

## Opgave 7.5

```
import java.awt.*;

public class Ball {
    double x, y, radius, dx, dy, mass;
    Color color;

    public Ball(double x, double y, double radius,
                double dx, double dy, Color color) {
        this.x = x; this.y = y;
        this.radius = radius;
        this.dx = dx; this.dy = dy;
        this.color = color;
        mass = Math.pow(radius, 3);
    }

    public double distance(Ball b) {
        double dx = x - b.x;
        double dy = y - b.y;
        return Math.sqrt(dx * dx + dy * dy);
    }

    public void move() {
        x += dx;
        y += dy;
    }

    public boolean collidesWith(Ball b) {
        return b != this && distance(b) <= radius + b.radius;
    }

    public void draw(Graphics g) {
        Color oldColor = g.getColor();
        g.setColor(color);
        g.fillOval((int) (x - radius), (int) (y - radius),
                  (int) (radius * 2), (int) (radius * 2));
        g.setColor(oldColor);
    }
}
```

```

import java.awt.*;
import java.util.*;

public class BallSet extends ArrayList {
    BallSet(Dimension d) {
        this.d = d;
    }

    void move() {
        for (int i = 0; i < size(); i++) {
            Ball b1 = (Ball) get(i);
            if (b1.dx < 0 ? b1.x < b1.radius :
                b1.x > d.width - b1.radius)
                b1.dx = -b1.dx;
            if (b1.dy < 0 ? b1.y < b1.radius :
                b1.y > d.height - b1.radius)
                b1.dy = -b1.dy;
            for (int j = i + 1; j < size(); j++) {
                Ball b2 = (Ball) get(j);
                if (b1.collidesWith(b2)) {
                    // swap velocities
                    double t;
                    t = b1.dx; b1.dx = b2.dx; b2.dx = t;
                    t = b1.dy; b1.dy = b2.dy; b2.dy = t;
                }
            }
            b1.move();
        }
    }

    void draw(Graphics g) {
        for (int i = 0; i < size(); i++)
            ((Ball) get(i)).draw(g);
    }

    Dimension d;
}

```

```

import java.awt.*;

public class BouncingBalls extends DBAnimationApplet {
    public BouncingBalls() {
        super(true);
    }

    public static BallSet balls;

    protected void initAnimator() {
        String att = getParameter("delay");
        if (att != null)
            setDelay(Integer.parseInt(att));
        balls = new BallSet(d);
        balls.add(new Ball(d.width * 2 / 3, d.height - 20,
            20, -2, -4, Color.green));
        balls.add(new Ball(d.width / 4, d.height - 20,
            20, 2, 10, Color.red));
        balls.add(new Ball(d.width / 10, d.height - 40,
            20, -5, 3, Color.blue));
    }

    protected void paintFrame(Graphics g) {
        g.setColor(Color.white);
        g.fillRect(0, 0, d.width, d.height);
        balls.move();
        balls.draw(g);
    }
}

```

En udgave af BallSet, der ved kollision imellem to bolde tager hensyn til deres masse:

```
class BallSet extends ArrayList {
    BallSet(Dimension d) {
        this.d = d;
    }

    void move() {
        for (int i = 0; i < size(); i++) {
            Ball b1 = (Ball) get(i);
            if (b1.dx < 0 ? b1.x < b1.radius :
                b1.x > d.width - b1.radius)
                b1.dx = -b1.dx;
            if (b1.dy < 0 ? b1.y < b1.radius :
                b1.y > d.height - b1.radius)
                b1.dy = -b1.dy;
            for (int j = i + 1; j < size(); j++) {
                Ball b2 = (Ball) get(j);
                if (b1.collidesWith(b2)) {
                    double f = (b2.mass - b1.mass) / (b1.mass + b2.mass);
                    double b1dx = f * (b2.dx - b1.dx) + b2.dx;
                    double b1dy = f * (b2.dy - b1.dy) + b2.dy;
                    double b2dx = f * (b2.dx - b1.dx) + b1.dx;
                    double b2dy = f * (b2.dy - b1.dy) + b1.dy;
                    b1.dx = b1dx; b1.dy = b1dy;
                    b2.dx = b2dx; b2.dy = b2dy;
                }
            }
            b1.move();
        }
    }

    void draw(Graphics g) {
        for (int i = 0; i < size(); i++)
            ((Ball) get(i)).draw(g);
    }

    private Dimension d;
}
```

```
<HTML>
<BODY>
  <APPLET CODEBASE="Java Classes" CODE=BouncingBalls.class
    WIDTH=250 HEIGHT=150>
    <PARAM NAME=delay VALUE=100>
  </APPLET>
</BODY>
</HTML>
```