Name:- Sreenath Reddy Kurukunda

ID:- 811211580

Scientific Visualization

Homework - 2

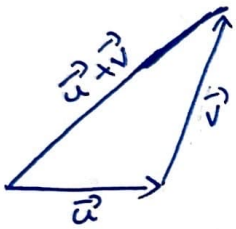
1) Graphics Vectors

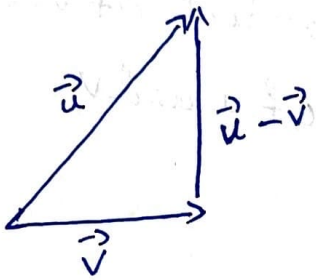
a) $u=[u_x, u_y, u_z]$

$V=[v_x, v_y, v_z]$

Ans:- $\vec{u} = u_x\hat{i} + u_y\hat{j} + u_z\hat{k}$

$\vec{v} = v_x\hat{i} + v_y\hat{j} + v_z\hat{k}$





b)

Ans:- we follow Right hand thumb rule. i.e. while calculating $\vec{a}\times\vec{b}$. rotating our palm from $\vec{a}$ to $\vec{b}$. the direction of thumb will point the direction of $\vec{a}\times\vec{b}$.

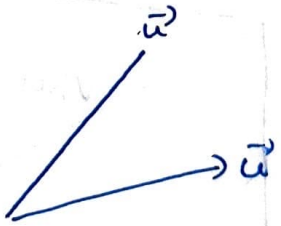
So. now. $\vec{v}\times\vec{u}$

two possible cases.

i)

Direction - Towards you.

ii)



Direction - Away from you.

c)

Ans:- $A(\theta)$ is represented as angle between 2 vectors (u and v)

As we know dot product =

$$u.v = ||u|| \times ||v|| \times \cos\theta$$

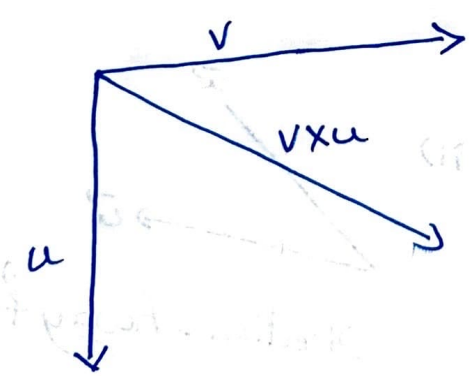
$$\theta = \cos^{-1} \frac{u.v}{|u||v|}$$

as per the above equation

cosine inverse of dot product of vectors (u and v) divided by magnitude of u and v.

e)

Ans:- Considering that on the screen, u and v are coplanar we know that the direction of the resultant a cross product can be determined using the right hand rule To apply the right hand rule, position your index, middle and thumb so that they are perpendicular to each other This rule will cause us to expand u x u in your direction.



2)

Ans:- Global illumination

→ Global illumination algorithms describe how light interacts with multiple surfaces.

→ The illumination and rendering methods that take into account GI include radiosity and raytracing.

→ Ray tracing is not used as a stand-alone rendering method but rather to compliment the other rendering methods.

→ Radiosity is a lighting/rendering strategy that calculates diffuse inter-reflections of light, automatically generates ambient illumination and light mixing, producing realistic results, especially when daylight is involved.

→ Radiosity is designed to work with physically based (photometric) lights that have parameters derived from real-world lighting properties.

Local illumination

→ light sources only effect those objects that they can directly illuminate

→ The effects of this reflected light doesn't mixed together.

→ Using a local illumination strategy, also referred to as Standard Lighting, requires arbitrary fill or ambient lights to simulate indirect lighting.

→ Using Ray traced materials in a scene lit by standard lighting permit for the calculation of specular reflections between surfaces, which create mirrored effects and highlights on shiny surfaces.

→ when a scene is illuminated with standard lighting, without ambient or indirect light, the ceiling and shadows are dark as there are no lights pointed directly at those areas.

3) Shading

a)

Ans:- (i) Ambient

(ii) Diffuse

(iii) specular

b)

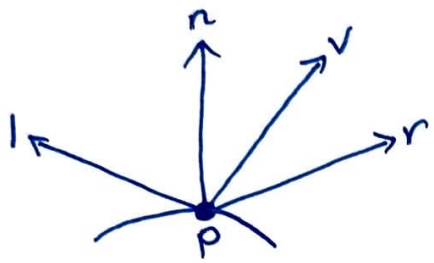
Ans:- (i) ambient La

(ii) diffuse Ld

(iii) specular Ls

c)

Ans:



r - It is direction that a perfectly reflected ray of light would take from this point on the surface

To compute r

$$r = 2(l.n)\,n - l$$

d)

Ans: $$I_p = k_a i_a + \sum_{m \in light} (k_d (L.N) i_{md} + k_s (R.V)^{\alpha} i_{ms})$$

I_p = Intensity point

k_s = specular reflection constant

k_d = diffuse reflection constant

k_a = ambient reflection constant

α = Shinsness constant for this material

L = light source

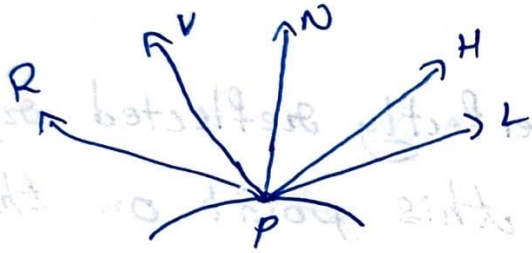
N = Normal point

R = Reflected Ray

V = viewo. point

e)

Ans:



$$H = \frac{L+V}{||L+V||}$$

H is the ~~reflection~~ reflect a point Hyper line

modification

Blinn modification is generally more realistic compared to default Phang shading.