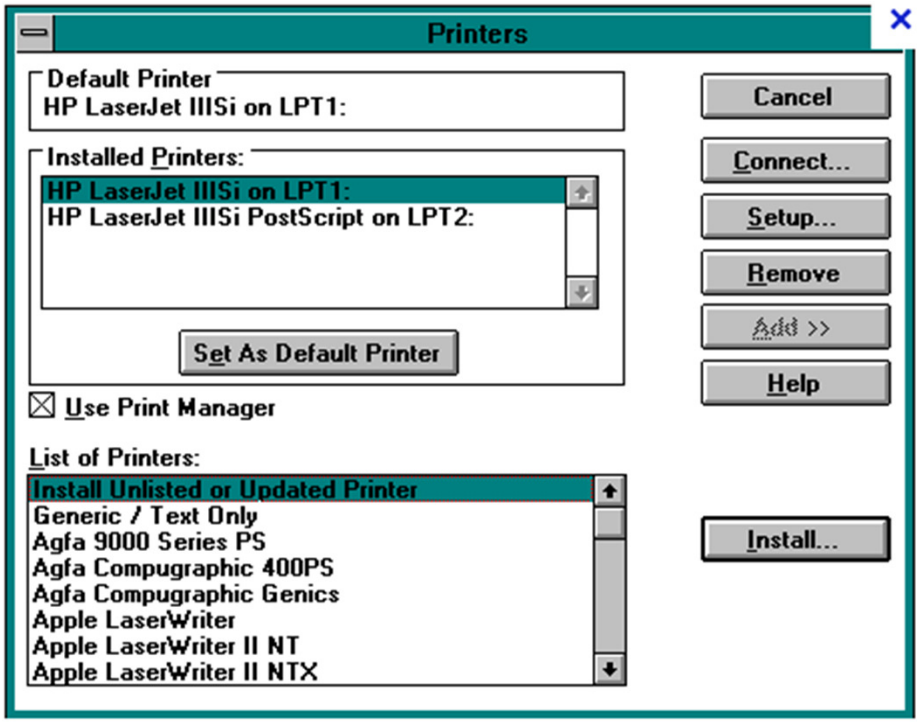
CS324e - Elements of Graphics and Visualization

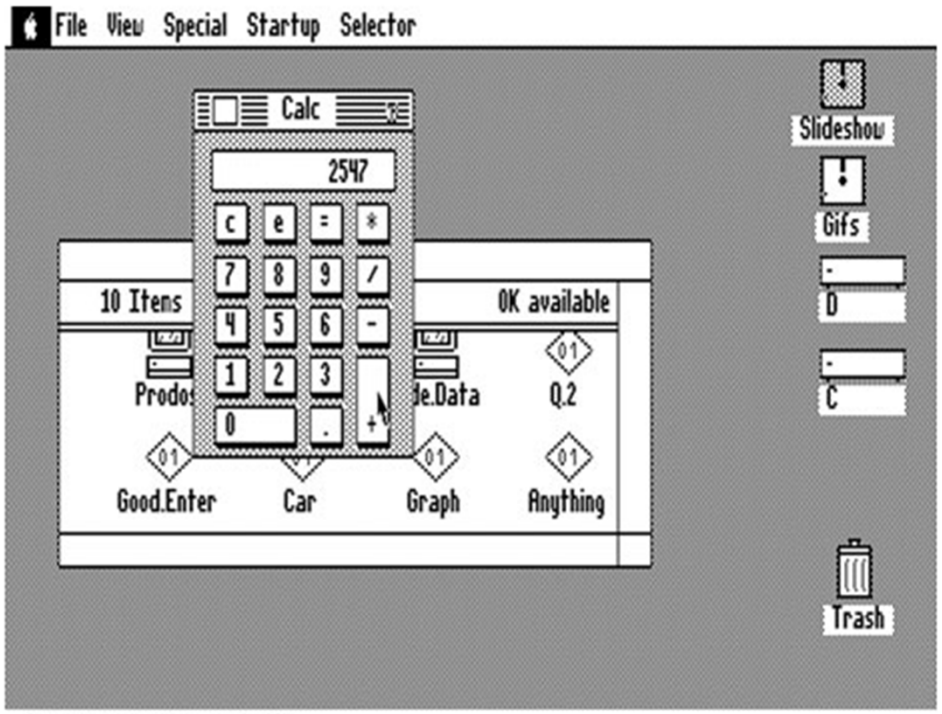
Gradients

GUIs

Windows 3 1990

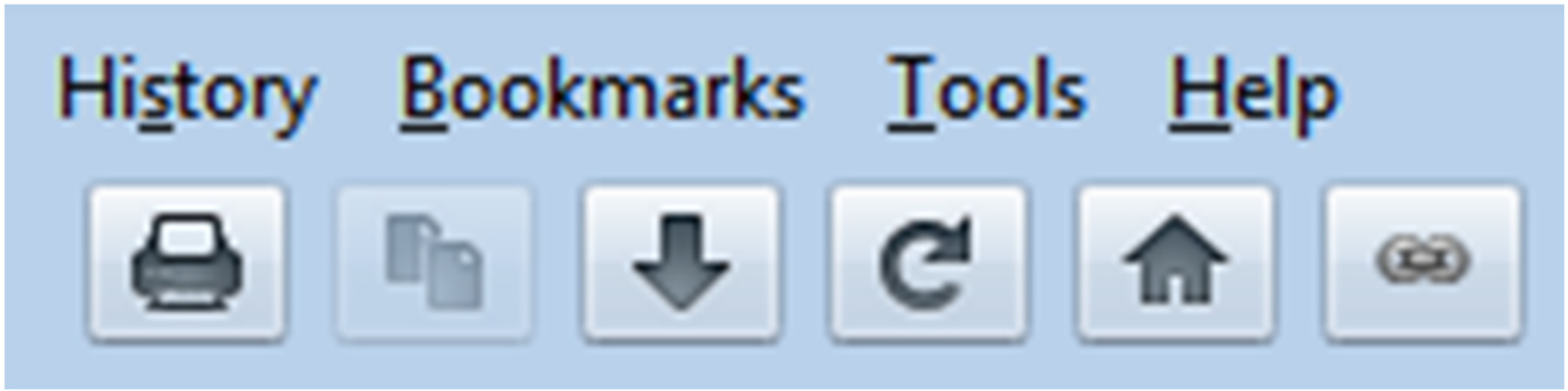


Mac 1984



The Apple Macintosh Desktop, 1984

GUIs



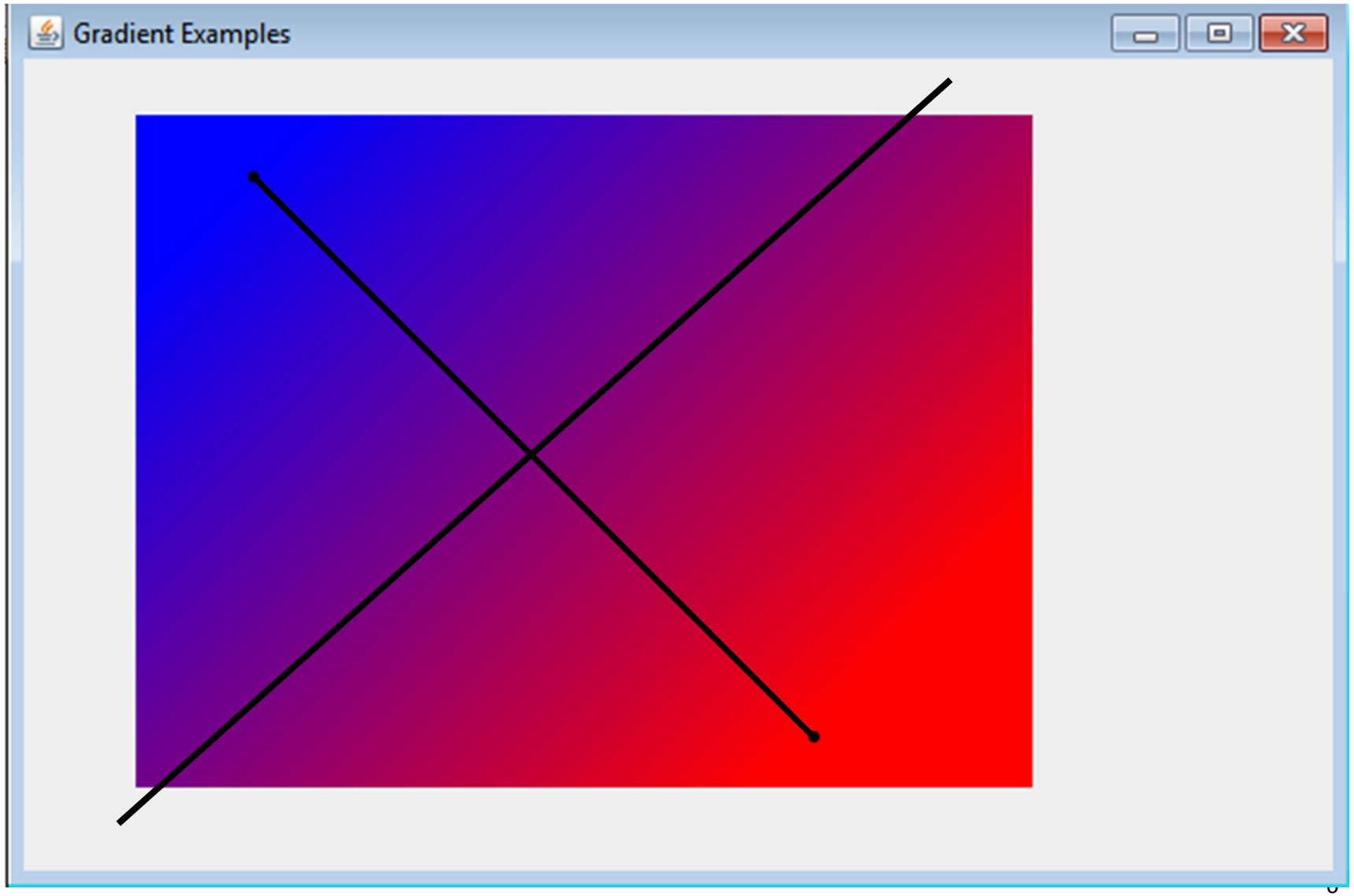
Gradients

- Gradient: vary color from one to another interpolating in between
- Current trend (~2010) is to use gradients everywhere in interfaces and graphic design
- Java provides some built in classes to create and apply gradients
  - GradientPaint
  - LinearGradientPaint
  - RadialGradientPaint

GradientPaint

- Define two end points and two colors
- color varies along a line drawn between two points
  - same colors along lines drawn perpendicular to line connecting points
- Set Graphics2D object paint to the GradientPaint
- Anything drawn or filled uses gradient

GradientPaint Example



GradientPaint

GradientPaint

```
public GradientPaint(float x1,
                     float y1,
                     Color color1,
                     float x2,
                     float y2,
                     Color color2)
```

Constructs a simple acyclic `GradientPaint` object.

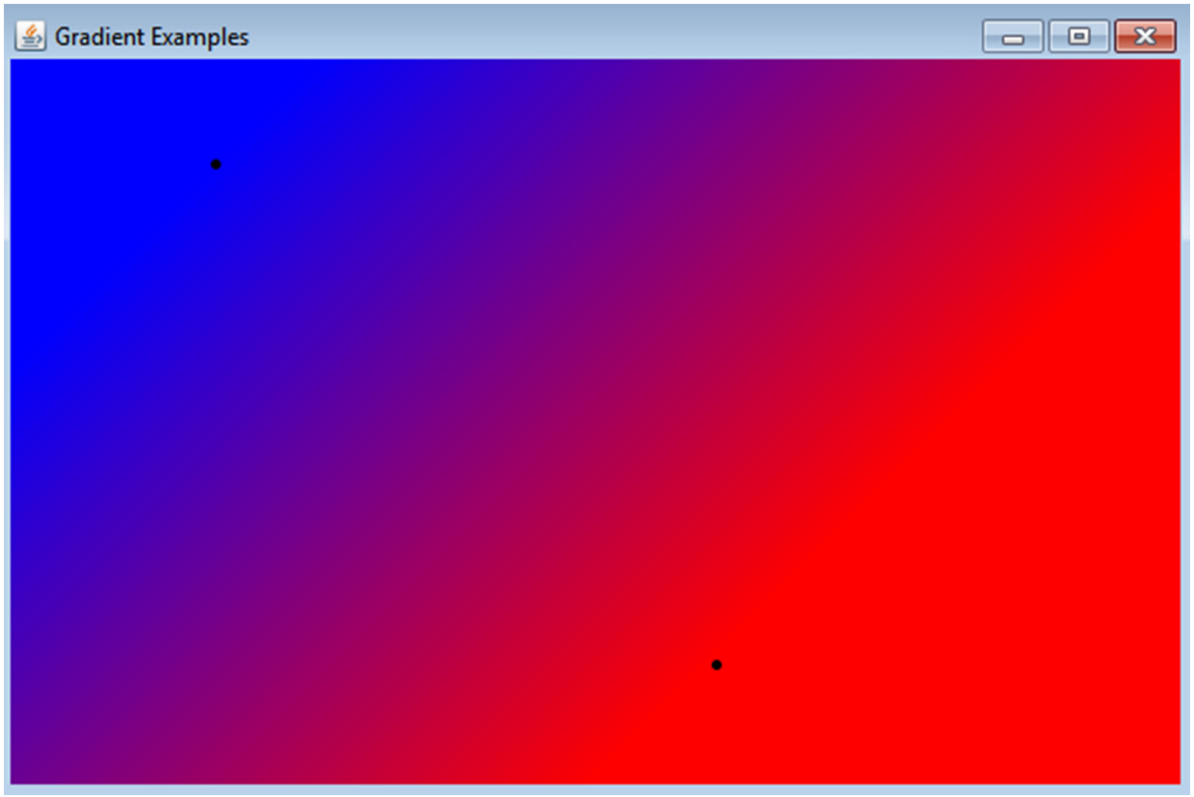
Parameters:

- `x1` - x coordinate of the first specified `Point` in user space
- `y1` - y coordinate of the first specified `Point` in user space
- `color1` - `Color` at the first specified `Point`
- `x2` - x coordinate of the second specified `Point` in user space
- `y2` - y coordinate of the second specified `Point` in user space
- `color2` - `Color` at the second specified `Point`

```
Rectangle2D temp
    = new Rectangle2D.Double(50, 25, 400, 300);

GradientPaint gp = new GradientPaint(100, 50, Color.BLUE,
        350, 300, Color.RED);
g2.setPaint(gp);
g2.fill(temp);
```

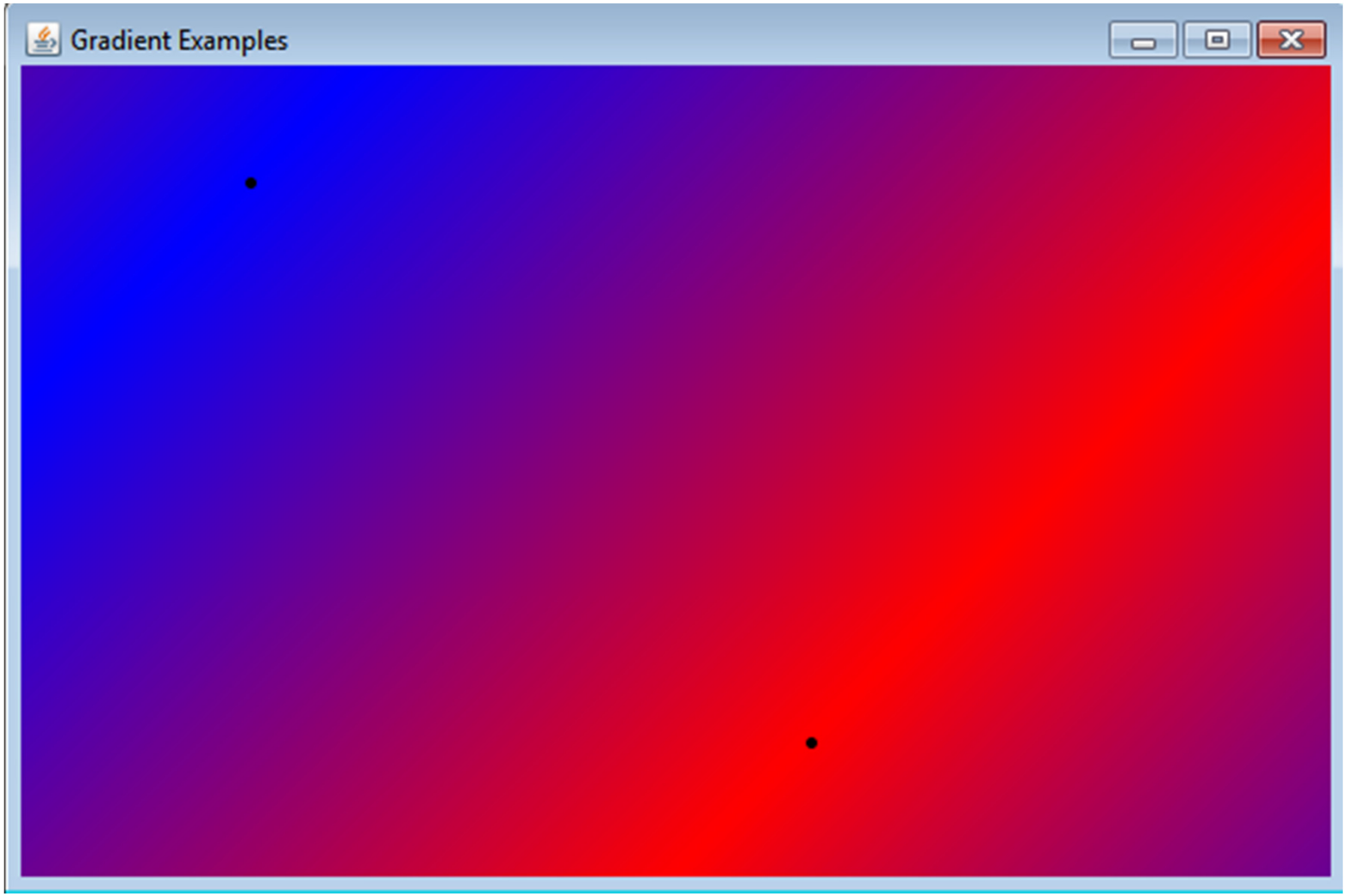
GradientPaint

- By default gradient is acyclic
  - beyond endpoints color is same as color at endpoint



GradientPaint

- Set GradientPaint to cyclical
  - another constructor

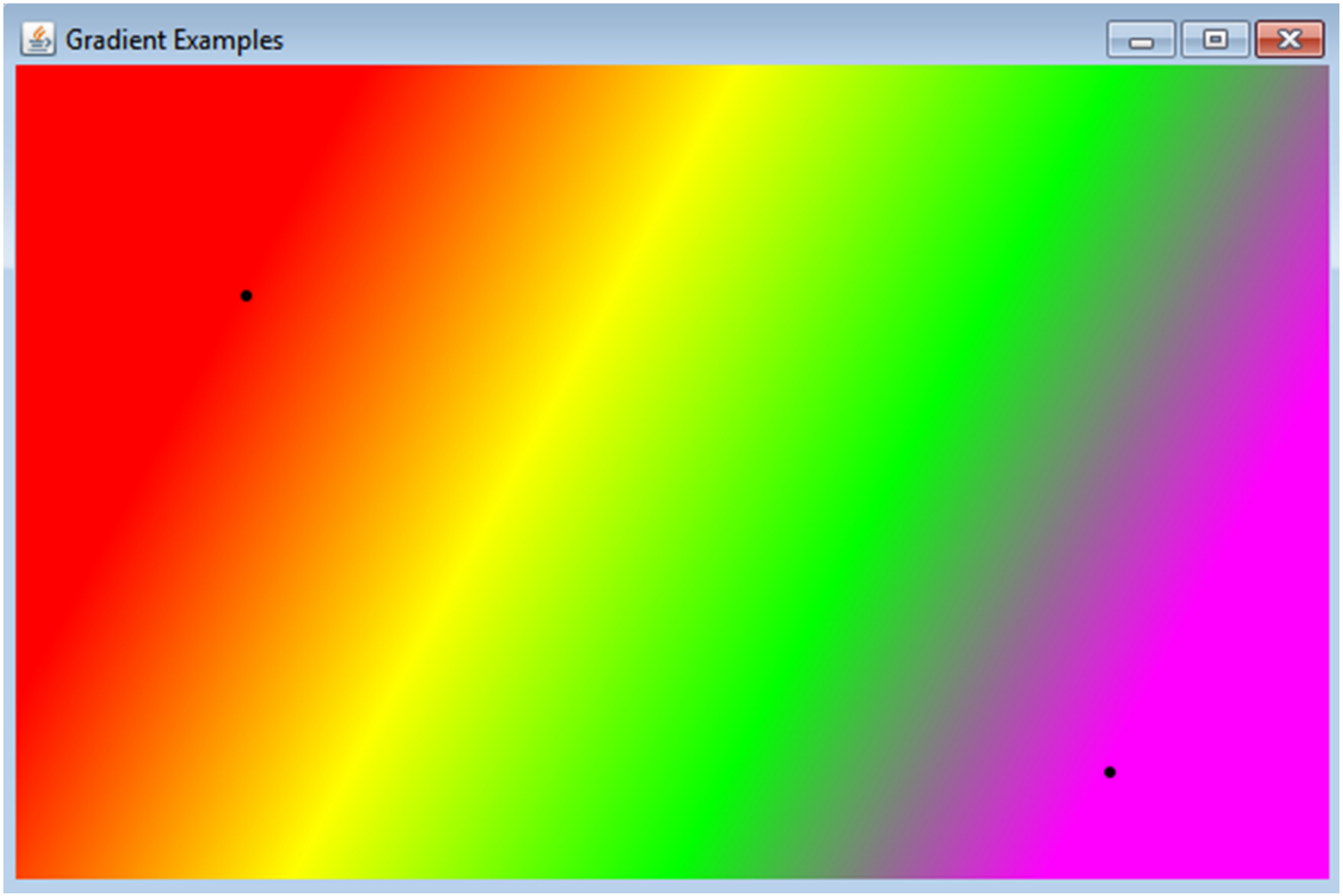


LinearGradientPaint

- Until Java 6.0 in 2006 GradientPaint was only gradient
- LinearGradientPaint added in version 6.0
- GradientPaint only allowed 2 paints
- LinearGradientPaint allows 2 or more colors
- Can alter "distance" between two paints
- More options

LinearGradientPaint

- 4 Colors



LinearGradientPaint

- Define 2 endpoints
- array of fractions and array of colors must be equal in length
- fractions defines portion to use that color

LinearGradientPaint

```
public LinearGradientPaint(float startX,
                           float startY,
                           float endX,
                           float endY,
                           float[] fractions,
                           Color[] colors)
```

Constructs a `LinearGradientPaint` with a default `NO_CYCLE` repeating method and `SRGB` color space.

Parameters:

`startX` - the X coordinate of the gradient axis start point in user space

`startY` - the Y coordinate of the gradient axis start point in user space

`endX` - the X coordinate of the gradient axis end point in user space

`endY` - the Y coordinate of the gradient axis end point in user space

`fractions` - numbers ranging from 0.0 to 1.0 specifying the distribution of colors along the gradient

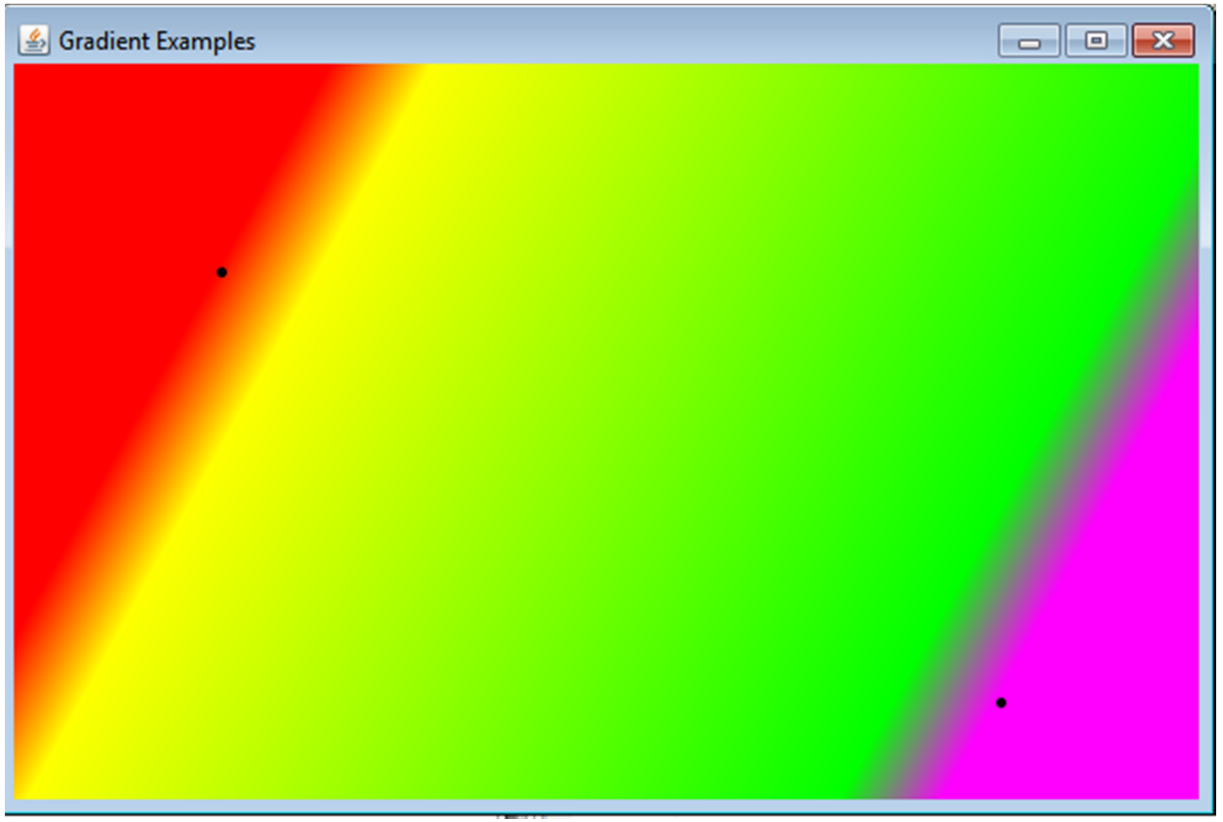
`colors` - array of colors corresponding to each fractional value

LinearGradientPaint

```
private void linearGradientPaint(Graphics2D g2) {
    Rectangle2D temp = new Rectangle2D.Double(0, 0,
            getWidth(), getHeight());

    float[] fractions = {0, 0.33f, 0.67f, 1};
    Color[] colors = {Color.RED, Color.YELLOW,
            Color.GREEN, Color.MAGENTA};

    LinearGradientPaint lgp = new LinearGradientPaint(100, 100,
            getWidth() - 100, getHeight() - 50,
            fractions, colors);

    g2.setPaint(lgp);
    g2.fill(temp);

    g2.setColor(Color.BLACK);
    g2.fillOval(100, 100, 5, 5);
    g2.fillOval(getWidth() - 100, getHeight() - 50, 5, 5);
}
```

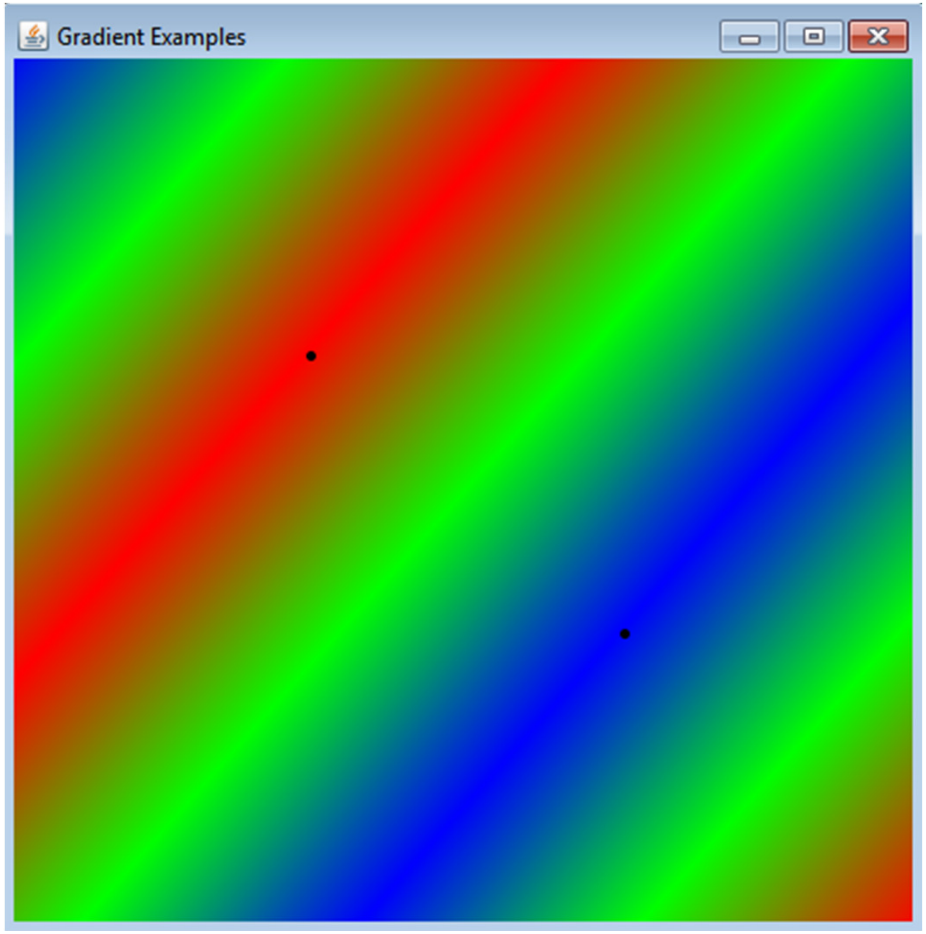
LinearGradientPaint

- Change Fractions
- {0, 0.1f, 0.9f, 1} // f for float
- fractions must be in strictly increasing order

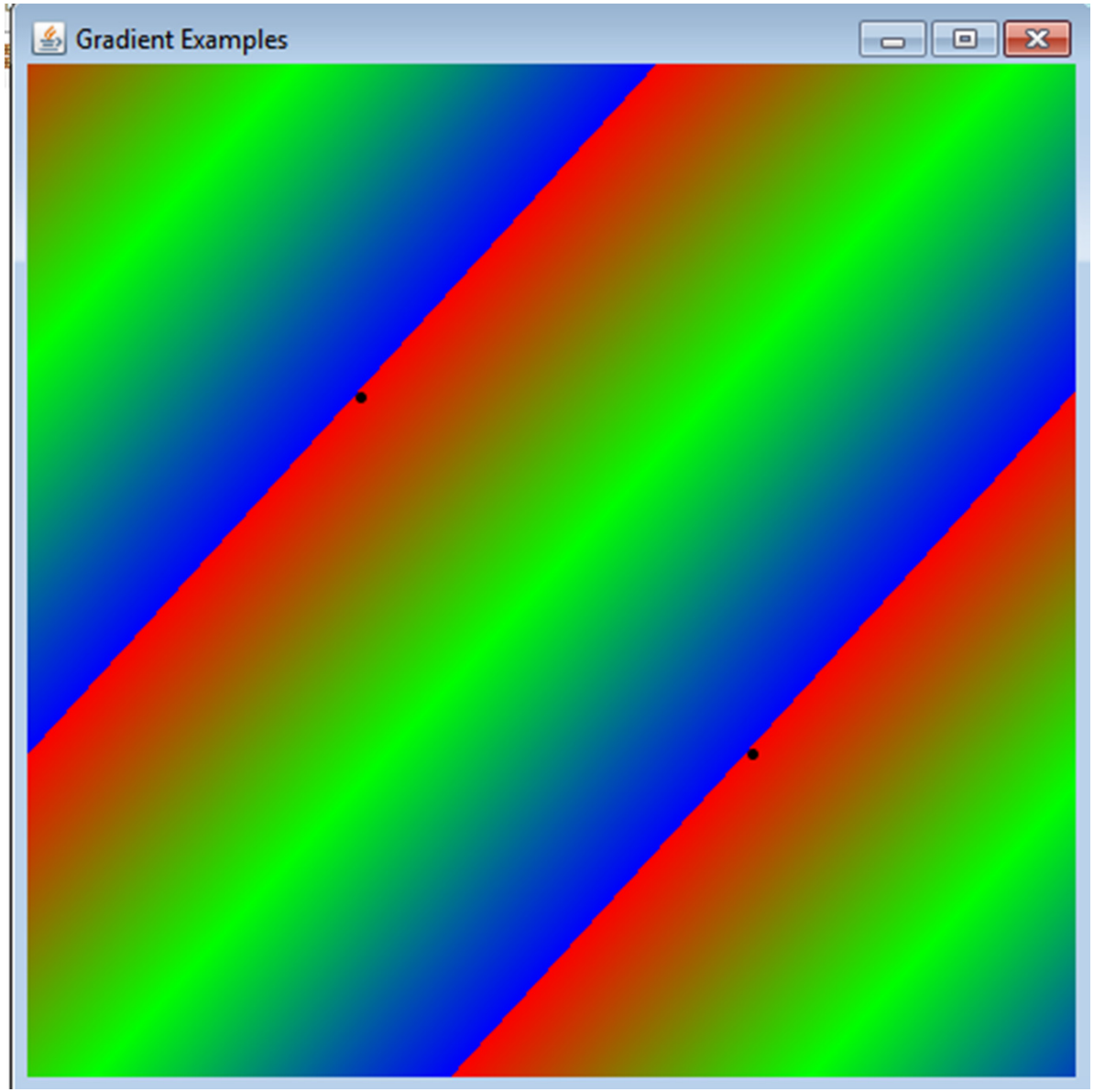


LinearGradientPaint - REFLECT

- Previous examples were acyclic
- Cycle can be set to *reflect* or *repeat*



LinearGradientPaint - REPEAT



LinearGradientPaint

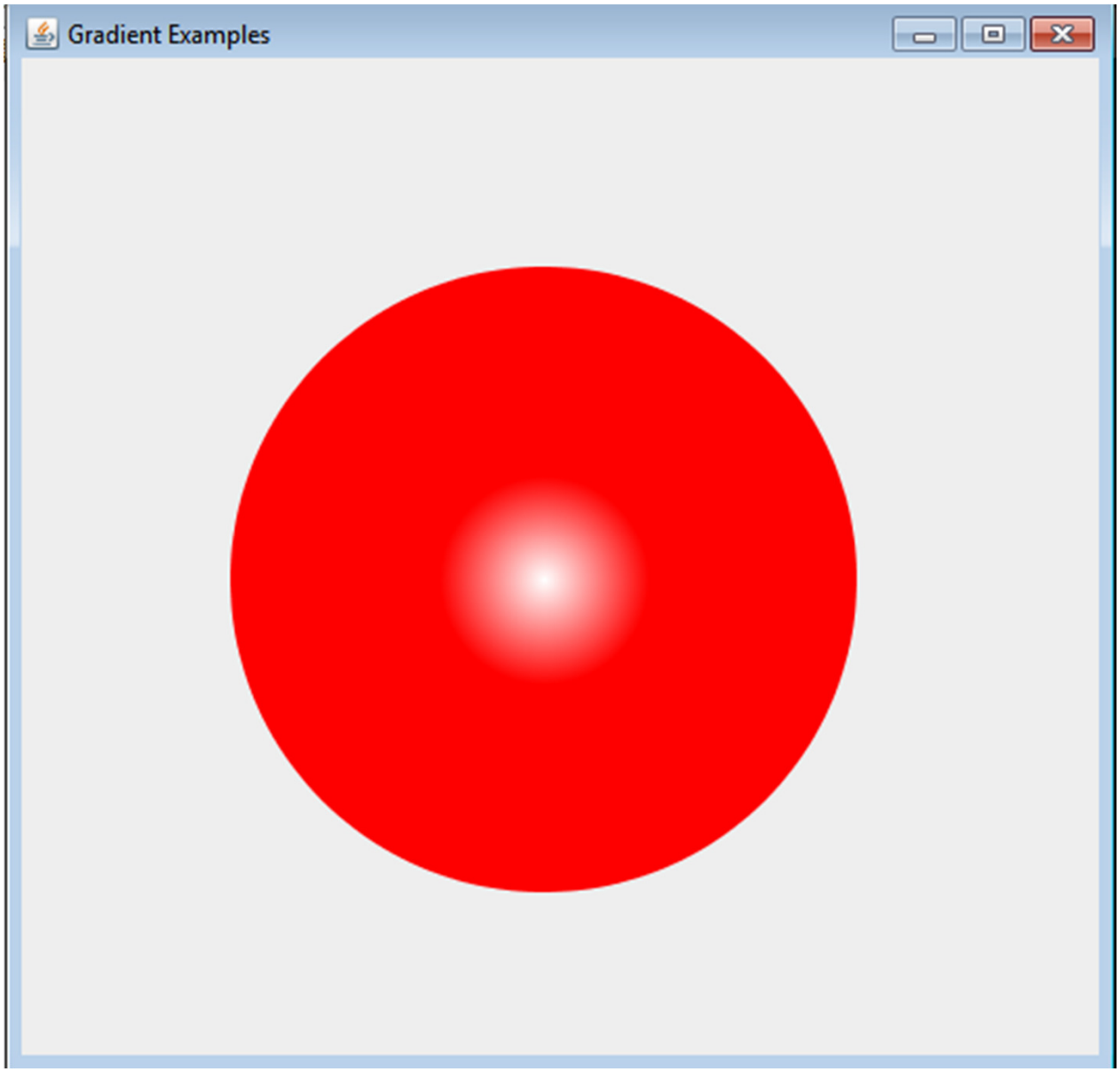
```
LinearGradientPaint lgp = new LinearGradientPaint(150, 150,
        getWidth() - 150, getHeight() - 150,
        fractions, colors,
        MultipleGradientPaint.CycleMethod.REPEAT);
```

- or REPEAT

RadialGradientPaint

- Specify two or more colors, a center point, and a radius
- can also set the focal point to a spot other than the center
- May be acyclic (NO_CYCLE), REFLECT, or REPEAT similar to LinearGradientPaint

RadialGradientPaint



RadialGradientPaint

```
private void radialGradientPaint(Graphics2D g2) {

    int rad = 300;
    int cx = 100;
    int cy = 100;

    Ellipse2D temp = new Ellipse2D.Double(cx, cy,
            rad, rad);

    float[] fractions = {0, 1};
    Color[] colors = {Color.WHITE,
            Color.RED};

    RadialGradientPaint rgp = new RadialGradientPaint(
            cx + rad / 2, cy + rad / 2, 50,
            fractions, colors);

    g2.setPaint(rgp);
    g2.fill(temp);
```

RadialGradientPaint Constructor

RadialGradientPaint

```
public RadialGradientPaint(float cx,
                           float cy,
                           float radius,
                           float[] fractions,
                           Color[] colors)
```

Constructs a `RadialGradientPaint` with a default `NO_CYCLE` repeating method and `SRGB` color space, using the center as the focus point.

Parameters:

`cx` - the X coordinate in user space of the center point of the circle defining the gradient. The last color of the gradient is mapped to the perimeter of this circle.

`cy` - the Y coordinate in user space of the center point of the circle defining the gradient. The last color of the gradient is mapped to the perimeter of this circle.

`radius` - the radius of the circle defining the extents of the color gradient

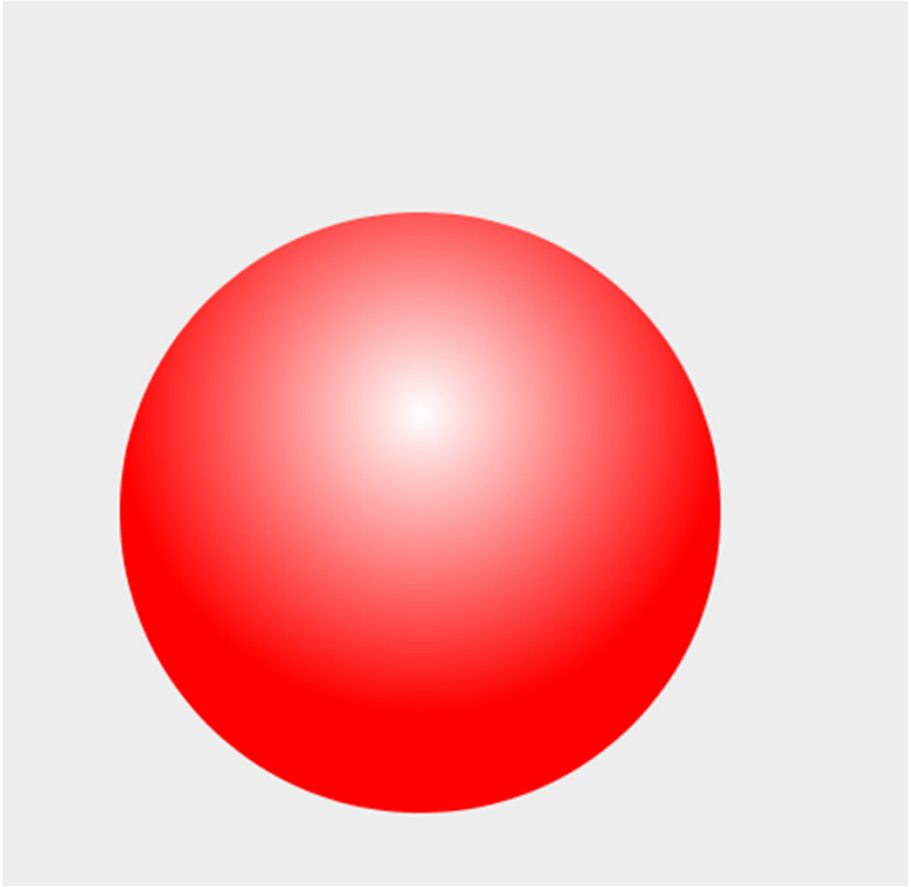
`fractions` - numbers ranging from 0.0 to 1.0 specifying the distribution of colors along the gradient

`colors` - array of colors to use in the gradient. The first color is used at the focus point, the last color around the perimeter of the circle.

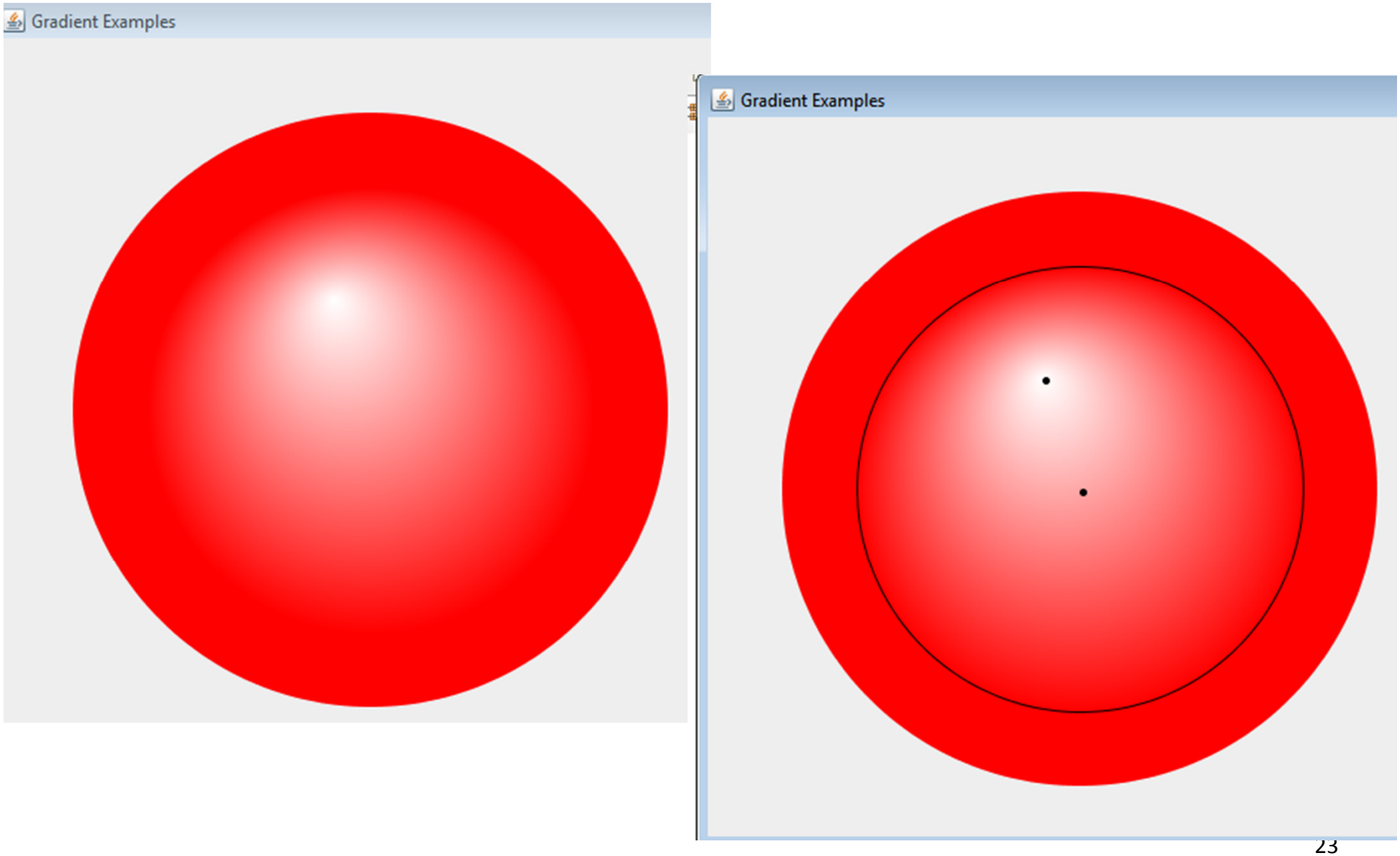
- Not only one!

RadialGradientPaint

- Example with ellipse not centered
- Can either move ellipse or change focal point of gradient paint.
- Slightly different effects



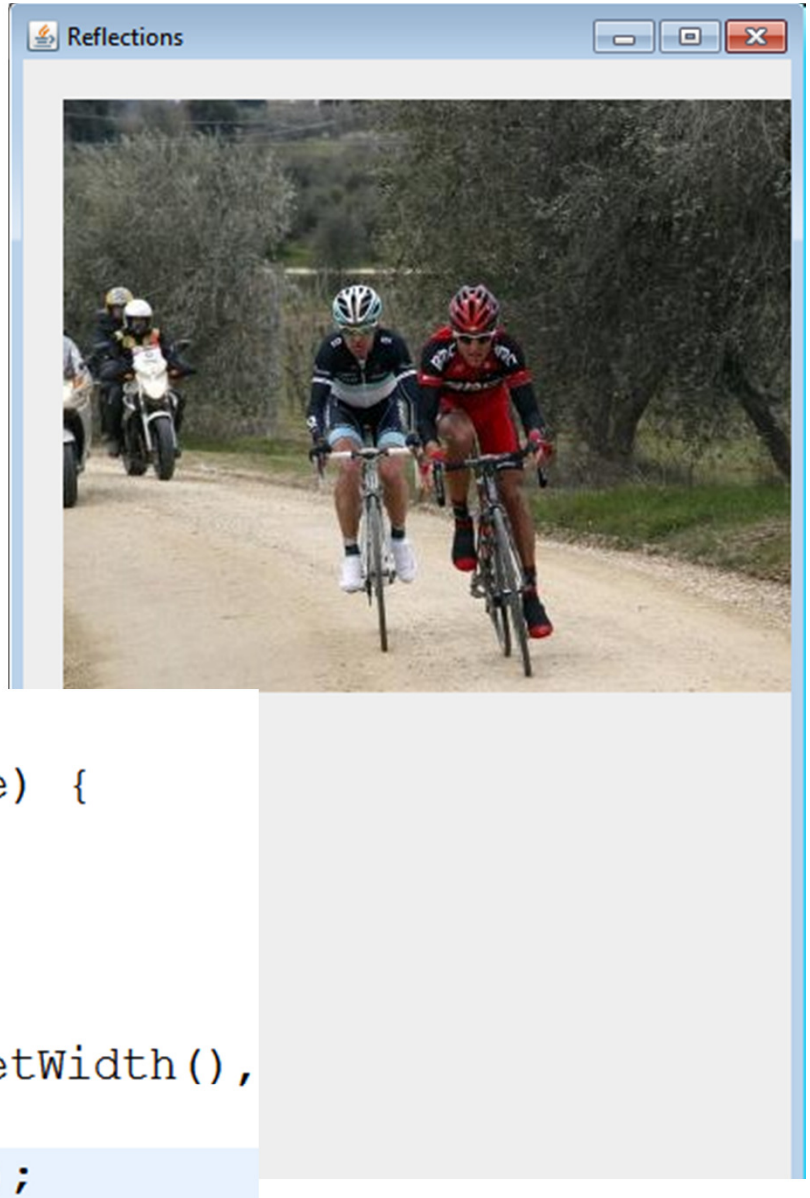
RadialGradientPaint - Altered Focal Point



Putting Gradients to Use

- Create a reflection of an image using gradients and alpha composite
- Draw an image
- Draw the same image below it, reflected
- Create a paint that varies alpha from half to 0
- Use Alpha Composite to combine alpha paint and upside down image

Image



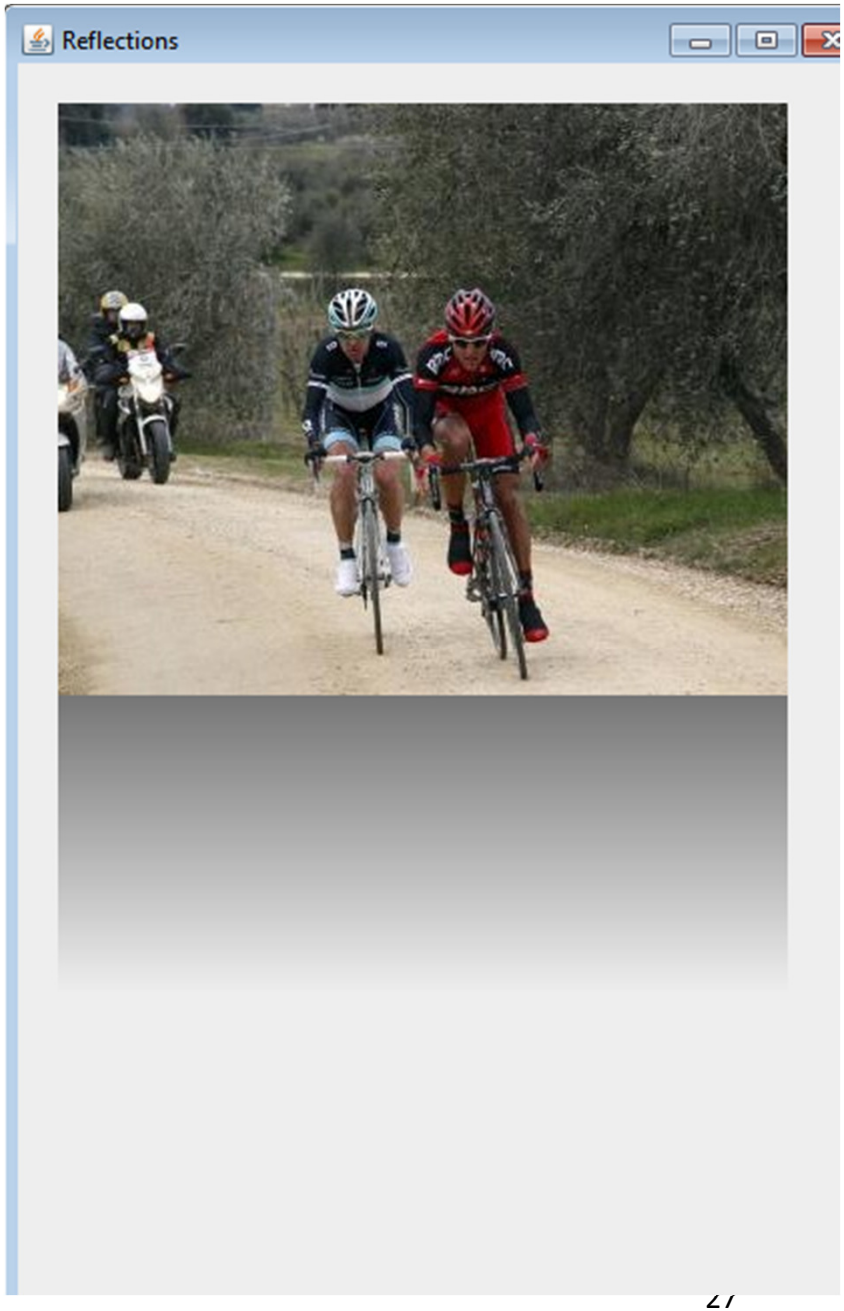

```
private BufferedImage
    createReflection(BufferedImage image) {

    int height = image.getHeight();

    BufferedImage result
            = new BufferedImage(image.getWidth(),
            height * 2,
            BufferedImage.TYPE_INT_ARGB);
    Graphics2D g2 = result.createGraphics();

    // Paints original image
    g2.drawImage(image, 0, 0, null);
```

Reflection

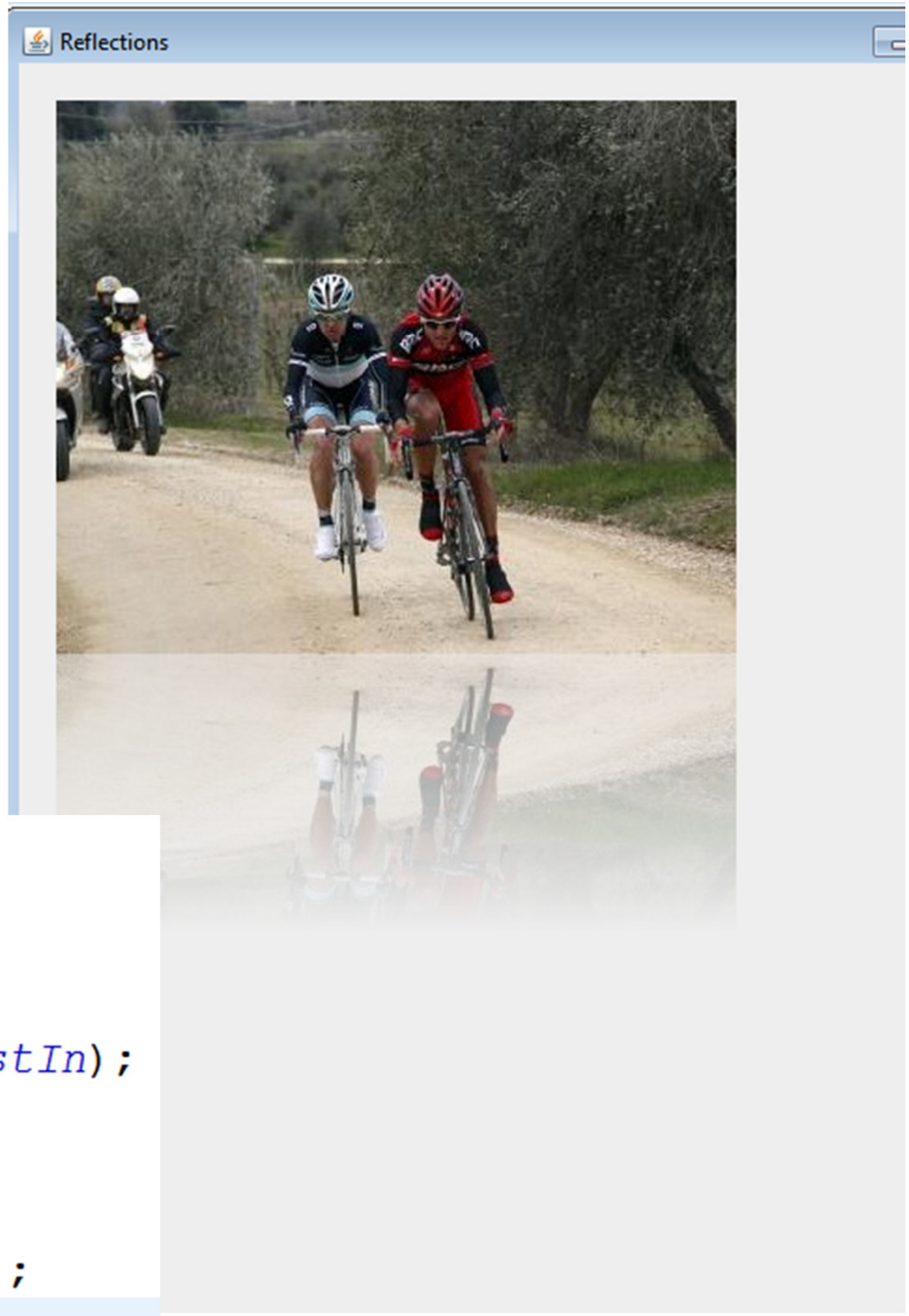
```
// Paints mirrored image
g2.scale(1.0, -1.0);
g2.drawImage(image, 0,
        -height - height, null);
g2.scale(1.0, -1.0);
```

Gradient (alpha mask)

```
g2.setColor(Color.BLACK);
g2.fillRect(0, height,
        image.getWidth(),
        image.getHeight());

// Move to the origin of the clone
g2.translate(0, height);

Color grayAlpha
    = new Color(1.0f, 1.0f,
                1.0f, 0.5f);

Color transparent
    = new Color(1.0f, 1.0f,
                1.0f, 0.0f));

// Creates the alpha mask
GradientPaint mask;
mask = new GradientPaint(0, 0,
        grayAlpha,
        0, height / 2,
        transparent);
Paint oldPaint = g2.getPaint();
g2.setPaint(mask);
```



Final result using AlphaComposite DstIn




```
Paint oldPaint = g2.getPaint();
g2.setPaint(mask);

// Sets the alpha composite
g2.setComposite(AlphaComposite.DstIn);

// Paints the mask
g2.fillRect(0, 0,
        image.getWidth(), height);
```