

## Examples of types of questions about Computer Graphics and Java 2D.

### Cap 1 – Introdução

---

1. Identify the main fields of Computer Graphics  
A–Image Synthesis, B–Image Processing and C–Image Analysis (Computer Vision)  
that are applicable to the following applications

1. Locate small bright spots in a mammogram image.
2. Construct a 3D model of a building from a set of its pictures.
3. Display a simulation of the solar system with the sun and nine planets in motion
4. Recognize the brain region in a MRI scan and display a 3D model of the brain.
5. Use computers to generate the scene of a car collision.
6. Make a computer identification of a person from a photograph.

More than one field can be applicable to a single application. Give the answer in the form

1 – B

2 – A

...

### Cap. 2 – Desenho de primitivas e Shape

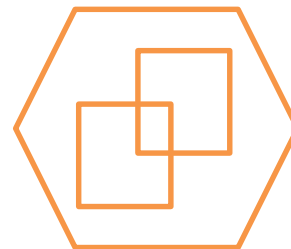
---

2. Write an algorithm in pseudocode or Java to draw an ellipse  
based on the following parametric equations.

$$x = x_0 + a \cos t$$

$$y = y_0 + b \sin t$$

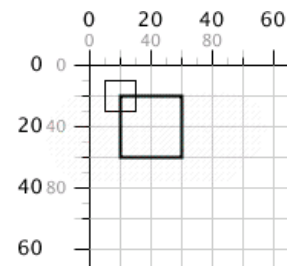
3. Determine the interior of the shape in the next figure using the  
even–odd rule.



4. Draw a sketch that represents the output of the following code.

```
public void paintComponent(Graphics g) {  
    super.paintComponent(g);  
    Graphics2D g2 = (Graphics2D)g;  
    g2.translate(100, 50);  
    GeneralPath path = new GeneralPath(GeneralPath.WIND_EVEN_ODD);  
    path.moveTo(150,0);  
    path.curveTo(-50, 50, -50, 250, 150, 300);  
    path.quadTo(50, 150, 150, 0);  
    path.closePath();  
    g2.fill(path);  
}
```

5. The following figure represents a scale transformation applied to the small square. Present the matrix of a compose transformation to apply the scale transformation but without changing the coordinates of the up-left corner.



6. Write the Java code to put in paintComponent() to display a square centered at the center of window and rotated by 45°.
7. Draw a sketch that represents the output of the following code.

```
public void paintComponent(Graphics g) {
    super.paintComponent(g);
    Graphics2D g2 = (Graphics2D)g;
    int w = this.getWidth();
    int h = this.getHeight();
    int r = Math.min(w, h) - 100;
    Area a = new Area(new Rectangle(r, r));
    a.subtract(new Area(new Ellipse2D.Double(r/4, r/4, r/2, r/2)));
    g2.translate((w-r)/2, (h-r)/2);
    GradientPaint paint = new GradientPaint(0, 0, Color.black, 0, r/2,
    Color.white, true);
    g2.setPaint(paint);
    g2.fill(a);
    g2.setColor(Color.black);
    g2.draw(a);
}
```

8. The image on the right represents the data processed by the convolution operation applied to an image. The  $I_{ij}$  are the original intensity of the pixels of an image and  $K_{ij}$  are the values of a specific kernel. Preset the equation of the convolution operation to calculate the final intensity value of pixel (2, 2).

Imagem					
$I_{11}$	$I_{12}$	$I_{13}$	$I_{14}$	$I_{15}$	$I_{16}$
$I_{21}$	$I_{22}$	$I_{23}$	$I_{24}$	$I_{25}$	$I_{26}$
$I_{31}$	$I_{32}$	$I_{33}$	$I_{34}$	$I_{35}$	$I_{36}$
$I_{41}$	$I_{42}$	$I_{43}$	$I_{44}$	$I_{45}$	$I_{46}$
$I_{51}$	$I_{52}$	$I_{53}$	$I_{54}$	$I_{55}$	$I_{56}$
$I_{61}$	$I_{62}$	$I_{63}$	$I_{64}$	$I_{65}$	$I_{66}$

Kernel		
$K_{11}$	$K_{12}$	$K_{13}$
$K_{21}$	$K_{22}$	$K_{23}$
$K_{31}$	$K_{32}$	$K_{33}$

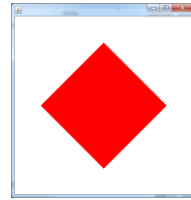
9. Complete the following function to create an output image by inverting the color of an input image. The color of every pixel is turned to its opposite color; that is, a color with components  $r$ ,  $g$ ,  $b$  is changed to  $1 - r$ ,  $1 - g$ ,  $1 - b$ .

```
BufferedImage RGBInvert(BufferedImage imgIn) {
    BufferedImage imgOut = new BufferedImage(imgIn.getWidth(),
        imgIn.getHeight(), imgIn.getType());

    //1° Create objects to access pixel data
    //2° Get the color of each pixel
    //3° Transform the color
    //4° Set the new pixel color

    return imgOut;
}
```

10. Complete the following code to create an animation where a shape of a square centered at the origin rotates continuously.



```
class Ex7Panel extends JPanel implements Runnable {
    _____;

    public Ex7Panel() {
        setPreferredSize(new Dimension(400, 400));
        setBackground(Color.white);

        _____;
    }

    public void paintComponent(Graphics g) {
        super.paintComponent(g);
        Graphics2D g2 = (Graphics2D) g;
        int w = getWidth();
        int h = getHeight();
        AffineTransform tx = new AffineTransform();
        tx.rotate(ang);

        tx._____;
        Rectangle2D rect = new Rectangle2D.Double(-200, -200,
            400, 400);

        Shape shape = _____;

        g2._____;
        g2._____;

        g2.fill(shape);
    }

    @Override
    public void run() {
        while (true) {

            _____;

            _____;
            try {
                Thread.sleep(50);
            } catch (InterruptedException e) {
                e.printStackTrace();
            }
        }
    }
}
```