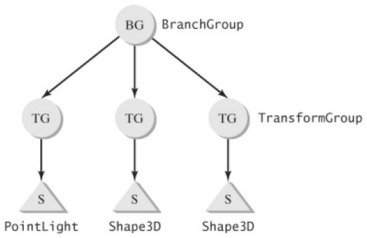
Examples of types of questions about Computer Graphics and Java 3D.

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



2. Draw the figure corresponding to the geometry defined by the following code. You must indicate in the drawing, the coordinates and indexes of the vertices.

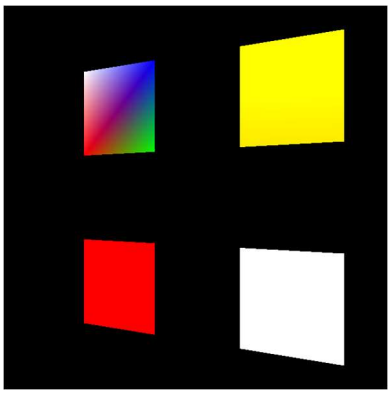
```
int[] stripIndexCounts = { 4, 4, 4 };
IndexedTriangleStripArray geom = new IndexedTriangleStripArray(5,
GeometryArray.COORDINATES, 12,stripIndexCounts);
Point3f[] coords = new Point3f[5];
coords[0] = new Point3f(0f, 0f, 0f);
coords[1] = new Point3f(0f, 0f, 1f);
coords[2] = new Point3f(1f, 0f, 1f);
coords[3] = new Point3f(1f, 0f, 0f);
coords[4] = new Point3f(0.5f, 1f, 0.5f);
geom.setCoordinates(0, coords);
int[] indices = { 0, 1, 4, 2, 0, 3, 4, 2, 0, 1, 3, 2};
 geom.setCoordinateIndices(0, indices);
```

Consider the following appearance configuration.

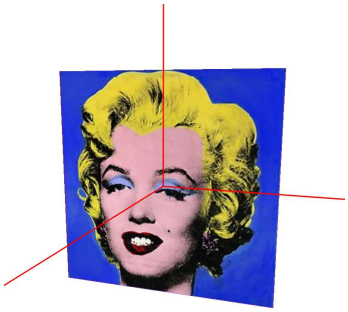
```
Appearance ap = new Appearance();
ap.setPolygonAttributes(new PolygonAttributes(PolygonAttributes.POLYGON_LINE,
PolygonAttributes.CULL_NONE, 0));
```

3. 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 that point.

4. 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.



5. Complete the following code to create a square panel, where it is mapped the top-right portion of the image as shown in the figure on the side.

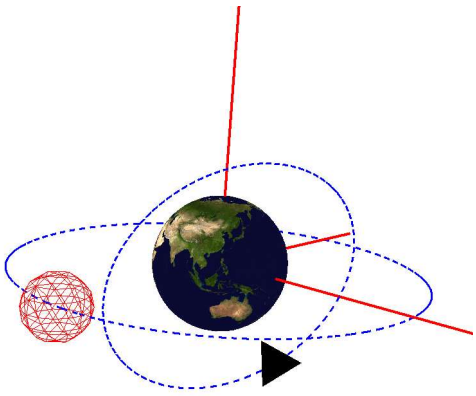


```
QuadArray p = new QuadArray(4, QuadArray.COORDINATES
                                    );  //1°
p.setCoordinate(0, new Point3d(          )); //2°
p.setCoordinate(1, new Point3d(          )); //3°
p.setCoordinate(2, new Point3d(          )); //4°
p.setCoordinate(3, new Point3d(          )); //5°
p.setTextureCoordinate(0,0,new
TexCoord2f(      ));//6°
p.setTextureCoordinate(0,1,new
TexCoord2f(      ));//7°
p.setTextureCoordinate(0,2,new
TexCoord2f(      ));//8°
p.setTextureCoordinate(0,3,new
TexCoord2f(      ));//9°
```

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

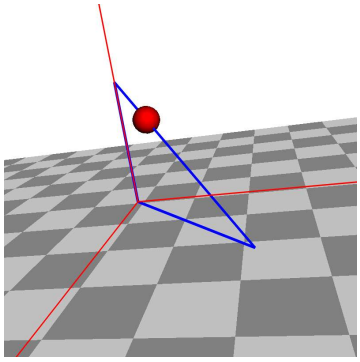
```
LoopCount = 5
TriggerTime = 0
PhaseDelayDuration = 100
AlphaAtZeroDuration = 0
AlphaAtOneDuration = 200
IncreasingAlphaDuration = 0
DecreasingAlphaDuration = 200
IncreasingAlphaRampDuration = 0
DecreasingAlphaRampDuration = 0
```

7. Consider the animated 3D scene of the figure on the side, with two spheres representing the Earth and the Moon, and a tetrahedron representing a satellite. The earth rotates around itself (Y-axis), and the Moon and the satellite describe orbits around the Earth. Consider that the orbit of the Moon and the satellite are defined in the XZ plane, but the orbit of the satellite is rotated 45º around the X axes. Draw the complete scene graph for this scene, including the appearance elements. Name the symbols of the graph with the names of the classes, or the names of the objects typically used in the book examples.



Consider that the scene has a spot light and a background. The appearance of the satellite is of the material type, the earth is of the texture type and the moon is such that only the edges are drawn in red. Do not include objects referring to the lines of the orbits and the axes seen in the figure.

8. Complete the following code to program a PositionPathInterpolator behavior that causes a sphere with a material-like appearance, to follow the triangular path shown in the figure on the side. It is intended that the sphere takes 4 seconds to travel through the hypotenuse of the triangle and 3 seconds to travel each of the legs of the triangle. Is the movement of the sphere always in the same direction? Justify.



```
...
Appearance ap =                                  //1°
Primitive sphere = new Sphere(0.05f,
Primitive.                  , 24, ap);           //2°

TransformGroup t = new TransformGroup();
t.                                               //3°
t.addChild(sphere);
root.addChild(t);

Alpha a = new Alpha(-1, 10000);
a.setMode(Alpha.INCREASING_ENABLE |
Alpha.DECREASING_ENABLE);
a.setDecreasingAlphaDuration(10000);
float[] k =                                      //4°
knots
Point3f[] p = {new Point3f(0f, 1f, 0f), }        //5°
positions

tr =                                             //6°
PositionPathInterpolator i = new
PositionPathInterpolator(a, t, tr, k, p);        //7°
i.                                               //8°
t.                                               //9°
. . .
```