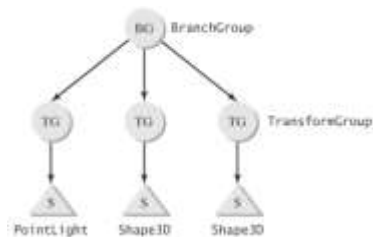


Examples of types of questions about Computer Graphics and Java 3D.

1. Write a Java 3D code segment corresponding to the scene graph branch shown in the next figure.



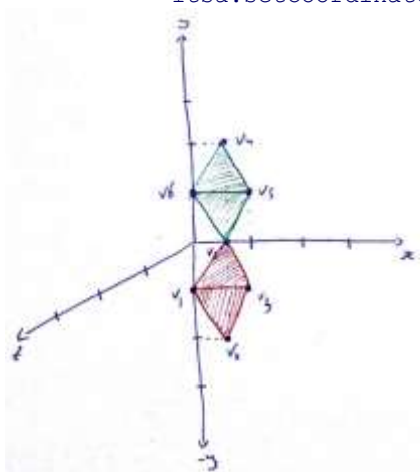
```

BranchGroup BG = new BranchGroup();
TransformGroup TG = new TransformGroup();
PointLight PL = new PointLight();
TG.addChild(PL);
root.addChild(TG);
TG = new TransformGroup();
Shape3D S1 = new Shape3D();
TG.addChild(S1);
root.addChild(TG);
TG = new TransformGroup();
Shape3D S2 = new Shape3D();
TG.addChild(S2);
root.addChild(TG);
  
```

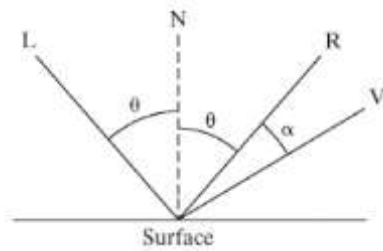
2. Draw a figure corresponding to the geometry defined by the following `TriangleStripArray` object:

```

int[] stripIndexCounts = { 4, 4 };
IndexedTriangleStripArray itsa = new IndexedTriangleStripArray(7,
    GeometryArray.COORDINATES, 8, stripIndexCounts);
Point3f[] coords = new Point3f[7];
coords[0] = new Point3f(0.5f, -2f, 0f);
coords[1] = new Point3f(0f, -1f, 0f);
coords[2] = new Point3f(0.5f, 0f, 0f);
coords[3] = new Point3f(1f, -1f, 0f);
coords[4] = new Point3f(0.5f, 2f, 0f);
coords[5] = new Point3f(1f, 1f, 0f);
coords[6] = new Point3f(0f, 1f, 0f);
itsa.setCoordinates(0, coords);
int[] indices = { 0, 3, 1, 2, 2, 5, 6, 4 };
itsa.setCoordinateIndices(0, indices);
  
```



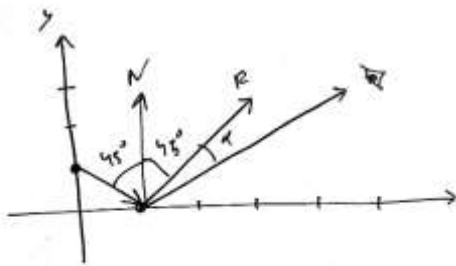
3. How do you position the view to maximize the specular reflection of a point light from a point on a surface?



$$I = I_a k_a + I_p k_d \cos \theta + I_p k_s \cos^n \alpha$$

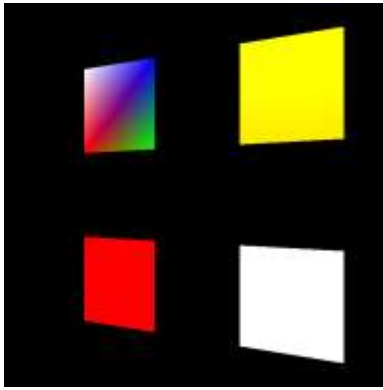
The view must be positioned in order to coincide with the reflection direction (where the angle alpha (α) = 0). In that way the value of the component $I_p k_s \cos^n \alpha$ will be the maximum possible, considering I_p and k_s constants.

4. The point (1, 0, 0) on an object has a surface normal in the direction (0, 1, 0). A point light with intensity 1.0 is placed at (0, 1, 0). The eye is located at (5, 3, 0). If the RGB diffuse coefficients of the object are (0.3, 0.5, 0.2), find the RGB values of diffuse reflection at the point.



$$\begin{aligned} I_d &= I_p \cdot k_d \cdot \cos \theta \\ I_p &= (1, 1, 1) \\ k_d &= (0.3, 0.5, 0.2) \\ \theta &= 45^\circ \Rightarrow \cos 45^\circ = \frac{\sqrt{2}}{2} \\ I_d^R &= 1 \times 0.3 \times \frac{\sqrt{2}}{2} \\ I_d^G &= 1 \times 0.5 \times \frac{\sqrt{2}}{2} \\ I_d^B &= 1 \times 0.2 \times \frac{\sqrt{2}}{2} \end{aligned}$$

5. The next figure shows the four coloring modes of Java 3D. Explain how to implement each coloring mode. Consider that the scene is illuminated with a point light of color yellow.



- a) Color vertices
- b) Light and Material
- c) Coloring Attributes
- d) No color mode

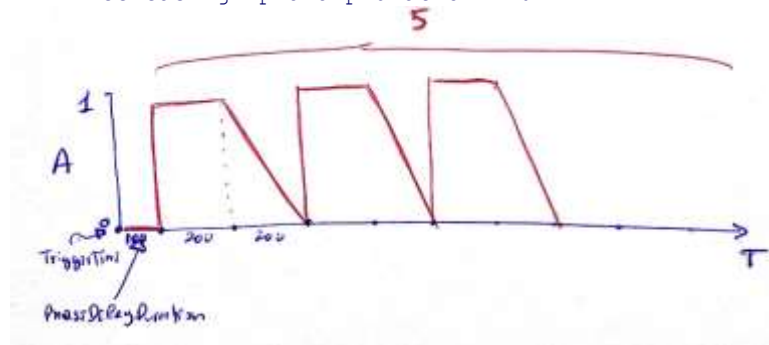
6. What is the texture coordinate for the center of a texture image? Explain.

(1/2, 1/2)

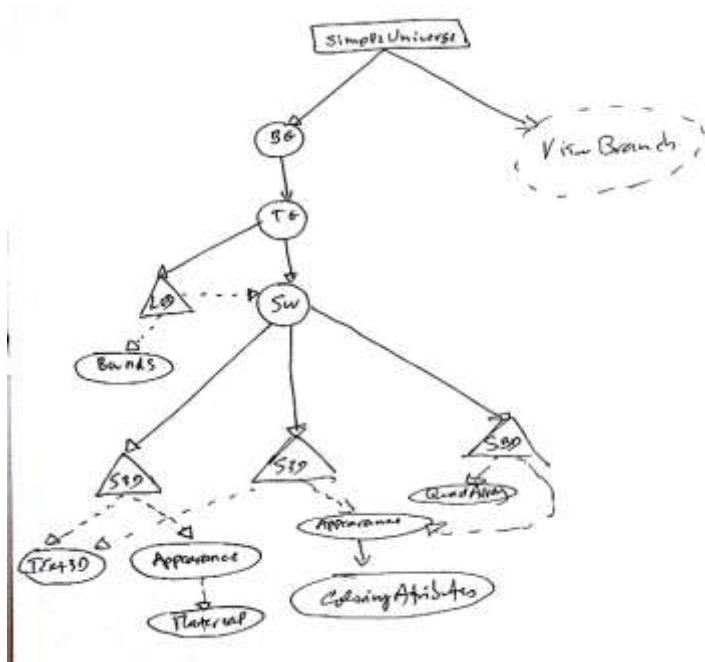
7. Draw the waveform of an Alpha with the following parameters:

```

LoopCount = 5
TriggerTime = 0
PhaseDelayDuration = 100
AlphaAtZeroDuration = 0
AlphaAtOneDuration = 200
IncreasingAlphaDuration = 0
DecreasingAlphaDuration = 200
IncreasingAlphaRampDuration = 0
DecreasingAlphaRampDuration = 0
  
```



8. Draw the scene graph of a program that uses a [DistanceLOD](#) object to set up three levels of detail for displaying a 3D text object of the string "Java." The first level uses a [Material](#) object in the appearance to enable lighting. The second level uses a flat color. The third level uses only a filled rectangle to represent the text.



9. Complete the following code to configure a `PositionPathInterpolator` to move an object along a triangular path defined by the points A (-2, 0, 1), B (0, 0, -1) and C (1, 0, 1). The object starts moving at position A and must take 5 seconds to arrive at point B, 3 seconds to arrive at point C and 2 seconds to return to point A.

```

Alpha alpha = new Alpha(-1, 10000); //1°
float[] knots = {0.0, 0.5, 0.8, 1.0}; //2° e 3°
Point3f[] pos = {new Point3f(-2f, 0f, 1f), new Point3f(0f, 0f, -1f), new
Point3f(1f, 0f, 1f), new Point3f(-2f, 0f, 1f)}; //4° e 5°
PositionPathInterpolator interp = new PositionPathInterpolator(alpha, path, new
Transform3D(), knots, pos); //6°

```