/**
 * File: BouncingBall.java
 * -----------------------
 * This program graphically simulates a bouncing ball.
 */

import acm.program.*;
import acm.graphics.*;

public class BouncingBall extends GraphicsProgram {

    /** Size (diameter) of the ball */
    private static final int DIAM_BALL = 30;

    /** Amount Y velocity is increased each cycle as a
     * result of gravity */
    private static final double GRAVITY = 3;

    /** Animation delay or pause time between ball moves */
    private static final int DELAY = 50;

    /** Initial X and Y location of ball */
    private static final double X_START = DIAM_BALL / 2;
    private static final double Y_START = 100;

    /** X Velocity */
    private static final double X_VEL = 5;

    /** Amount Y Velocity is reduced when it bounces */
    private static final double BOUNCE_REDUCE = 0.9;

    /** Starting X and Y Velocities */
    private double xVel = X_VEL;
    private double yVel = 0.0;

    /* private instance variable */
    private GOval ball;

    public void run() {
        setup();
        waitForClick();

        // Simulation ends when ball goes off right hand end of screen
        while (ball.getX() < getWidth()) {
            moveBall();
            checkForCollision();
            pause(DELAY);
        }
    }
}
/** Create and place ball. */
private void setup() {
    ball = new GOval(X_START, Y_START, DIAM_BALL, DIAM_BALL);
    ball.setFilled(true);
    add(ball);
}

/** Update and move ball */
private void moveBall() {
    // increase yVelocity due to gravity on each cycle
    yVel += GRAVITY;
    ball.move(xVel, yVel);
}

/** Determine if collision with floor, update velocities *
and location as appropriate. */
private void checkForCollision() {
    // determine if ball has dropped below the floor
    if (ball.getY() > getHeight() - DIAM_BALL) {
        // change ball's Y velocity to now bounce upwards
        yVel = -yVel * BOUNCE_REDUCE;

        // assume bounce will move ball an amount above the
        // floor equal to the amount it would have dropped
        // below the floor.
        double diff = ball.getY() - (getHeight() - DIAM_BALL);
        ball.move(0, -2 * diff);
    }
}
}