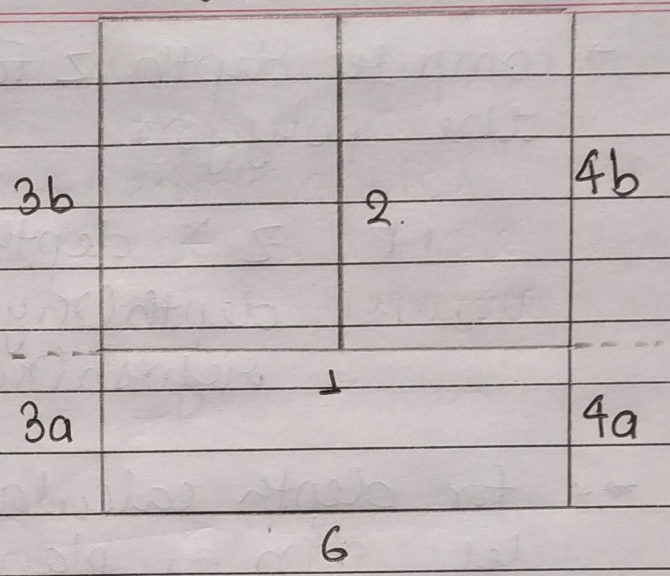
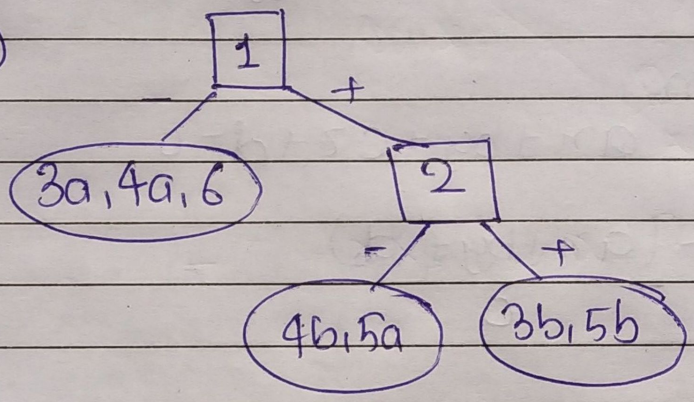
a)

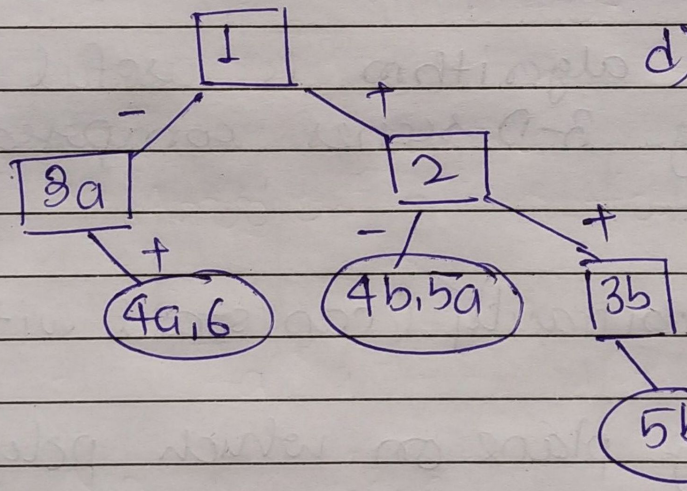




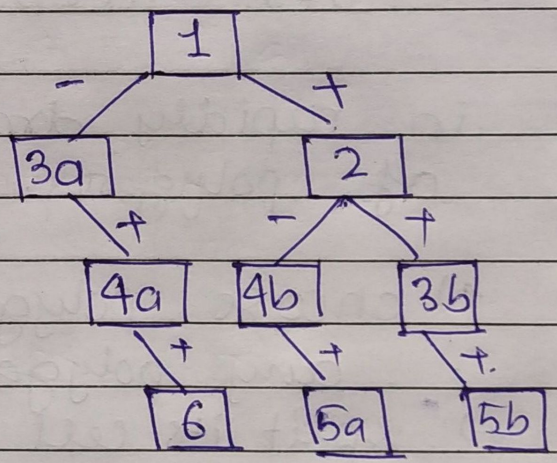
b)



c)



d)



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ANSWER-2

A) Various illumination models.

a) Ambient light:

* In this model, color doesn't depend on the position, only on the object.

$$I = I_a K_a$$

I_a = ambient light intensity.
K_a = ambient reflection coefficient.

* This is a very crude model as object shape is invisible.

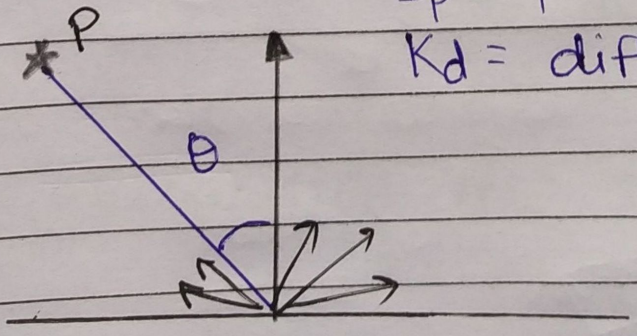
b) Diffuse reflection:

In this model,

*) light from source is sent in every direction.
*) object aspect independent from viewer position.
*) Only depends on relative position of light source.

$$I = I_p K_d \cos\phi$$

I_p = point light source intensity.
K_d = diffuse reflection coefficient.



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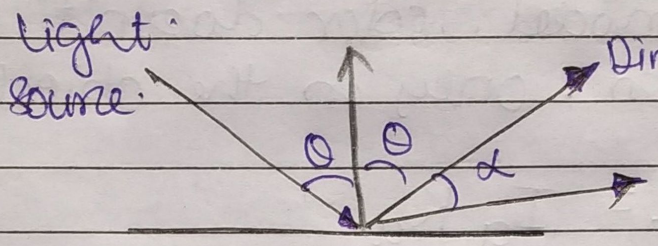
c) Specular Reflection:

* Light reaching reaching the object is reflected in the direction having the same angle.
* With point light source, effect is visible only at the one point on the surface.



* $I = I_p K_s (\cos\alpha)^n$ (for imperfect specular ~~spe~~ reflector).

d) Phong Model:

* used in imperfect specular reflector.
* This model has ~~three~~ types of reflected light.
  → Ambient + diffuse + imperfect specular reflector.

$$I = I_a K_a + I_p K_d \cos\phi + I_p K_s (\cos\alpha)^n$$

* No physical meaning model.

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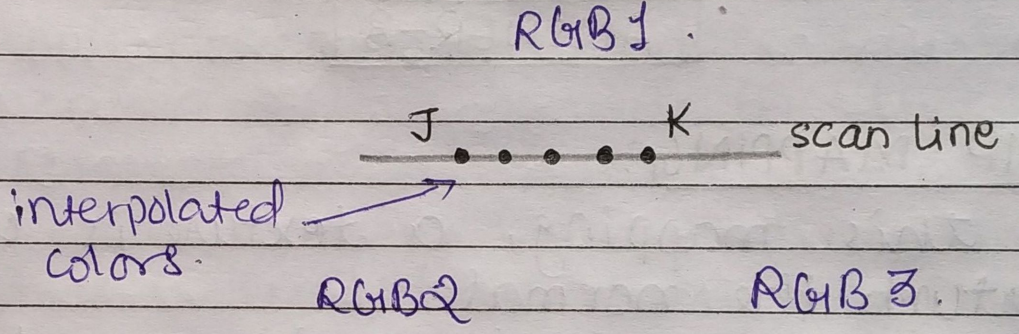
2. B

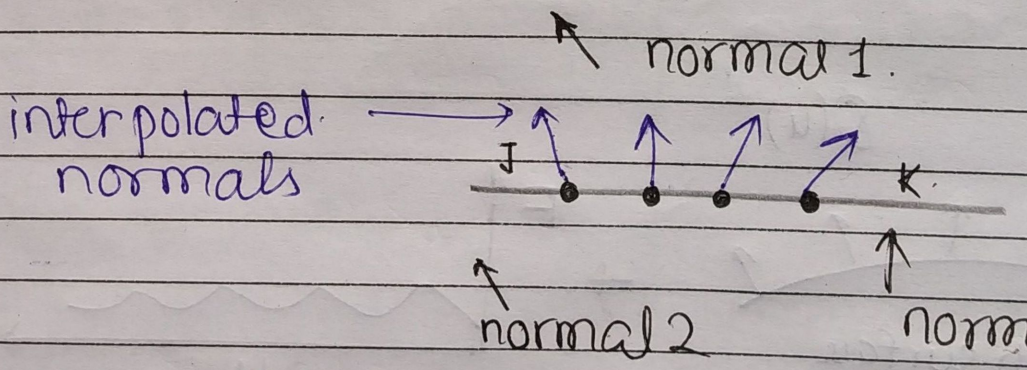
Gouraud Shading:

* Take the colors at the vertices.
* Interpolate these colours across the edge and across the scan lines.
* Typically linear interpolation.



Phong Shading:

* Take the normals at the vertices.
* interpolate these normals across the edges and across the scan lines.



Comparision b/w these two models:

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* Phong shading is more accurate way of shading a polygon since the illumination model is applied to every point.

* Phong ~~mod~~ shading is more computationally intensive than the Gouraud.

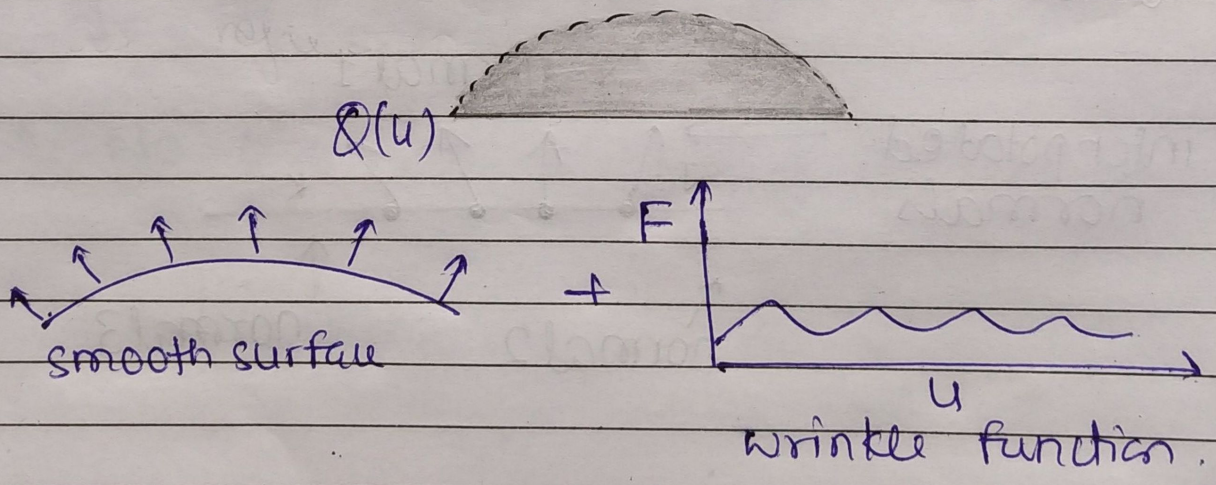
ANSWER-3

BUMP MAPPING:

In this mapping, a texture is used to perturb the normal.

* Use the original, simpler geometry, Q(u), for hidden surfaces.
* Use the normal from the displacement map for shading:

N = normal [Q(u)].



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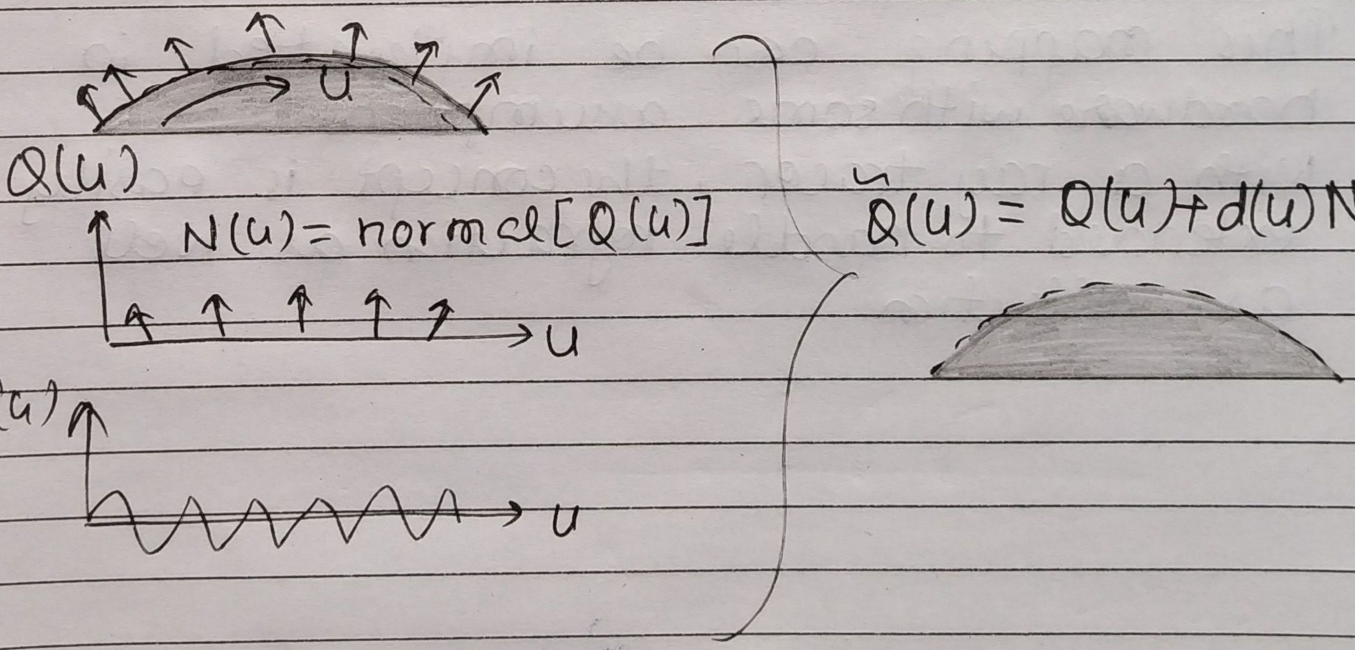
normal to this new surface.

$\vec{N'} = \vec{F_u} \times \vec{F_v}$ (cross product of partial derivatives of new surface).

Displacement Mapping:

This mapping alters the surface using the texture as a mesh defined in UV co-ordinates.

* Texture can be used for more than just colr
* a texture is used to perturb the surface geometry itself.



* These displacements "animate" with the surface.

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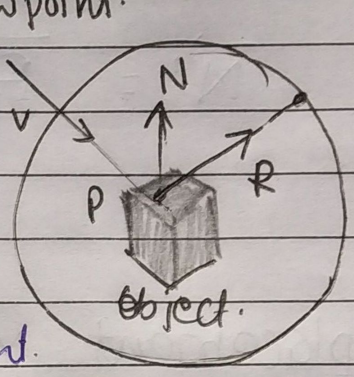
Environment Mapping:



* also known as reflection mapping.
* A texture is used to model an object's environment.
  - → rays are bounded back to environment.
  - → color of the environment used to determine color of the illumination.
  - → Really, a simplified form of ray tracing.
  - → Environment mapping works well when there is just a single object
* This mapping can be implemented in hardware with some assumptions.
* With a ray tracer, the concept is easily extended to handle refraction as well as reflection.